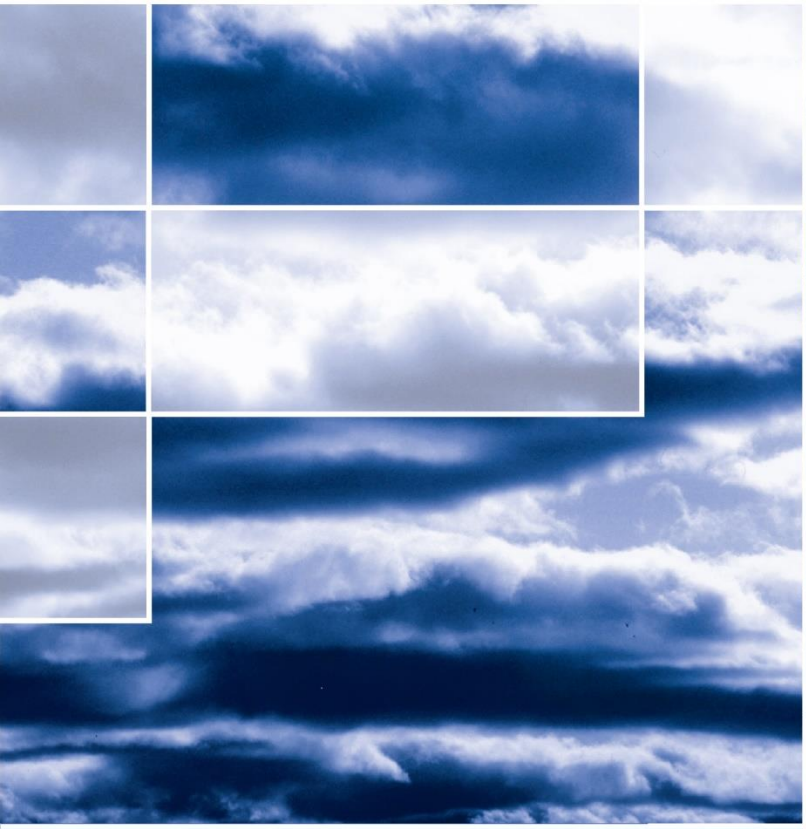
November 2022— Final

Northern Virginia

Hazard Mitigation Plan



Executive Summary

Successful mitigation leads to a more resilient community in the face of future disasters. Resilient communities proactively protect themselves against hazards, build self-sufficiency, and become more sustainable. Resilience…is fostered not only by government, but also by individual, organization, and business actions.

—National Response Framework, United States Department of Homeland Security

Mitigation is commonly defined as sustained actions taken to reduce long-term risks to people and property from hazards and their effects. Hazard mitigation focuses attention and resources on community policies and actions that produce successive benefits over time. A mitigation plan states the community's aspirations and the specific courses of action it intends to follow to reduce vulnerability and exposure to future hazard events. These plans are formulated through a systematic process centered on the participation of individuals, businesses, public officials, and other community stakeholders. Traditionally, mitigation plans address natural hazards. However, this plan discusses natural and non-natural hazards, their impacts, and strategies to reduce their risk. The National Institute of Building Sciences has found that natural hazard mitigation saves, on average, $6 for every $1 spent on federal mitigation grants.[1]

Disasters can happen anytime and anywhere. They can cause loss of life, damage buildings and infrastructure, and have devastating consequences for a community's economic, social, and environmental well-being. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies do not reflect the actual cost of disasters, as tax dollars do not cover additional costs incurred by insurance companies and private entities. Many natural disasters are predictable. Much of the damage and expenses caused by these events can be reduced or even avoided. By integrating mitigation into all aspects of disaster planning, communities can build resilience and reduce the risk of future hazard events.

The **2022 Northern Virginia Hazard Mitigation Plan (NOVA HMP)**[2] brings together hazard risk and disaster resilience efforts through its planning process and related activities with the aim of reducing long-term vulnerability for all jurisdictions in the region.

The hazard mitigation planning process benefits Northern Virginia and its jurisdictions in many ways:

- Hazard identification and risk assessment establish the foundation for all hazards and all phases of disaster and emergency management programs—mitigation, preparedness, prevention/ protection, response, and recovery.
- The inclusive planning process builds partnerships by involving agencies, organizations, individuals, and businesses.
- The planning process increases education and awareness of threats and hazards, as well as their impacts, consequences, and risks.

[1] Multi-Hazard Mitigation Council (2019). Natural Hazard Mitigation Saves: 2019 Report. Principal Investigator Porter, K.; Co-Principal Investigators Dash, N., Huyck, C., Santos, J., Scawthorn, C.; Investigators: Eguchi, M., Eguchi, R., Ghosh., S., Isteita, M., Mickey, K., Rashed, T., Reeder, A.; Schneider, P.; and Yuan, J., Directors, MMC. Investigator Intern: Cohen-Porter, A. National Institute of Building Sciences. Washington, DC. http://2021.nibs.org/files/pdfs/NIBS_MMC_MitigationSaves_2019.pdf

[2] The *2022 Northern Virginia HMP* update project was funded by the Federal Emergency Management Agency through the Virginia Department of Emergency Management, Grant Agreement Number PDMC-PL-03-VA-2018-003 and administered by the Prince William County Office of Emergency Management.

- The Plan communicates needs and priorities to federal officials, and it positions local jurisdictions for financial and technical assistance.
- The Plan provides for the most efficient and effective use of resources to reduce risk.
- The process provides opportunities to align hazard risk reduction with other state and local objectives.

Effective mitigation begins by identifying threats and hazards that a community faces and determining the associated risks, consequences, and vulnerabilities. Comprehensive assessment requires risk information based on credible science, technology, and intelligence validated by experience. No single threat or hazard exists in isolation. For example, a severe thunderstorm can lead to flooding, dam failures, and hazardous material spills.

Understanding risks makes it possible to develop strategies and plans to manage or avoid them. Avoiding and reducing risks are ways to reduce a community's long-term vulnerability and build individual and community resilience.[3]

Risk, not the occurrence of incidents, drives this Plan. By fostering comprehensive risk considerations, this plan encourages behaviors and activities that will reduce future exposure and vulnerability for individuals and communities.

The participating jurisdictions of the 2022 *HMP* includes 21 jurisdictions in the Northern Virginia region.

Table 1: 2022 Planning Area Jurisdictions

Counties	Towns	Cities
Arlington	Clifton	Alexandria
Fairfax	Dumfries	Fairfax
Loudoun	Haymarket	Falls Church
Prince William	Herndon	Manassas
	Leesburg	Manassas Park
	Lovettsville	
	Middleburg	
	Occoquan	
	Purcellville	
	Round Hill	
	Vienna	

This Plan, which has two volumes, is designed to be a user-friendly source for all hazard information for participating jurisdictions. **Volume I** includes the **Base Plan, Appendices, and Jurisdiction Annexes**.[4] The Base Plan provides the regional context for the identification and risk assessment of natural hazards, the resulting mitigation strategy, and action plans for implementation. The appendices document the steps taken in updating the Plan and its specific components. The jurisdiction annexes present hazard risk and vulnerability information that is specific to that jurisdiction. They provide a foundation for developing effective and feasible mitigation actions that result in the successful reduction of hazard

[3] United States Department of Homeland Security. (2019). *National Response Framework*, Fourth Edition. https://www.fema.gov/sites/default/files/2020-04/NRF_FINALApproved_2011028.pdf
[4] The appendices and jurisdiction annexes are part of the overall plan but are separate from this document.

vulnerability. The jurisdiction annexes are self-contained documents that augment the regional context presented in the Base Plan.

Volume II is a new addition to this Plan. It presents the regional hazard and risk assessment and mitigation strategies that address **non-natural hazards**.

The 2022 NOVA HMP will be a useful tool for all communities and their stakeholders by increasing public awareness about local hazards and risks while providing information about the options and resources available to reduce those risks. Informing the public about potential hazards will help each of the region's jurisdictions protect itself against the effects of hazards, and it will enable informed decision-making on where to live, purchase property, or locate businesses.

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Volume I: Natural Hazard Base Plan

1. Introduction

What is hazard mitigation?

Mitigation is commonly defined as sustained actions taken to reduce long-term risks to people and property from hazards and their effects. Hazard mitigation focuses attention and resources on community policies and actions that produce successive benefits over time. A mitigation plan states the community's aspirations and the specific courses of action it intends to follow to reduce vulnerability and exposure to future hazard events. These hazard mitigation plans are formulated through a systematic process centered on the participation of individuals, businesses, public officials, and other community stakeholders.

A local hazard mitigation plan is the physical representation of a jurisdiction's commitment to reduce risks from natural hazards. Local officials can refer to the plan in their day-to-day activities and in making decisions about regulations and ordinances, granting permits, funding capital improvements, and undertaking other community initiatives. Local plans also serve as the basis for states to prioritize future grant funding as it becomes available.

The *2022 Northern Virginia Hazard Mitigation Plan* will be a useful tool for all communities and their stakeholders by increasing public awareness of local hazards and risks while providing information about the options and resources available to reduce those risks. Teaching the public about potential hazards will help each jurisdiction in the area protect itself against the effects of hazards, and it will enable informed decision-making on where to live, purchase property, or locate businesses.

To reduce the nation's mounting losses from natural disasters, the United States Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Section 322 of DMA 2000 emphasizes the need for state and local government entities to closely coordinate mitigation planning activities, and it makes the development of a hazard mitigation plan a specific eligibility requirement for any local government applying for federal mitigation grant funds. These funds include the Hazard Mitigation Grant Program (HMGP) and the Building Resilient Infrastructure and Communities (BRIC) program (formerly known as the Pre-Disaster Mitigation Program), administered by the Federal Emergency Management Agency (FEMA) under the Department of Homeland Security. Communities with an adopted and federally approved hazard mitigation plan thereby become pre-positioned and more apt to receive available mitigation funds before and after the next disaster strikes.

The *2022 Northern Virginia Hazard Mitigation Plan* (NOVA HMP) has been prepared in coordination with the offices of FEMA Region 3 and the Virginia Department of Emergency Management (VDEM) to ensure that it meets all applicable DMA 2000 and commonwealth requirements. The Local Mitigation Plan Crosswalk in **Appendix A** provides a summary of federal minimum planning standards, and it notes the location in this Plan where each requirement is met.

1.1. Plan Overview

Local hazard mitigation planning is the process of organizing community resources, identifying and assessing hazard risks, and determining how to best minimize or manage those risks. This process results in a hazard mitigation plan that identifies specific mitigation actions, each designed to achieve both short-term planning objectives and long-term risk reduction. To ensure the functionality of each mitigation action, responsibility is assigned to a specific individual, department, or agency, along with a schedule for its implementation. Plan maintenance procedures are established for the routine monitoring of implementation progress, as well as for evaluating and enhancing the mitigation plan itself. These plan maintenance procedures ensure that the plan remains current, dynamic, and effective over time.

Mitigation planning offers many benefits, including the following:

- Saving lives and property,
- Saving money,
- Faster recovery following disasters,
- Reducing future vulnerability through wise development and post-disaster recovery and reconstruction,
- Expediting the receipt of pre-disaster and post-disaster grant funding, and
- Demonstrating a firm commitment to improving community health, safety, and resiliency.

Typically, mitigation planning has the potential to produce long-term and recurring benefits by breaking the cycle of repetitive disaster loss. A core assumption of hazard mitigation is that pre-disaster investments significantly reduce the demand for post-disaster assistance by lessening the need for emergency response, repair, recovery, and reconstruction. Furthermore, mitigation practices enable individuals, businesses, and industries to reestablish themselves in the wake of a disaster, getting the community economy back on track sooner and with less interruption.

The benefits of mitigation planning go beyond solely reducing hazard vulnerability. Measures such as the acquisition or regulation of land in known hazard areas can help achieve multiple community goals, such as preserving open space, maintaining environmental health, and enhancing recreational opportunities. Thus, it is vitally important that any local mitigation planning process be integrated with other local planning efforts, and that any proposed mitigation strategies must consider other existing community goals or initiatives that will help complement or hinder their future implementation.

1.1.1. Background

Natural hazards are a part of the world around us. Their occurrence is inevitable, and while there is little, we can do to control their force and intensity, many actions can be taken to lessen their potential impacts on our communities. The effective reduction of a hazard's impact can decrease the likelihood that such events will result in a disaster. The concept and practice of reducing risks to people and property from known hazards is generally referred to as hazard mitigation.

Hazard mitigation techniques include structural measures, such as strengthening or protecting buildings and infrastructure from the destructive forces of potential hazards, and nonstructural measures, such as adopting sound land-use policies or creating public awareness programs. Some of the most effective mitigation measures are implemented at the local government level, where decisions on the regulation and control of development are made.

A comprehensive mitigation strategy addresses hazard vulnerabilities that exist today and in the foreseeable future. Therefore, it is essential that projected patterns of development are evaluated and considered in terms of how that growth will increase or decrease a community's overall hazard

vulnerability. Land use is a particularly important topic in the Northern Virginia region, where many communities are facing rapid growth and redevelopment. Now is the time to effectively guide development away from identified hazard areas and environmentally sensitive locations before unsound development patterns emerge that place people and property in harm's way.

The Northern Virginia region is vulnerable to a wide range of natural hazards, including flooding, severe storms, hurricanes, and winter weather. These hazards threaten the safety of residents, and they have the potential to damage or destroy both public and private property, disrupt the local economy, and impact the overall quality of life of individuals who live, work, and play in the Northern Virginia region.

One of the most effective tools a community can use to reduce hazard vulnerability is a local hazard mitigation plan that is developed, adopted, and updated as needed. Such a plan establishes a broad community vision and guiding principles for addressing hazard risk, including the development of specific mitigation actions designed to reduce identified vulnerabilities. The *2022 NOVA HMP* (or "the Plan") is a logical first step toward incorporating hazard mitigation principles and practices into routine activities and functions of local government in the region.

The mitigation actions in the Plan go beyond recommending structural solutions to reduce existing vulnerability. Local policies addressing community growth, incentives to protect natural resources, and public awareness and outreach campaigns are examples of other measures that can help reduce the future hazard vulnerability of the region. The Plan has been designed to be a living document, with implementation and evaluation procedures included to help achieve meaningful objectives and successful outcomes.

1.1.2. Purpose

The purpose of the Plan is to:

- Protect life, safety, and property by reducing the potential for future damages and economic losses that result from all hazards,
- Make communities safer places to live, work, and play,
- Qualify for grant funding in both the pre-disaster and post-disaster environments,
- Speed recovery and redevelopment following future disaster events,
- Demonstrate a firm local commitment to hazard mitigation principles, and
- Comply with commonwealth and federal requirements for local multi-jurisdictional hazard mitigation plans.

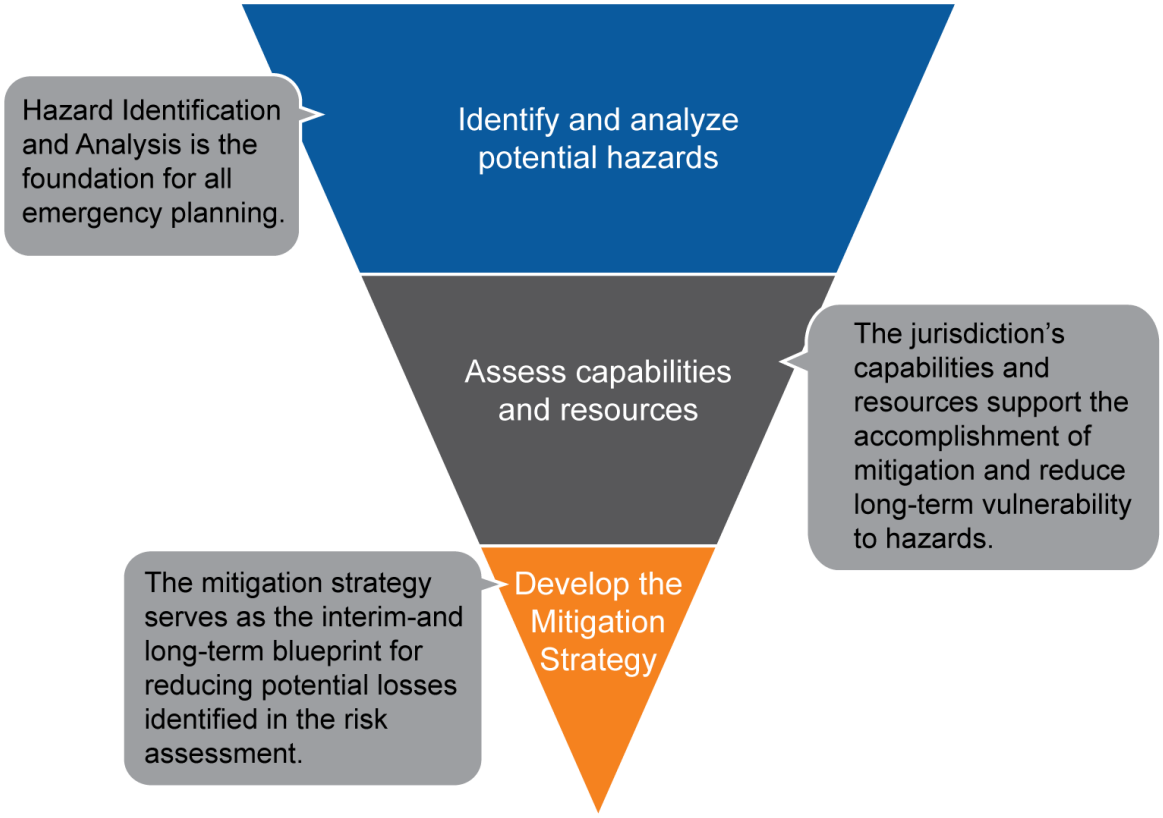


Figure 1: Purpose of the Northern Virginia Hazard Mitigation Plan

1.1.3. Applicability and Scope

The Plan is applicable to the geographic areas within the political boundaries of the participating jurisdictions of the Northern Virginia region. It involves the participation of multiple departments, agencies, and organizations in these jurisdictions, as well as key local, regional, commonwealth, and federal stakeholders that provide services and resources to or support NOVA jurisdictions. In addition, the Plan complements and is consistent with the *2017 Commonwealth of Virginia Hazard Mitigation Plan*.

The Plan is an update of the *2017 Northern Virginia Hazard Mitigation Plan*. It is a dynamic document that can serve as a guide for all-hazard planning, addressing natural and non-natural human-caused hazards in relation to prevention, preparedness, response, recovery, mitigation, and long-term redevelopment.

1.1.4. Authority and Guidance

The Plan was prepared in compliance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (Stafford Act), 42 U.S.C. 5165, as amended by Section 104 of the Disaster Mitigation Act of 2000 (DMA 2000). Local mitigation planning requirements are codified in the Code of Federal Regulations (CFR) Title 44, Section 201.6 (44 CFR §201.6). DMA 2000 specifies requirements for local governments to undertake a risk-based approach to reducing the impacts and consequences of natural hazards through mitigation planning. In addition, DMA 2000 requires that local plans be updated every five years, with each planning cycle requiring a complete review, revision, and approval of the mitigation plan by the Commonwealth and FEMA.

The Plan shall be routinely monitored, evaluated, and revised to maintain compliance with the following provisions, rules, and legislation:

- Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390), and
- FEMA's Interim Final Rule published in the Federal Register on February 26, 2002, 44 CFR Part 201.

The method and schedule for plan maintenance are provided in additional detail in **Section 3** of the Plan.

1.1.5. Plan Adoption

The Plan, developed in accordance with current commonwealth and federal rules and regulations governing local hazard mitigation plans, will be adopted by the 4 counties, 5 cities, and 12 participating municipalities in accordance with the authority and police powers granted to counties, cities, and municipalities under §15.2-2223 through §15.2-2231 of the Virginia State Code.

Following its designation as Approvable Pending Adoption (APA) by both VDEM and FEMA, the Plan will be brought forth to each participating jurisdiction for formal adoption by its governing body. Copies of local adoption resolutions are in **Appendix D**.

Additional information related to the adoption of the Plan is provided in **Section 3** of this Plan.

1.1.6. Plan Format and Content

The *2022 NOVA HMP* is presented in two volumes:

- **Volume I:** Natural Hazard Base Plan, Supporting Appendices, and Jurisdictional Annexes
- **Volume II:** Non-Natural Hazard Supplement

Table 2: 2022 Northern Virginia, Volume I: Hazard Mitigation Plan Organization

Part 1: The Plan	Content
Section 1: Introduction	• Provides the justification and approach to hazard mitigation • Defines the legal authority for hazard mitigation planning • Describes how the Plan is organized • Presents the regional profile to establish context for the Plan
Section 2: Planning Process	• Describes the process used to review, revise, and update the 2017 NOVA HMP • Describes changes in priorities and processes since the 2017 NOVA HMP • Defines the planning organization, participation, timeline, and public engagement aspects of the planning process • Lists existing plans, studies, reports, and technical information reviewed and integrated into the 2022 update

Part 1: The Plan	Content
Section 3: Plan Maintenance and Adoption	• Describes the method and schedule for monitoring, evaluating, and updating the Plan over the five-year planning cycle • Describes how the Plan and its strategy will be implemented and maintained by incorporating it into existing planning mechanisms • Provides maintenance procedures, forms, and checklists to help keep the Plan current • Describes how the Plan will be adopted by the governing bodies of participating counties, cities, and towns

Part 2: Natural Hazard Analysis	
Section 4: Hazard Identification and Risk Assessment Methodology	• Defines the hazard identification and risk assessment process • Identifies hazards considered for the 2022 Plan • Identifies hazards eliminated from consideration in the Plan • Presents a regional hazard profile, including federal disaster declarations and regional summaries of FEMA community lifelines and assets
Section 5: Hazard Profiles, Risks, and Vulnerability	• Defines the hazard identification and risk assessment process • Identifies hazards considered for the 2022 Plan • Identifies hazards eliminated from consideration in the Plan • Presents a regional hazard profile, including federal disaster declarations and regional summaries of FEMA community lifelines and assets
Section 6: Impacts of Climate Change	• Presents hazard profiles, including types, locations, extent, previous occurrences, and probability for future occurrences • Presents risk assessments related to the impacts and consequences of hazards and vulnerability analysis for 11 natural hazards included in the 2022 Plan

Part 3: Mitigation Strategy	
Section 7: Capability Assessment	• Provides a regional summary of the planning and regulatory, administrative and technical, safe growth, financial, and education and outreach capabilities of Plan participants • Describes how capabilities that support hazard mitigation may be improved • Presents the National Flood Insurance Program assessment and describes how jurisdiction will maintain compliance

Part 3: Mitigation Strategy	
Section 8: Mitigation Strategy	• Explains the process used to review and update the goals and objectives for the 2022 Plan • Presents a status summary of mitigation actions included in the 2017 plan • Presents a summary of new mitigation actions and previous actions moved forward in the 2022 Plan • Describes the criteria for prioritizing mitigation actions • Presents a summary of the jurisdictions' action plans for implementation • Describes federal, commonwealth, local, and other mitigation funding sources

Appendices	
Appendix A: The Plan	• Supporting Documentation for Part 1
Appendix B: Natural Hazard Analysis	• Supporting Documentation for Part 2
Appendix C: Mitigation Strategy	• Supporting Documentation for Part 3

Jurisdictional Annexes	
Jurisdictional Annexes	• Provide detailed jurisdiction-specific information on hazard risks and vulnerability, capabilities, mitigation actions, and action plans for implementation that augment information in the Base Plan

Table 3: 2022 Northern Virginia, Volume II: Non-Natural Hazards Supplement

Volume II	Non-Natural Hazards Supplement
Section 1: Introduction, Planning Process, and Plan Maintenance	• Describes the purpose for including non-natural hazards • Describes how the Plan is organized • Presents the regional profile to establish the context of the plan
Section 2: Hazard Profiles	• Presents hazard profiles, including types, locations, extent, previous occurrences, and probability for future occurrences • Presents risk assessments related to the impacts and consequences of hazards and vulnerability analysis for seven non-natural hazards included in the 2022 Plan
Section 3: Mitigation Actions and Implementation	• Describes the method and schedule for monitoring, evaluating, and updating the Plan over the five-year planning cycle • Describes how the Plan and its strategies will be implemented and maintained by incorporating them into existing planning mechanisms • Provides maintenance procedures, forms, and checklists to help keep the Plan current

The structure of the Plan is designed to be as reader-friendly and functional as possible. While significant background information is included in the Plan itself related to the processes used and studies completed (e.g., the risk and capability assessments), some information is separated from the more meaningful planning outcomes or actions (e.g., mitigation strategies and mitigation action plans) and provided as appendices.

1.1.7. The Planning Area

The jurisdictions covered by the Plan include the following 4 counties, 5 cities, and 11 towns. Hereinafter, they are referred to as the Northern Virginia Region, the Region, or the planning area (see Table 4 and Figure 2).

Table 4: 2022 Planning Area Jurisdictions

Counties	Towns	Cities
Arlington	Clifton	Alexandria
Fairfax	Dumfries	Fairfax
Loudoun	Haymarket	Falls Church
Prince William	Herndon	Manassas
	Leesburg	Manassas Park
	Lovettsville	
	Middleburg	
	Occoquan	
	Purcellville	
	Round Hill	
	Vienna	

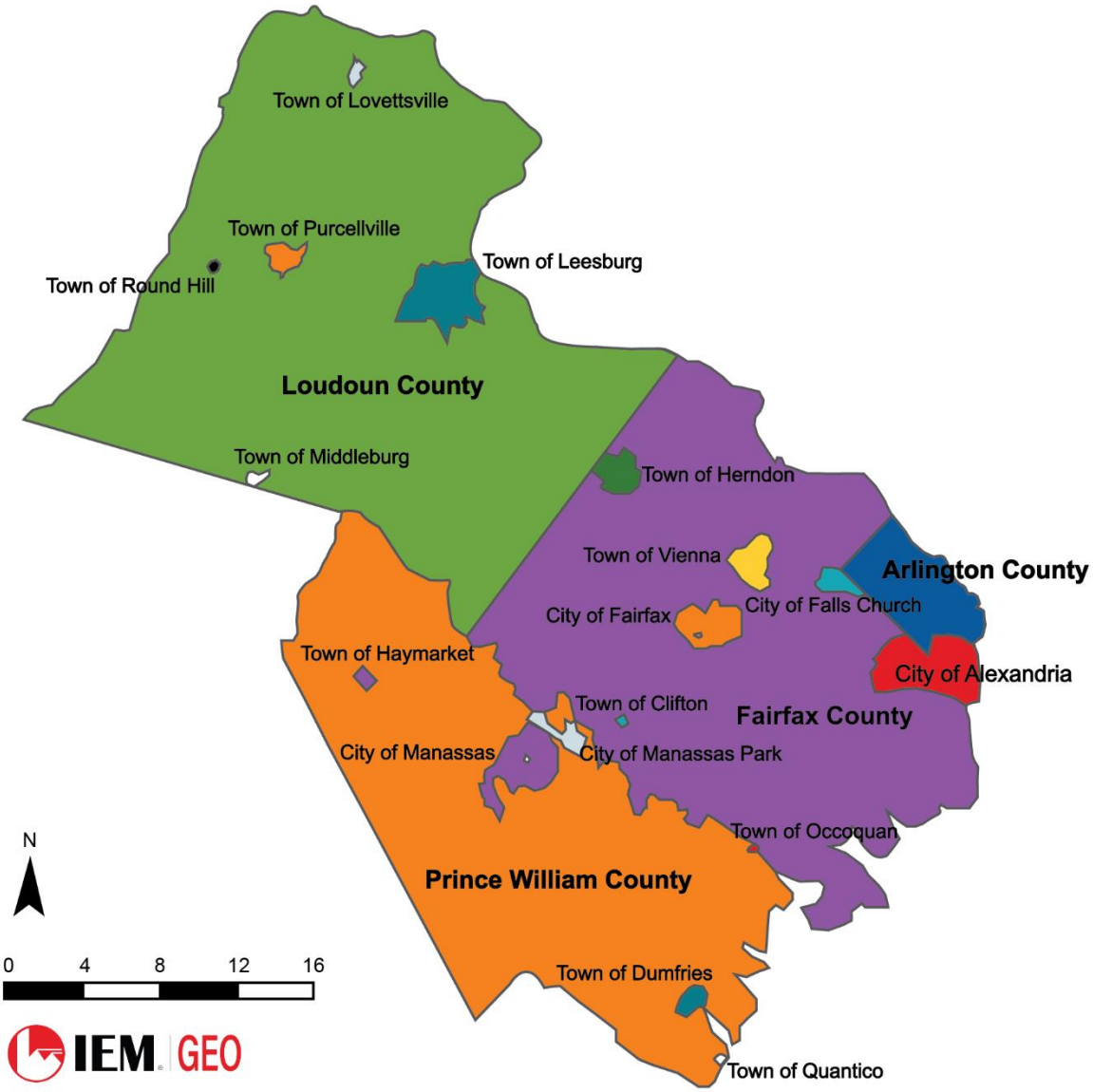


Figure 2: The Planning Area

1.2. Regional Profile

1.2.1. Physical Environment

1.2.1.1. Geography

The Northern Virginia planning area is in the northeast corner of the Commonwealth of Virginia, across the Potomac River from the Nation's Capital, Washington, D.C. It is part of the Washington, D.C.–Maryland–Virginia–West Virginia Primary Metropolitan Statistical Area, as defined by the U.S. Census.

Northern Virginia is home to numerous federal government facilities, such as the Pentagon, Central Intelligence Agency, and the United States Geological Survey. Historic and cultural resources include

George Washington's historic home on the Potomac, Mount Vernon; Arlington National Cemetery; and the Udvar–Hazy Center of the Smithsonian Institution's National Air and Space Museum at Dulles International Airport.

1.2.1.2. Hydrology

The planning area is part of three of the five physiographic provinces of Virginia: The Coastal Plain, the northern Piedmont, and the Blue Ridge. The coastal plain lies roughly east of Interstate 95/395, and it includes the eastern portions of the city of Alexandria, and Fairfax and Prince William Counties. The northern piedmont province lies roughly between Interstate 95 and United States Highway 15 in central Loudoun and western Prince William Counties. It is bounded by the Blue Ridge Mountains on the west, with ridges, foothills, and hollows rolling down to the Potomac River to the east. Elevations range from more than 1,950 feet above sea level in the Blue Ridge Mountains in western Loudoun County to sea level in eastern Prince William County on the Potomac River. The total planning area is 1,304 square miles.

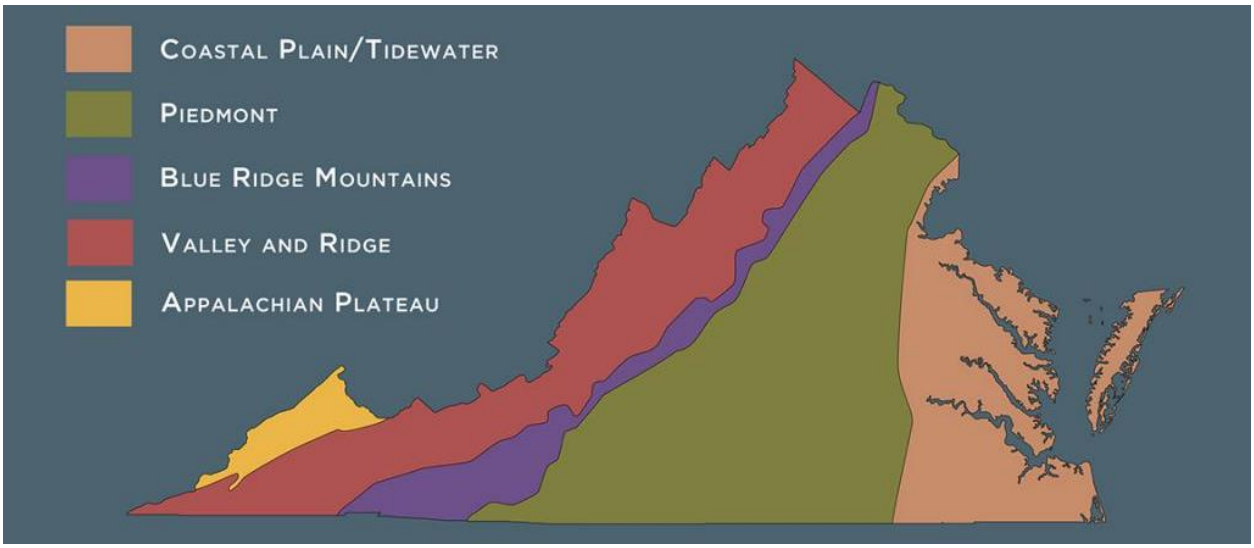


Figure 3: The Five Physical Regions of Virginia[5]

Northern Virginia lies entirely within the Potomac River watershed. After passing Harper's Ferry, West Virginia, the river forms the border between Maryland and Virginia, flowing in a southeasterly direction. The watershed, also known as the Potomac basin, contains a variety of land types, including forests. The basin also includes developed land, agriculture, water, and wetlands.[6]

The basin's major industries include agriculture and forestry throughout the basin, coal mining and pulp and paper production along the North Branch Potomac River; chemical production and agriculture in the Shenandoah Valley; high-tech, service, and light industry, as well as military and government installations in the Washington metropolitan area; and fishing in the lower Potomac estuary.[7]

Public water treatment plants treat approximately 83% of the basin's wastewater. Another 16% is treated by private septic systems. An average of approximately 486 million gallons of water is withdrawn daily in the Northern Virginia/Washington area for water supply. Approximately 100 million gallons per day of

[5] Virginia Museum of History and Culture. (n.d.). *The Regions of Virginia* https://virginiahistory.org/learn/regions-virginia
[6] Interstate Commission on the Potomac River Basin. (n.d.). *Potomac Basin Facts* https://www.potomacriver.org/potomac-basin-facts/
[7] Ibid.

groundwater are used in rural areas. Almost 86% of the basin's population receives its drinking water from public water suppliers, while 13% uses well water.[8]

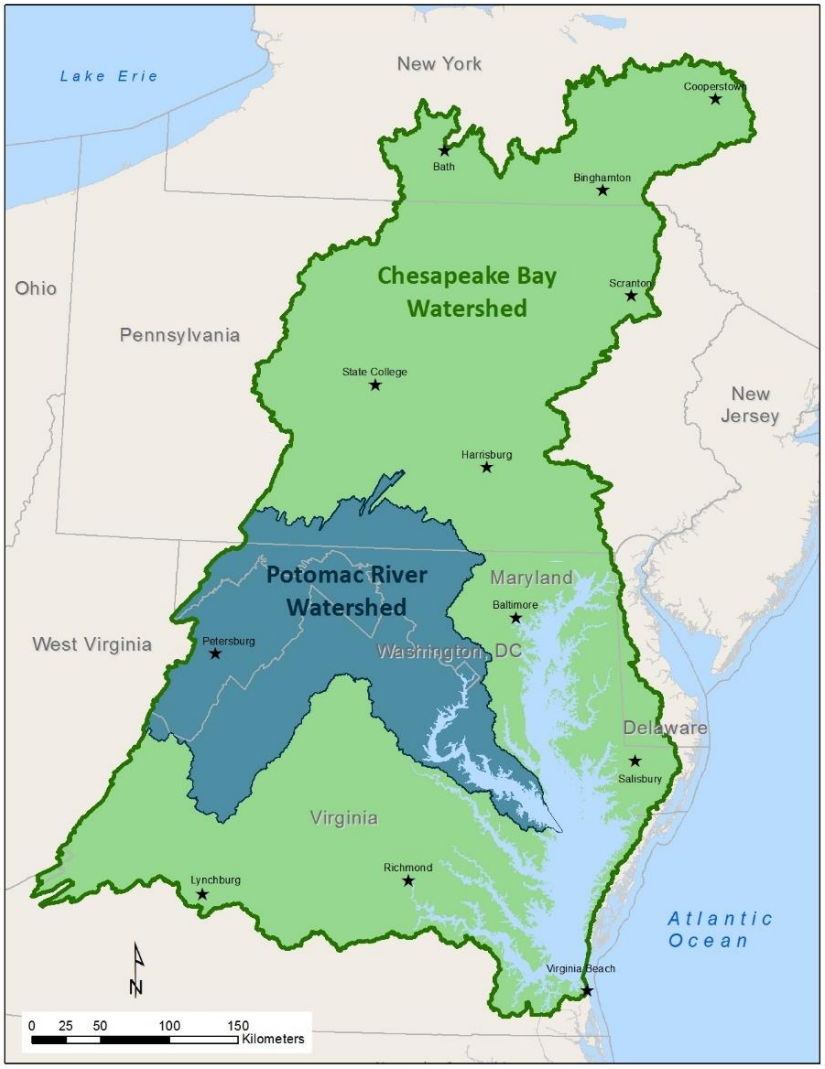


Figure 4: The Potomac River Watershed[9]

1.2.1.3. Climate

The area has a moderate climate. Average temperatures range from 26 degrees Fahrenheit (°F) to 87°F throughout the year, and the area experiences all four seasons. Winter (December–February) can be quite cold, and it often includes snow and ice; average temperatures range from 30–50 °F. January is typically the coldest month of the year. Spring (March–May) temperatures range between approximately 40°F–75°F. The summer months are June through August, and average temperatures then range from about 65°F to 95°F with high humidity. July is usually the hottest month. The fall (September–November) brings cooler temperatures and lower humidity. Average temperatures range from 40–80°F.[10] Annual

[8] Ibid.
[9] Potomac River Basin Atlas. (n.d.). *Sub-Watersheds*. https://www.potomacriver.org/Atlas-Maps/Subwatersheds/
[10]Virginia Tech Northern Virginia Center. (n.d.) *Climate and Weather* https://www.nvc.vt.edu/international/intlstudents/climate.html

rainfall averages above 40 inches, and the average snowfall ranges from approximately 15 inches at Reagan National Airport to 22 inches at Dulles International Airport.

Climate change amplifies existing weather patterns, and it can significantly alter them, increasing the extent and intensity of hazards. Extreme weather events have become more frequent over the past 40–50 years, and this trend is projected to continue. Rising sea level, coupled with potentially higher hurricane wind speeds, rainfall intensity, and storm surges, are expected to have a significant impact on coastal communities, including those in NOVA. More intense heat waves may mean more heat-related illnesses, droughts, and wildfires. The full extent of climate change on weather in NOVA is still emerging, and jurisdictions in the planning area should remain vigilant of the changing trends for planning and mitigation purposes.

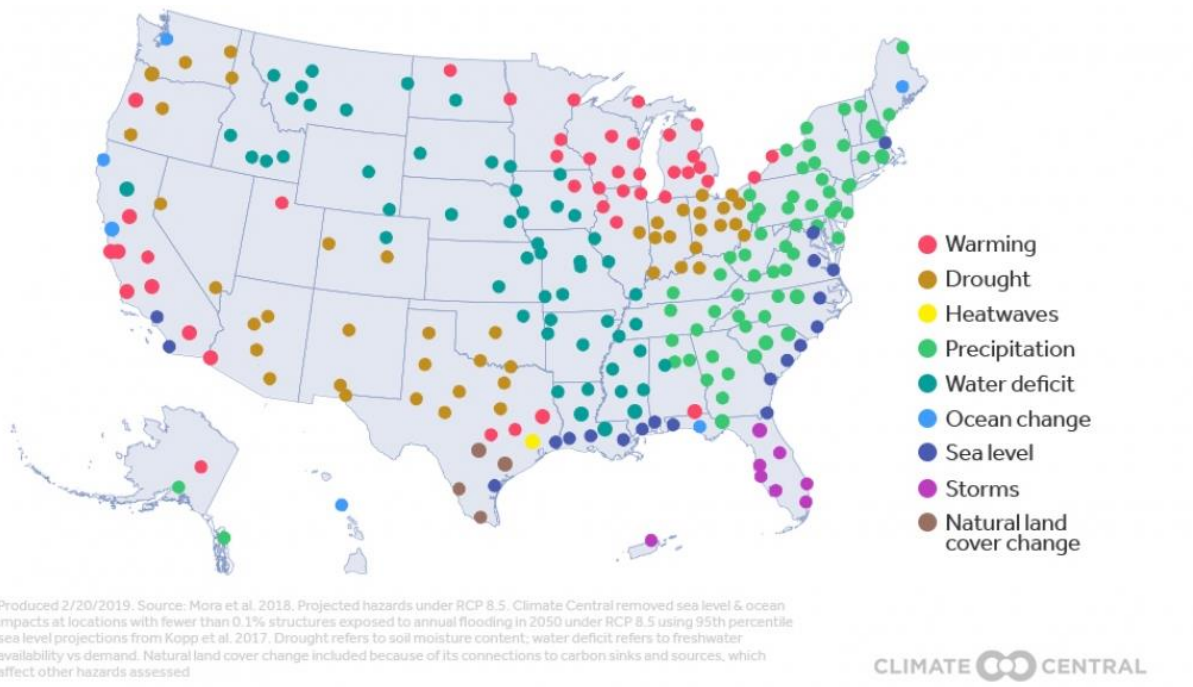


Figure 5: Most Intensified Hazards Due to Climate Change,[11] Social Environment

1.2.1.4. Brief History of the NOVA Region

People lived in Virginia for approximately 17,000 years before European contact. The Piedmont area, which includes the planning area, was home to two Siouan confederacies: the Monacan and the Manahoac.[12] The Northern Virginia region was colonized by the English in 1649, and it has a prominent place in American history. The region was the center of many conflicts during the Civil War because of its location between the Union capital of Washington, D.C., and the Confederate capital of Richmond, Virginia. Because of this history, the NOVA region is home to many historical and cultural sites and battlefields, including Manassas Battlefield Park. All of this presents unique planning considerations, especially for mitigation purposes.

[11] Land Trust Alliance. (2019, February 20). *Climate Plie Up: Global Warming's Compounding Dangers* https://climatechange.lta.org/climate-pile-up-global-warmings-compounding-dangers/
[12] Virginia Department of Education. (n.d.). *Language* https://www.doe.virginia.gov/instruction/history/virginias-first-people/culture/language/index.shtml

1.2.1.5. County Government[13]

Counties in the Commonwealth have two distinct governmental capacities. As units of local government, they adopt and enforce local ordinances and provide services for their residents. As political subdivisions of the Commonwealth, they assist in the local implementation of commonwealth laws and programs. Counties are governed by boards of supervisors, constitutional officers, and appointed officials.

The Board of Supervisors constitutes the governing body of each Virginia County. In this capacity, the elected members of the board are responsible for establishing local public policy, raising local resources to support public programs, and acting through the county's appointed administrative officials to oversee the conduct of county affairs. Constitutional officers are responsible for overseeing statutory responsibilities, and they include positions such as county treasurer and sheriff.

Several appointed officials, boards, commissions, and advisory agencies serve each county, including a Planning Commission and a Board of Zoning Appeals.

The Commonwealth is responsible for maintaining local county roads, which is important for infrastructure mitigation planning purposes.

Virginia cities are distinct from cities in other states in that they are independent governmental entities. No county authority or taxing power extends into the boundaries of a Virginia city. Because of this, cities in the region are also required to serve (like counties) as administrative subdivisions of the Commonwealth for implementing commonwealth programs and policies.

Besides being an independent governmental entity, the City of Alexandria is a separate geographic entity, so it is not geographically located within any county.

1.2.1.6. City and Town Government[14]

Virginia towns are governmentally part of the county in which they are located. Thus, towns exist primarily to provide urban services to their residents. In general, they do not have responsibility for the administration of commonwealth programs. Forms of city and town governments throughout the NOVA region include the Council–Manager Form and the Mayor–Council Form.

1.2.1.7. Population and Demographics

Based on the 2020 United States Census, over 2.2 million people live in the planning area. This represents a 13.9% increase in population since the 2010 census.[15] Although cities in Virginia are separate entities from counties, for the purpose of census data collection, information about the cities and towns is reported in conjunction with the counties, except for the City of Alexandria.

[13] The Virginia General Assembly. (n.d.). *Virginia Government in Brief 2018-2022* https://publications.virginiageneralassembly.gov/download_publication/119
[14] Ibid.
[15] University of Virginia Weldon Cooper Center for Public Service Demographics Research Group. (n.d.). *Census 2020 Overview* https://demographics.coopercenter.org/census2020-differential-privacy

Table 5: 2010 and 2020 Decennial Census Counts by Population for NOVA Jurisdictions

Jurisdiction(s)	2010 Census Population	2020 Census Population	Numeric Increase	Percent Increase
City of Alexandria	139,993	159,467	19,474	13.9%
City of Fairfax	22,565	24,146	1,581	7%
City of Falls Church	12,332	14,658	2,326	19%
City of Manassas	37,821	42,772	4,951	13%
City of Manassas Park	14,273	17,219	2,946	21%
Arlington County	207,627	238,643	31,016	14.9%
Fairfax County Including the towns of Clifton, Herndon, and Vienna	1,081,699	1,150,309	68,610	6.6%
Loudoun County Including the towns of Leesburg, Lovettsville, Middleburg, Purcellville, and Round Hill	312,311	420,959	108,648	34.8%
Prince William County Including the towns of Dumfries, Haymarket, and Occoquan	402,002	482,204	80,202	20%
Totals	**2,230,623**	**2,550,377**	**319,754**	**14%**

The population density in the planning area is high. As measured by the 2020 Census,[16] Loudoun County had the lowest population density, and the City of Alexandria had the highest.

- City of Alexandria: 10,677.4 people per square mile
- Arlington County: 9,179.6 people per square mile
- Fairfax County: 2,941.8 people per square mile

[16] United States Census Bureau. (2021, August 25). Virginia Adds More Than 600,000 People Since 2010 https://www.census.gov/library/stories/state-by-state/virginia-population-change-between-census-decade.html

- Loudoun County: 816.2 people per square mile
- Prince William County: 1,438.3 people per square mile

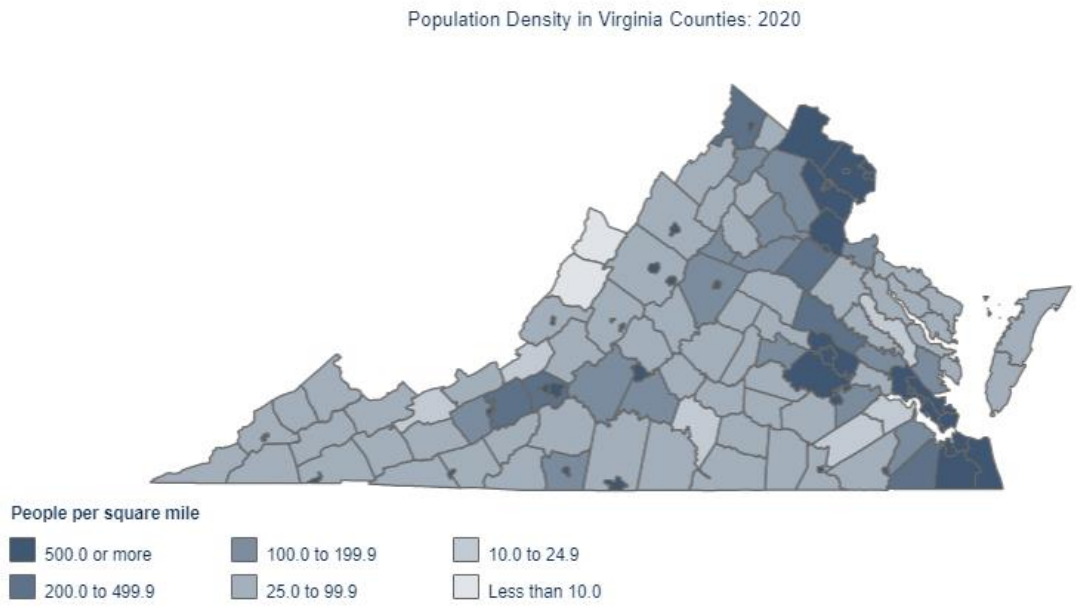


Figure 6: Population Density by County[17]

Continued population growth in NOVA is creating the need to expand capacity through new development, redevelopment, and infrastructure expansion. The Metropolitan Washington Council of Governments (MWCOG) population forecasts estimate a 17.3% increase in the NOVA region by 2045, resulting in a total population of 3,194,000.[18] This growth and the resulting increase in new or redeveloped built environment provide mitigation opportunities and challenges for the entire planning area.

Table 6: MWCOG Intermediate Population Forecasts for NOVA Jurisdictions (in Thousands)

Jurisdiction	Forecast for 2025	Forecast for 2030	Forecast for 2035	Forecast for 2030	Forecast for 2045	2025–2045 Numeric Increase	2025–2045 Percent Increase
City of Alexandria	185.5	197.7	207.4	217.3	231.8	46.3	25%
Arlington County	249.2	261.6	273.9	287.2	299.5	50.3	20.2%
City of Fairfax	29.2	31.6	32.7	33.9	35.2	6.0	20.3%

[17] 2020 U.S. Census https://www.census.gov/library/stories/state-by-state/virginia-population-change-between-census-decade.html
[18] Metropolitan Washington Council of Governments. (2021, December 2). *Cooperative Forecasts: Employment, Population, and Household Forecasts by Transportation Analysis Zone* https://www.mwcog.org/documents/2021/12/02/cooperative-forecasts-employment-population-and-household-forecasts-by-transportation-analysis-zone-cooperative-forecast-demographics-housing-population/

Jurisdiction	Forecast for 2025	Forecast for 2030	Forecast for 2035	Forecast for 2030	Forecast for 2045	2025–2045 Numeric Increase	2025–2045 Percent Increase
Fairfax County Including the towns of Clifton, Herndon, and Vienna	1,207.8	1,255.7	1,312.0	1,363.8	1,405.9	198.1	16.4%
City of Falls Church	18.4	20.8	22.3	23.4	24.5	6.1	33.2%
Loudoun County Including the towns of Leesburg, Lovettsville, Middleburg, Purcellville, and Round Hill	466.9	508.4	526.5	539.2	548.2	81.3	17.4%
City of Manassas	45.3	46.7	48.1	49.2	50.3	5.0	11.1%
City of Manassas Park	15.9	15.9	15.9	15.9	15.9	0	0%
Prince William County Including the towns of Dumfries, Haymarket, Occoquan, and Quantico	504.2	530.3	551.6	569.2	582.7	78.5	15.6%
Totals	**2,722.3**	**2,868.7**	**2,990.4**	**3,099.1**	**3,194.0**	**471.6**	**17.3%**

Table 7: 2020 Decennial Census Information by Race for NOVA Jurisdictions[19]

Jurisdiction	Asian Number (Percent)	Black Number (Percent)	Pacific Islander Number (Percent)	Native American	Other Race Number (Percent)	White Number (Percent)
City of Alexandria	15,230	35,436	417	3,225	25,956	97,735
Arlington County	34,246	24,900	539	4,317	32,948	169,402
City of Fairfax	5,144	1,440	53	447	3,947	16,147
Fairfax County Including the towns of Clifton, Herndon, and Vienna	269,522	130.292	2,974	20,054	176,774	689,040
City of Falls Church	2,099	815	39	241	1,443	11,887
Loudoun County Including the towns of Leesburg, Lovettsville, Middleburg, Purcellville, and Round Hill	102,090	38,065	1,009	6,867	53,147	267,606
City of Manassas	3,320	6,084	81	1,301	16,156	21,869
City of Manassas Park	2,062	2,551	45	414	6,947	7,586
Prince William County Including the towns of Dumfries, Haymarket, Occoquan, and Quantico	62,755	111,909	1,675	12,010	3,145	257,341

Note: data is from those who self-identified as a race alone or in combinations with other races or ethnicities.

[19] University of Virginia Weldon Cooper Center for Public Service Demographics Research Group. (n.d.). *Census 2020 Overview.* https://demographics.coopercenter.org/census2020-differential-privacy

Table 8: 2020 Decennial Census Information About Hispanic or Latino* Population for NOVA Jurisdictions[20]

Jurisdiction	Population Count
City of Alexandria	29,372
Arlington County	37,362
City of Fairfax	4,278
Fairfax County Including the towns of Clifton, Herndon, and Vienna	199,234
City of Falls Church	1,529
Loudoun County Including the towns of Leesburg, Lovettsville, Middleburg, Purcellville, and Round Hill	59,744
City of Manassas	18,345
City of Manassas Park	7,799
Prince William County Including the towns of Dumfries, Haymarket, Occoquan, and Quantico	121,524

***Note*: *Hispanics or Latino** refers to a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race.https://demographics.coopercenter.org/census2020-differential-privacy.[21]

A Note about Using 2020 Census Data

The 2020 Census was different from previous censuses in several significant ways, and caution should be used when using the data, especially for comparisons with previous census data.[22]

- Every data element (population, race, Hispanic origin, age, vacant housing units, etc.), except the total population for the state and housing unit counts, is injected with "noise" by the Census Bureau, using a new privacy protection method called "differential privacy." This method, while not changing large populations very much, significantly distorted the population counts of small geographies (such as neighborhoods) and racial/ethnic groups, particularly when they account for a small share of the population. Numbers were artificially inflated or deflated to blur the community "portrait."
- Published racial data has been significantly altered not only by noise injection, but also by how the Census Bureau coded and processed the responses. The alteration is more significant than the changes in people's racial identification about themselves since the last census. As a result, the 2020 census data on race are not comparable to previous censuses.
- In addition, the pandemic impacted census taking and census results. College towns, for example, may still miss counting some students, especially those who live off campus.

[20] Ibid.
[21] U.S. Census Bureau, Population Estimates Program (PEP). (n.d). *Hispanic or Latino Origin*. https://www.census.gov/quickfacts/fact/note/US/RHI725219#:~:text=Hispanics%20or%20Latino%20refers%20to,or%20origin%20regardless%20of%20race.
[22] University of Virginia Weldon Cooper Center for Public Service Demographics Research Group. (n.d.). *Census 2020 Overview.* https://demographics.coopercenter.org/census2020-differential-privacy

1.2.1.8. Economics

Northern Virginia is a strong subregional component of the larger Washington economy, as are suburban Maryland and the District of Columbia. Most of the employment is in the profession and business services sector. The fifty largest employers in the planning area include federal, county, and city governments and services, education, and private companies. Northern Virginia represents 37% of all jobs in the Commonwealth.[23] As of January 2022, the economy showed signs of growth, employment rose, the unemployment rate fell, and housing market indicators were positive. Figure 7 shows the employment composition by sector, and Figure 8 lists the 50 largest employers in NOVA.

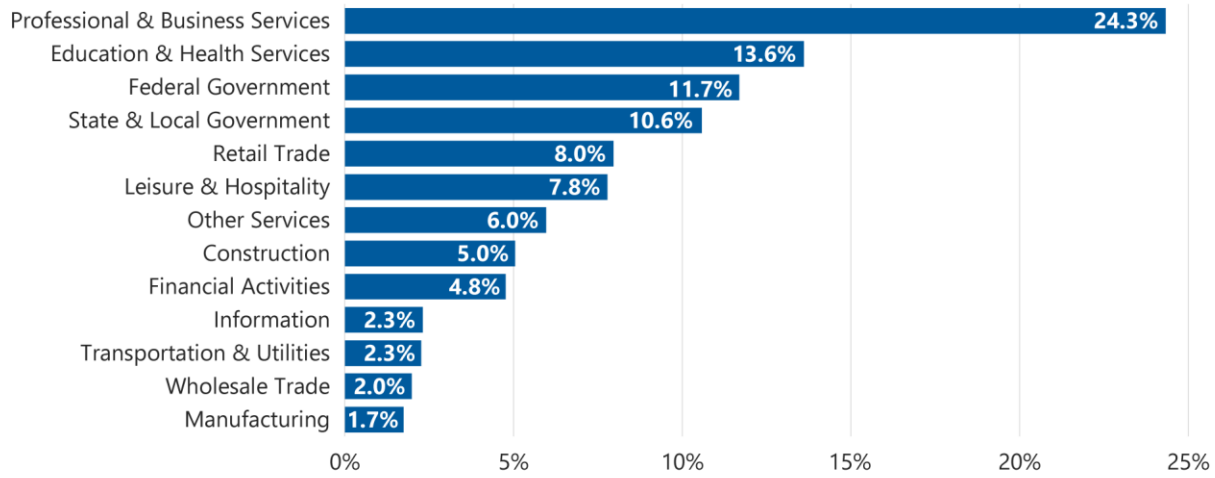


Figure 7: Employment Composition in Northern Virginia, by Sector[24]

[23] Virginia Department of Planning and Budget. (n.d.). Economic Forecast. https://dpb.virginia.gov/budget/buddoc20/parta/EconomicForecast.pdf

[24] George Mason University Schar School of Policy and Government Center for Regional Analysis. (2021, July 20). *Washington Area Economy: Performance and Outlook*. https://cra.gmu.edu/wp-content/uploads/2021/07/2021.7.20-Indicator-Slides.pdf

1	U.S. Department of Defense	26	Deloitte Consulting LLP
2	Fairfax County Public Schools	27	The Mitre Corporation
3	Inova Health System	28	Amazon Web Services LLc
4	County of Fairfax	29	County of Arlington
5	Loudoun County Schools	30	Target Corp
6	Prince William County School Board	31	SAIC Gemini, Inc.
7	U.S. Department of Homeland Defense	32	The Home Depot
8	Booz, Allen and Hamilton	33.	Amazon Fulfillment Services Inc.
9	U.S. Department of Commerce	34	Virginia Hospital Center
10	Capital One Bank	35	Catholic Diocese of Arlington
11	George Mason University	36	Wegmans Store #07
12	Federal Home Loan Mortgage	37	Equifax Workforce Solutions
13	Arlington County School Board	38	Security Forces, Inc.
14	Accenture National Securities	39	City of Alexandria
15	Wal Mart	40	Ernst & Young
16	United Airlines Inc	41	Northern Virginia Community College
17	County of Prince William	42	Harris Teeter Supermarket
18	Postal Service	43	Alexandria City Public Schools
19	County of Loudoun	44	Costco
20	Anteon Corporation	45	United States Department of Justice
21	Navy Federal Credit Union	46	Fannie Mae
22	Northrop Grumman Corporation	47	HCA Virginia Health System
23	Giant Food	48	Washington Metro Area Transit Authority
24	Administaff	49	U.P.S.
25	Science Applications International Corporation	50	Prime Now LLC

Figure 8: Fifty Largest Employers in Northern Virginia[25]

1.2.2. Built Environment

1.2.2.1. Land Use and Changes in Development Patterns

According to the 2019 Multi-Resolution Land Characteristics Consortium National Land Cover Database (NLCD), 90% of the types of land cover in the planning region has not changed since the 2016 NLCD land cover survey (see Figure 9). The biggest change is a .70% increase in urban land cover, much of which is in southeastern Loudoun County and northwestern Prince William County near the town of Haymarket.

[25] Virginia Employment Commission Labor Market Information. (2022, January 6). Community Profile Northern Virginia RC. https://virginiaworks.com/_docs/Local-Area-Profiles/5109000308.pdf

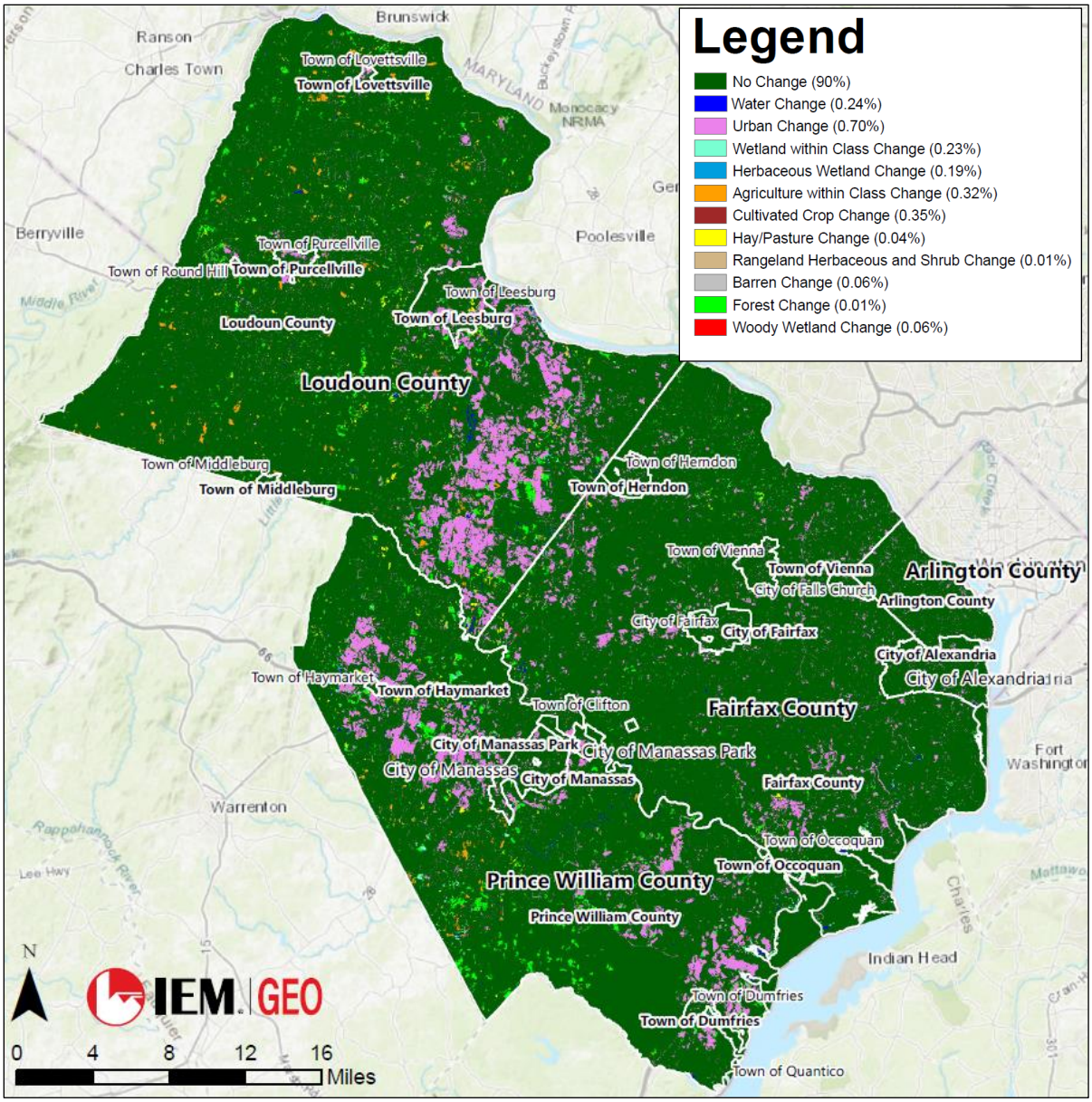


Figure 9: Land Cover Change Since 2016[26]

[26] Multi-Resolution Land Characteristics Consortium. (2019). *National Land Cover Database Land Cover Change Index.* https://www.mrlc.gov/data/nlcd-land-cover-change-index-conus

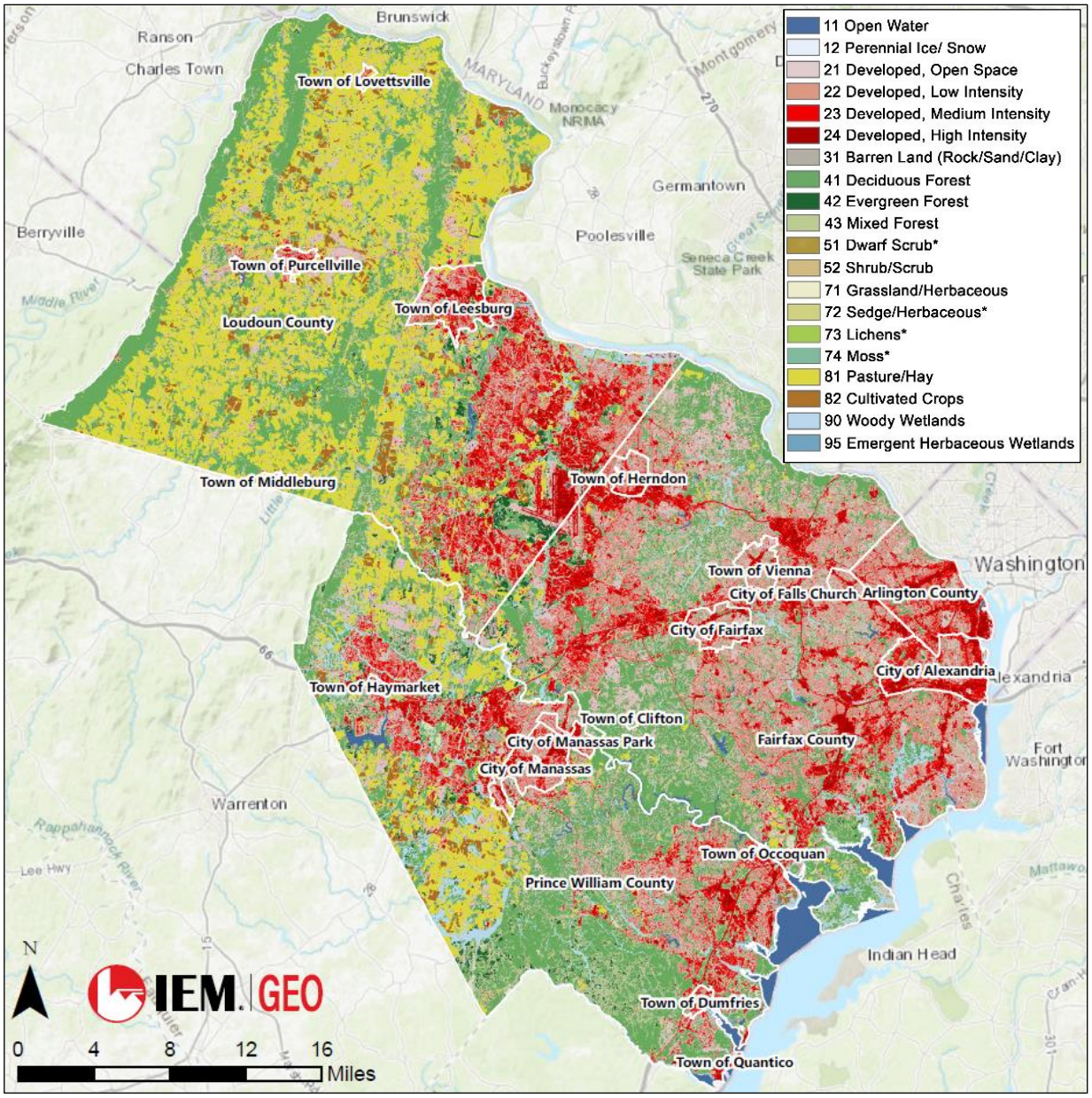


Figure 10: Land Cover in the NOVA Region, 2019[27]

As urban development grows to meet population demands, it is important for planning participants to continue to enforce existing land-use planning efforts, ordinances, and codes and update and expand them as necessary to meet evolving circumstances. Most planning participants have strong land-use capabilities and meet or exceed the American Planning Association's Safe Growth guidance. Additional information about these abilities is in the jurisdiction annexes.

[27] Ibid.

1.2.2.2. Housing

There is a constant demand for affordable housing in the Northern Virginia planning area because of low vacancy rates, population growth, and economic expansion. Many households spend an excessive fraction of their income on housing, putting pressure on family budgets and forcing many to trade short commutes for more affordable housing options. In 2018, the MWCOG wrote a memo about meeting the region's current and future housing needs.[28] In this memo, MWCOG stated that the region would have, by 2045, more than 100,000 additional households than are currently projected. Based on the "jobs-to-housing" metric used in the study, to close this gap, the region would need to add 235,000 housing units by 2025 rather than the 170,000 currently anticipated. Similarly, the region would need to add 365,000 new units by 2030 rather than the 290,000 currently projected, and 690,000 units by 2045 compared to the 575,000 currently assumed. To meet short- and long-term housing needs, the region would need a sustained housing production of at least 25,600 units per year.

As of May 2021, the average sales price of a home in NOVA was $679,976.[29] This is more than the average in December 2014 of $408,000 referenced in the 2017 HMP. Incomes have not kept pace with rising home and rent prices, increasing the share of households that pay a large share of their income for housing. In the American Community Survey area that includes Arlington, Fairfax, and Loudoun counties and the cities of Alexandria, Fairfax, and Falls Church, almost half of the renters and a quarter of homeowners pay 30% or more of their income on housing. The US Department of Housing and Urban Development considers such a share unaffordable. Moreover, 23% of renters and 10% of homeowners are severely cost-burdened, meaning housing eats up at least half their income.[30]

An analysis using HAZUS-MH® software found an estimated 663,000 buildings in the NOVA region, with approximately 92% of the buildings associated with residential housing.

1.2.2.3. Transportation Systems

Roads

Northern Virginia has a substantial transportation network consisting of interstate, US, state, and county highways, rail systems, and airports. There are 12 interstate highways and 42 other highways in the region. Major highways include Virginia Route 7, 28, and 29; Interstates 66, 95, and 395; U.S. Highways 50 and 1; and U.S. Route 211 (Langston Boulevard). The Capital Beltway (Interstates 495 and 95) encircles Washington, D.C., and passes through the City of Alexandria and Fairfax County. The Fairfax, Loudoun, and Prince William Parkways also are significant thoroughfares in the region. The Point of Rocks bridge on U.S. Highway 15 north of Leesburg is the only bridge across the Potomac River between there and the Capital Beltway.

Trains and Buses

The Washington Metropolitan Area Transit Authority (WMATA) was created by an interstate compact in 1967 to plan, develop, build, finance, and operate a balanced regional transportation system in the region. Today, Metrorail serves 91 stations and has 117 miles of track with 1,500 buses. The Washington Area Metro Rail System (Metro) services the planning area with four rail lines. These lines take riders into Washington D.C., and they provide service to Ronald Reagan Washington National Airport. The expansion of the Silver Line to Dulles International Airport and into Loudoun County is mostly completed and could begin carrying passengers in 2022.

[28] Metropolitan Washington Council of Governments. (2018, September 5). Memorandum: Meeting the Region's Current and Future Housing Needs. https://www.mwcog.org/documents/2018/09/12/regional-housing-memo-to-cog-board-cog-board-affordable-housing-housing/

[29] George Mason University Schar School of Policy and Government Center for Regional Analysis. (2021, July 20). *Washington Area Economy: Performance and Outlook*. https://cra.gmu.edu/wp-content/uploads/2021/07/2021.7.20-Indicator-Slides.pdf

[30] Urban Institute Greater DC (2018, October 2018). *What HQ2 Could Mean for the Washington Region's Housing Market, in 7 Charts*. https://apps.urban.org/features/amazon-hq2-washington-housing-charts/

The Virginia Railway Express (VRE) commuter rail system has two lines with stops in the cities of Alexandria, Manassas Park, and Manassas, the town of Quantico as well as Fairfax and Prince William Counties. Amtrak trains also operate in the planning area, with stops in the cities of Alexandria and Manassas and the Town of Quantico. Several bus systems also provide service throughout the region.

Airports

Ronald Reagan Washington National Airport and Washington Dulles International Airport provide commercial airline service to the area. From November 2020 to November 2021, 12.59 million passengers used Reagan National Airport, and 14.07 million passengers used Dulles International Airport.[31] In addition, Manassas Regional Airport in the city of Manassas is the largest general aviation airport in the Commonwealth.

Although the region has multiple transportation options, vehicular travel accounts for the majority of transportation. Transportation systems are vital to providing effective and efficient emergency responses and evacuations. High levels of traffic congestion are a regular occurrence in the region, and they will likely increase as the population grows, the demand for delivery services increases, and weather occurrences like heavy rain and snow that impact travel increase.

Planning participants are working to alleviate the burden on the region's transportation systems by creating and updating regional transportation plans, working with transit systems to expand service, and increasing the number of high occupancy toll lanes in the area.

1.2.2.4. Emergency Services and Hospital and Healthcare Facilities

There are 11 hospitals, not including Ft. Belvoir in the region, with a total bed capacity of 2,890 beds. Trauma centers include, Inova FFX – Level 1, Reston – Level 2, VHC Health – Level 2, Sentara – Level 3, Inova Loudoun – Level 3[32]. There are 110 fire stations, 46 police stations, and 14 emergency operations centers (EOCs)[33]. These facilities are located throughout the region. In Figure 11, medical care facilities are designated with a blue H, fire stations with a red diamond, police stations with a blue P, and EOCs with a green E. More details about these facilities are in the jurisdiction annexes.

[31] Metropolitan Washington Airports Authority. (2022, January 14). *Air Traffic Statistics, November 2021*. https://www.mwaa.com/sites/mwaa.com/files/2022-01/11-21%20ATS%20%281.14.22%29.pdf
[32] NVHA
[33] These numbers come from Hazus, a FEMA modeling software, local jurisdiction data may differ.

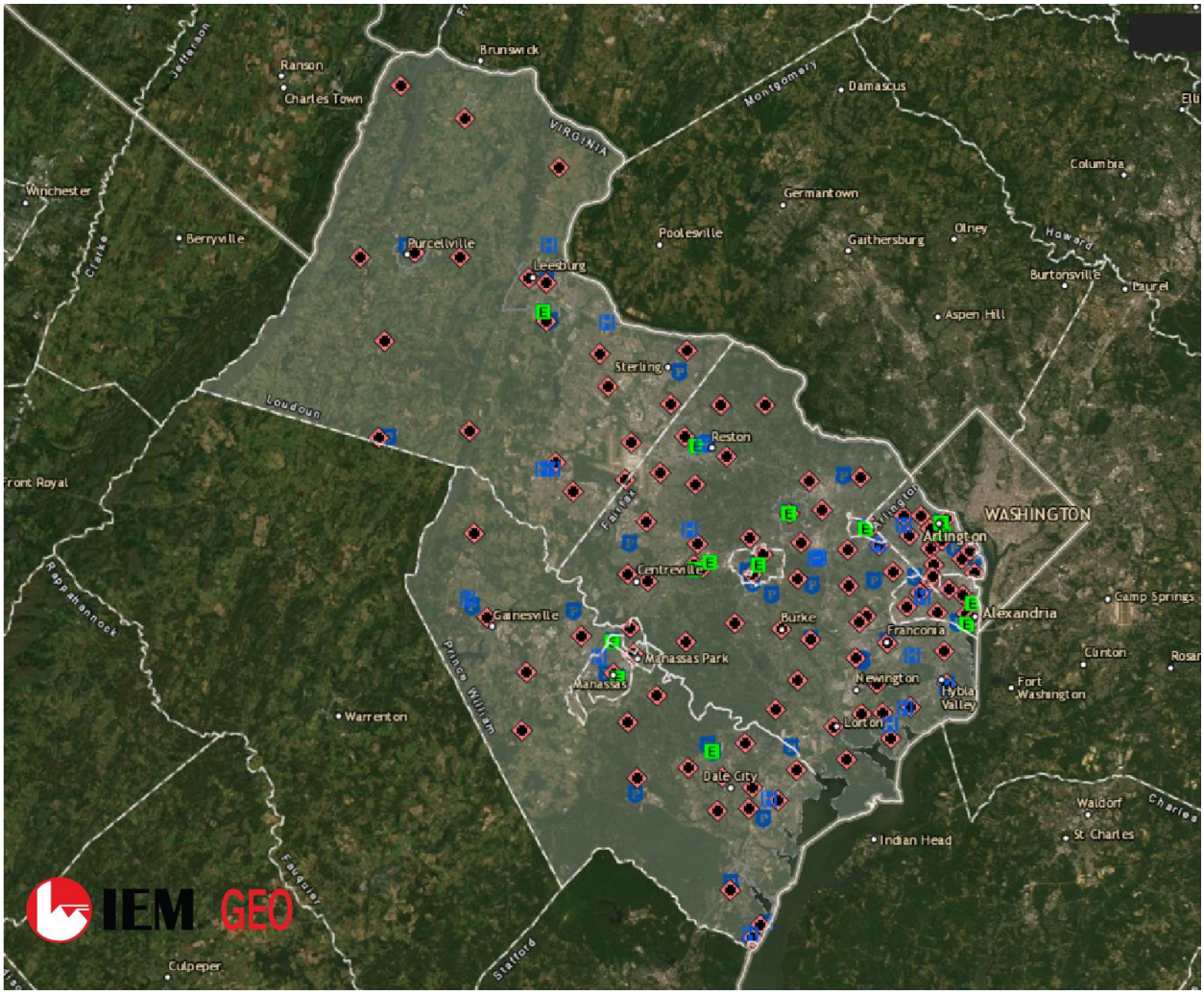


Figure 11: Emergency Services and Medical Care Facilities in Northern Virginia

1.2.2.5. Cultural and Historical Facilities

The NOVA region is home to many historical and cultural sites and Civil War era battlefields, including Manassas Battlefield Park, George Washington's historic home on the Potomac, Mount Vernon; Arlington National Cemetery; and the Udvar-Hazy Center of the Smithsonian Institution's National Air and Space Museum at Washington-Dulles International Airport.

In addition, many areas in the region are historic districts. The entire town of Haymarket is designated as a historic district, and Arlington County alone has 32 historic districts.

A significant number of churches, schools, community buildings, houses, monuments, cemeteries, parks, and farms are identified as historic buildings and structures, either locally or at the commonwealth or federal levels.

A Hazus map of historic buildings, districts, objects, and sites shows that they are throughout the planning area, with concentrations in Arlington County and the City of Alexandria.

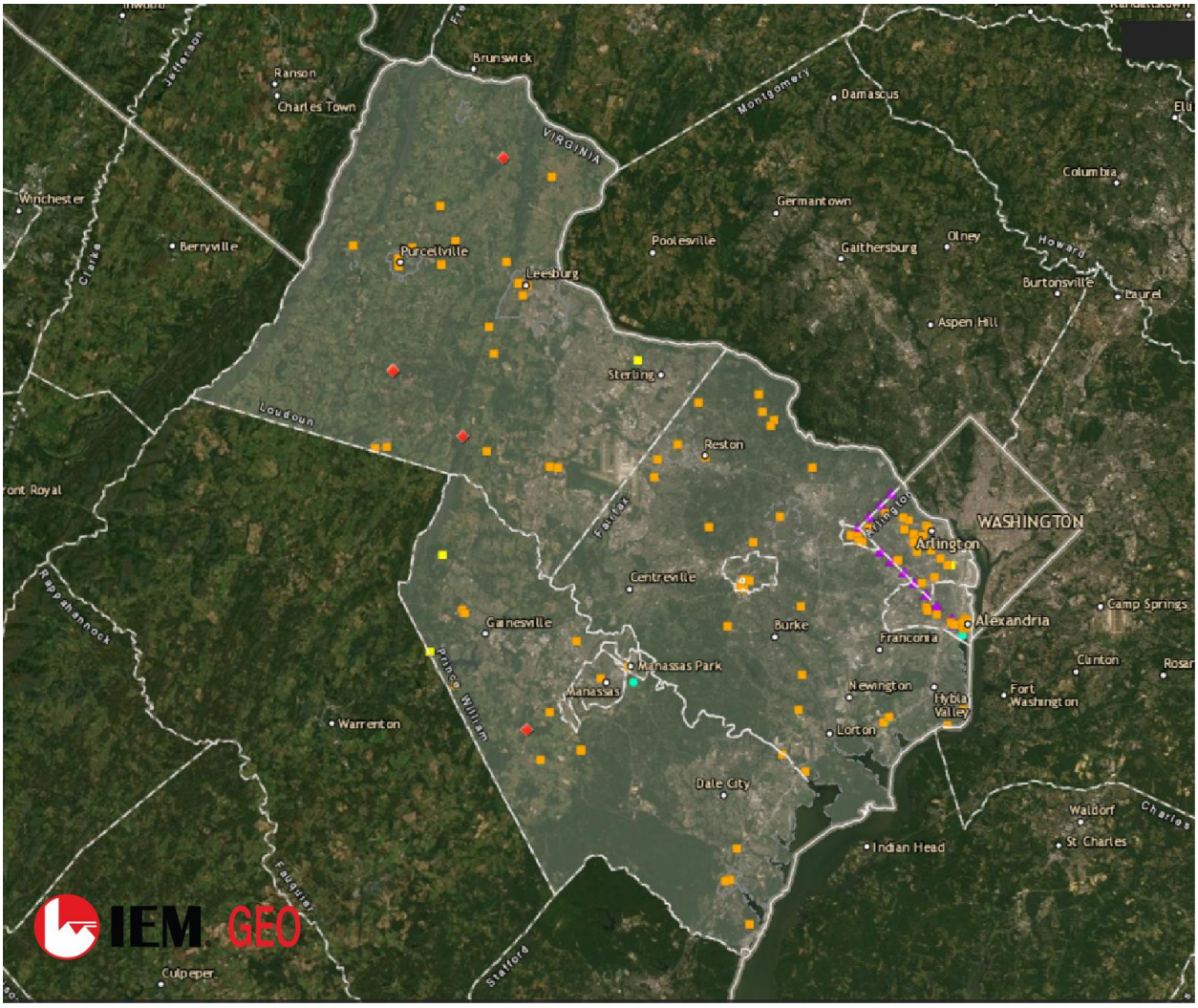


Figure 12: Historic Points in Northern Virginia

1.2.2.6. Future Conditions

It is anticipated that as the population continues to expand and additional businesses move into the NOVA region, more housing, buildings, and infrastructure will be built to accommodate growth. Plan participants have strong, detailed, and enforced building codes and zoning laws. There is an emphasis on regulating or prohibiting new construction in floodplains and flood zones. This is because the region has seen an increase in flooding occurrences, and previously unflooded areas have become inundated during high rain events.

Climate change is also anticipated to increase risks and vulnerabilities for future populations and infrastructure. Climate change increases the frequency, duration and intensity of natural hazards. These increases create new risks to local governments and challenge pre-existing mitigation plans. They also pose a unique threat to the most at-risk populations by exacerbating the impacts of disasters on underserved and socially vulnerable populations who already experience the greatest losses from natural hazards.

Aging infrastructure is a global challenge amplified by the intensifying natural disasters and aging workforce. These issues continue to highlight the adverse effects of climate change on our infrastructural

systems and call for significant investment in improving the resilience of the world's built environment. Aging infrastructure will also be a concern as the demand to meet the needs of the increasing population will be a challenge to keep up with.

1.2.2.7. Federal Government and Military Presence

The NOVA region has buildings that house federal and high-level government operations. There is also a strong military presence in the area. The United States Marine Corps base in Quantico includes a Federal Bureau of Investigation training academy. The Joint Base Myer-Henderson Hall, near Arlington Cemetery, comprises Fort Myer, Fort McNair, Fort Belvoir, and Henderson Hall. It is commanded by the United States Army, but it has resident commands of the Army, Navy, and Marines.

2. Planning Process

Requirements

- **§201.6(c)(2)(1):** [The] plan documents the planning process, including how it was prepared and who was involved in the process for each jurisdiction.
- **§201.6(b)(2):** [The] plan documents an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process.
- **§201.6(b)(1):** [The] plan documents how the public was involved in the planning process during the drafting stage.
- **§201.6(b)(3):** [The] plan describes the review and incorporation of existing plans, studies, reports, and technical information.
- **§201.6(b)(4)(iii):** The plan describes how the communities will continue public participation in the plan maintenance process.
- **§201.6(b)(4)(I):** The plan describes the method and schedule for keeping the plan current (monitoring, evaluating, and updating the mitigation plan within a 5-year cycle).

2022 HMP Update

- This section was reorganized and updated for consistency with the review criteria.
- Participant and engagement information was updated to reflect the 2021–2022 planning process and adaptation of engagement methodology to accommodate social distancing measures during the Coronavirus (COVID-19) pandemic.

The jurisdictions of Northern Virginia are committed to creating comprehensive and functional emergency management programs, which include mitigation, preparedness, prevention/protection, response, and recovery.

The mitigation planning process used for this 2022 Plan update followed multiple steps that built on previous planning efforts. It ensured that the 2022 Plan is compliant with Federal Emergency Management Agency (FEMA) regulations, consistent with the standards of the Emergency Management Accreditation Program (EMAP), and appropriate for all 21 participating jurisdictions in the Northern Virginia planning area to use.

2.1. Overview

The 2022 NOVA HMP update project was funded by FEMA through the Virginia Department of Emergency Management (VDEM) Grant Agreement Number PDMC-PL-03-VA-2018-003 and administered by the Prince William County Office of Emergency Management. A contract was executed with IEM to facilitate the Plan update process in coordination with Prince William County.

As part of the Plan update process, the contractor was tasked with researching national best practices in hazard mitigation planning and coordinating a jurisdiction needs analysis to identify specific community needs in relation to hazard vulnerabilities and mitigation planning. The results of these two tasks helped inform how the data and information in this update are presented in a more functional way.

In conjunction with the best practices and needs analysis, the contractor prepared multiple options for reorganizing the components of the Plan that would improve the ease of locating specific data and information, and, more specifically, merge data and information related to each jurisdiction into separate components of the Plan.

The *2017 Northern Virginia Hazard Mitigation Plan* underwent a comprehensive review and revision of this 2022 update. The update process was based on the accepted planning principles and guidance used in 2017, the planning criteria contained in 44 Code of Federal Regulations (CFR), Part 201.6, and the FEMA *Local Multi-Hazard Mitigation Planning Handbook (LHMP Handbook)* of March 2013. In addition, the document review included the standards of the Emergency Management Accreditation Program (EMAP) of 2019. The aim was to ensure consistency with the relevant standards for jurisdictions desiring to pursue accreditation. The EMAP standard is nationally recognized as a mark of excellence that provides a measure of accountability for a jurisdiction's emergency management program.

2.2. Summary of Changes

The 2022 revision is a comprehensive review and update of the *2017 Northern Virginia Hazard Mitigation Plan*. Changes to the Plan's format and contents involved a multistep process that included best practices research and an assessment of jurisdiction planning needs.

Table 9: Summary of Changes in the 2022 HMP

Section	Changes
All	• Comprehensive review and update of hazard risk and vulnerability data and information • Plan format reorganized to highlight the Plan support sections, hazard analysis, and mitigation strategy • Reformatted to be consistent with FEMA planning guidance • Jurisdiction Annexes developed to consolidate jurisdiction-specific data and information • Reviewed for consistency with the *2017 Virginia Hazard Mitigation Plan* • Non-natural hazards were added and addressed in a separate volume • Jurisdictional-specific annexes were added

Part 1: The Plan	Volume I: Base Plan
Section 1: Introduction	• Streamlined to highlight key information locations in the plan • Updated to reflect content location changes • Brief profile provided for Plan context
Section 2: Planning Process	• Participant and engagement information updated to reflect the 2021–2022 planning process and adaptation of engagement methodology to accommodate social distancing measures during the Coronavirus (COVID-19) pandemic
Section 3: Plan Maintenance and Adoption	• Reformatted to include procedural guidance to include the method and schedule for monitoring, evaluating, and updating the Plan • Expanded detail on Plan monitoring, evaluating, and updating to include roles and responsibilities, description of specific method and schedule, and data forms • Developed Plan maintenance worksheets (see Appendix A)

Part 2: Natural Hazard Analysis	Volume I: Base Plan
Section 4: Hazard Identification and Risk Assessment Methodology	• Hazard analysis methodology consolidated into a separate section • Updated description of the methodology
Section 5: Hazard Profiles, Risks, and Vulnerability	• Latest hazard impact and disaster declaration data added • Hazard profiles revised to reflect the latest impacts and consequences • Added new hazard profiles for human infectious diseases • Incorporated stakeholder input into hazard profiles • Detailed summary of 2019 flooding impacts and discussion of changes in level of risk and vulnerability added to Section 5.5, Flood/Flash Flood • High Hazard Potential Dam Grant Program (HHPD) requirements were considered and referenced in Section 5.1, Dam Failure
Section 6: Impacts of Climate Change	• New section incorporates discussion of climate change impacts to all natural hazards

Part 3: Mitigation Strategy	Volume I: Base Plan
Section 7: Capability Assessment	• Updated capabilities assessments conducted for all jurisdictions
Section 8: Goals and Objectives	• Goals and objectives from the 2017 NOVA HMP were reviewed and revised to a streamlined goal statement to ensure consistency with FEMA mitigation requirements
Section 9: Mitigation Actions	• Adapted from the 2017 NOVA HMP to include additional analysis of progress in mitigation • Updated funding descriptions and requirements were added per the latest FEMA guidance documents and the 2018 Virginia Hazard Mitigation Plan

Appendices	Volume I: Base Plan
Appendices to the Base Plan	• Documentation of the planning process, the data sources, and the mitigation strategy
Jurisdictional Annexes	• Detailed data and information incorporated into individual annexes for each jurisdiction

Section	Volume II: Non-Natural Hazards
Plan Sections	• Hazard Profiles (including risk assessment and vulnerability analysis) were developed for participation jurisdictions • Mitigation Strategies were developed for participating jurisdictions

2.3. Participation

The participating jurisdictions of the 2022 *HMP* includes 21 jurisdictions in the Northern Virginia region and various subject matter experts.

2.3.1. Planning Team

Each jurisdiction had a primary point of contact who represented their jurisdiction in the Planning Team. The primary role of Planning Team members was to provide jurisdictional information with input from local support within their jurisdiction. In Virginia, Incorporated communities located within a county that are not independent cities are called Towns, and for these areas many services are provided by the county, including police and fire response, the school system, and so forth. Counties are also responsible for Emergency Management functions. Given this County/Town relationship, Counties also represent the Towns located within their borders. In addition, information for many hazards and other types of community data is available only at the county or city level.

Table 10: 2022 Planning Team Members

Jurisdiction	Primary Point of Contact
Arlington County	Director, Department of Public Safety Communications and Emergency Management
Fairfax County	Coordinator, Office of Emergency Management
Loudoun County	Assistant Coordinator, Office of Emergency Management
Prince William County	Deputy Emergency Management Coordinator
Town of Clifton	Councilmember
Town of Dumfries	Director of Public Works
Town of Haymarket	Chief of Police
Town of Herndon	Police Lieutenant
Town of Leesburg	Emergency Management Coordinator
Town of Lovettsville	Project Manager
Town of Middleburg	Town Manager
Town of Occoquan	Deputy Chief of Police
Town of Purcellville	Chief of Police
Town of Round Hill	Town Administrator
Town of Vienna	Deputy Chief of Police
City of Alexandria	Acting Emergency Manager
City of Fairfax	Emergency Planner
City of Falls Church	Emergency Management Coordinator
City of Manassas	Emergency Management Specialist
City of Manassas Park	Fire Chief

Over the planning period from March 2021 to September 2022, jurisdictions participated in meetings, received technical assistance, and reviewed the plan and provided and input. Participation is documented in **Appendix A, Record of Participation**.

Coordination between state agencies, regional agencies and organizations, and local jurisdictions was accomplished with one-on-one virtual meetings and emails sent during the planning process, along with periodic phone meetings between the Planning Team members and the contractor.

2.3.2. Stakeholders

Stakeholders were also invited to participate in the planning process via email. Stakeholders involved neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, as well as other interests to be involved in the planning process. The primary role of these stakeholders was to provide data and review the draft of the plan. The stakeholder meetings were conducted virtually and by phone, and they were in addition to the regular meetings of the Planning Group.

Table 11: 2022 HMP Stakeholders

Organization	Primary Position/Title
Amtrak	Regional Emergency Manager
Council of Community Services	Northern Virginia Outreach Manager
Fort Belvoir	Deputy Emergency Manager
Fort Belvoir	Emergency Manager
George Mason University	Emergency Planner
George Mason University	Executive Director, Safety and Emergency Management
Metropolitan Washington Airports Authority	Operations Analyst
Northern Virginia Community College	Emergency Coordinator
Northern Virginia Emergency Response System	Program Director
Northern Virginia Planning Commission	Environmental & Resiliency Planner
Northern Virginia Regional Council	Resiliency Planner
NVERS	Senior Project Manager
NVERS	Executive Director
NVERS	Program Director
NVRIC	Intelligence Resource Manager
VDEM	All Hazards Planners
VDEM	Program Support Technician
VDEM	Region 7 Hazardous Materials Officer
VDEM	NCR Public Safety-HS Liaison
VDEM	Chief Regional Coordinator, VII
VDEM	Disaster Response and Recovery Officer
VDEM	Director of Regional Support East, Disaster Operations
VDEM	VEST Coordinator: Operations
VDEM	VEST Coordinator: Planning
VDOT	Incident Management Coordinator

Organization	Primary Position/Title
Virginia Community College System	Director of Emergency Planning, Safety & Security Services
Virginia Department of Social Services	Regional Administrator
WMATA, OEM	Fire/Life Safety Liaison Officer

During the planning meetings, stakeholders were asked to provide insight into how their agencies/ organizations engaged in mitigation and planning efforts, along with input and information on the hazards facing the jurisdictions and the NOVA region. Stakeholders were contacted by email to participate in stakeholder workshops, given progress reports and an opportunity to participate in public surveying, and provided hazard data sources and action items. They reviewed the draft of the Plan to provide input. Those who did not participate in the planning meetings or individual meetings provided input through technical review and assistance, and by providing data.

Throughout the planning process, between meetings and final submission, stakeholders were provided the opportunity to review drafts of the base plan which includes hazard profiles and provide feedback along with data such as damage histories, frequency of current and future events, and resources.

2.4. Planning Organization

Planning organization roles and responsibilities were defined as an initial step in the planning process. Roles were described as follows:

- **Project Team**: Point of Contact, Deputy Emergency Management Coordinator for Prince William County Office of Emergency Management, and Contractor
- **Planning Team**:
  - Northern Virginia (NOVA) Emergency Managers (“Emergency Managers Group”)
  - NOVA Emergency Management Planners (“Planning Group”)
  - Subject matter experts/technical specialists

The NOVA Emergency Managers Group was tasked with oversight of the 2022 Plan update process. Some members of this group were involved with the 2017 Plan update, so they were familiar with the scope of hazards, risks, and mitigation opportunities and projects in the region. The NOVA Emergency Managers Group tasked all projected responsibilities to the NOVA Planning Group.

Table 12: Team Participants and Responsibilities

Project Team	Participants	Responsibilities
NOVA	Project Coordinator (Deputy Emergency Management Coordinator, Prince William County Office of Emergency Management)	• Point of contact for Northern Virginia Hazard Mitigation planning grant • Coordinate planning activities • Monitor project deliverables and schedules
IEM	Consultant Team	• Coordinate hazard mitigation planning process with Project Coordinator • Develop all Plan components, with updated data, analysis, and graphics

Project Team	Participants	Responsibilities
		• Coordinate community and public outreach activities with the Planning Group • Conduct Plan review and writing with contractor staff, update formats and information to meet compliance requirements • Prepare and submit deliverables • Prepare and submit weekly progress reports • Provide technical assistance to the Project Coordinator during the planning, writing, review, approval, and adoption processes

Planning Team	Participants	Responsibilities
Planning Group	Local Jurisdictions	• Represent their jurisdictions in the planning process • Participate in planning meetings through attendance and assistance in identifying, locating, collecting, compiling, and/or analyzing relevant information and data • Make planning recommendations as needed to the Emergency Managers Group • Participate in developing the risk assessment and mitigation strategy • Review the Plan and provide feedback and recommendations for improvement • Validate specific data and topics related to the area of authority and/or responsibility • Identify potential resources from agencies, departments, disciplines, and organizations that could support the mitigation strategy, including specific mitigation actions and potential funding sources
Stakeholders	Subject matter experts/technical specialists from other governments, nonprofits, and the private sector	• Assist in identifying, locating, collecting, compiling, and/or analyzing information and data relevant to expertise • Assist in developing the risk assessment and mitigation strategy • Validate specific data and topics related to the area of authority and/or responsibility • Review the Plan and provide feedback relevant to the area of expertise • Identify potential resources from agencies, departments, disciplines, and organizations that could support the mitigation strategy, including specific mitigation actions and potential funding sources

Since the 2017 update, the Emergency Managers Group has maintained its responsibilities as the oversight group for monitoring, evaluating, and revising the plan, and it will continue this function in overseeing and implementing the 2022 Plan.

A key focus of the 2021–2022 planning effort was the importance of working as a team to ensure regionwide involvement in the development of all components of the Plan. Representatives from

participating jurisdictions, key stakeholders, and partner agencies and organizations gathered data and critical information throughout the planning process, and this was then analyzed and validated by the Planning Team. This process helped the Planning Team identify the greatest opportunities for loss reduction by addressing the most frequent hazards, building support and ownership of the mitigation strategy and its identified activities, and ensuring that the resulting strategy would lead to comprehensive progress in reducing risk.

2.5. Planning Process

The planning process followed the step-by-step framework described in FEMA's *LHMP Handbook.*[34] The following four steps describe the general methodology for mitigation planning:

1. Identification and analysis of natural and non-natural hazards and their associated risks that could impact the community.
2. Assessment of the community's vulnerability to natural and non-natural hazards.
3. Assessment of the community's capabilities, including current policies, ordinances, and resources, to implement mitigation initiatives that reduce or avoid the impacts of disasters.
4. Development of hazard mitigation strategies that can be implemented to reduce future vulnerability.

The process for moving each planning step forward involved presenting planning concepts, data, and plan elements to the Planning Group at scheduled meetings. The group then made recommendations to the Emergency Managers Group, who made decisions such as identifying hazards to include in the Plan; determining the plan format; reviewing, providing input, and approving plan components, and making the decisions necessary to move the plan update process forward.

Figure 13: Planning Process

The planning process was initiated by the Prince William County Office of Emergency Management in 2020, with the development of a scope of work and a request for proposals from consultants to facilitate the plan update process. With the selection of a vendor and contract approval, the Project Team was formed, and work began in late February 2021. On March 9, 2021, the Project Team met virtually via Microsoft Teams to formally initiate the project by establishing a project management plan and schedule

[34] Federal Emergency Management Agency. (2013, March). Local Mitigation Planning Handbook. https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-planning-handbook_03-2013.pdf

that addressed project coordination, stakeholder engagement, group meetings, one-on-one stakeholder meetings, public outreach and input, data review and updates, other community engagement opportunities, and briefings to key officials. Consideration was given to the following issues and needs at the outset of the process:

- What are the key hazard concerns of the jurisdictions?
- What partnerships should be forged to understand these concerns?
- How can the whole community and emergency management support each other?
- How can the hazard mitigation plan be improved to make it more useable?
- What key issues need to be addressed to achieve a successful plan update?

A Virtual Engagement Plan outlining the methods and schedule for conducting public outreach in a COVID-19 environment was presented by the contractor at the March 2021 meeting and approved by the Planning Group.

2.6. Planning Meetings

The planning process was carried out through various methods, including project team coordination meetings, Planning Group and Emergency Managers Group meetings, email, virtual data collection, validation meetings, one-on-one virtual jurisdiction planning meetings, weekly progress reports to the Project Coordinator, public engagement opportunities, and phone and email communication to facilitate workflow and validate data and information. Meetings were conducted virtually throughout the planning period because of ongoing limitations for in-person meetings related to COVID-19 restrictions.

Along with the meetings outlined below, updates of the planning process were provided every month at both the NOVA Planner's Meeting and NOVA EM Meetings.

Table 13: Planning Meeting Schedule, Topics, Participants, and Format

Date	Topic	Participants
March 9, 2021	Project Team Initial Meeting	Project Coordinator, IEM Contractor
April 19, 2021	Kick-Off Meeting	Planning Group, IEM Contractor
May 25, 2021	Best Practices Research, Jurisdiction Needs Assessment, Plan Format	Planning Group, IEM Contractor
June 1, 2021	HIRA Overview, Hazard Risk Ranking Methodology	Planning Group, IEM Contractor
June 4, 2021	Plan Format, Risk Ranking Methodology, Non-natural Hazard decision	Managers Group, IEM Contractor
June 22, 2021	Hazard Data updates, Capabilities Assessment	Planning Group, IEM Contractor

Date	Topic	Participants
July 6, 2021	Mitigation Strategy 1: Goals and Objectives, Hazard Problem Statements	Planning Group, IEM Contractor
July 20, 2021	Mitigation Strategy 2: Mitigation Actions and Priorities	Planning Group, IEM Contractor
August 3, 2021	Mitigation Strategy 3: Projects Workshop	Planning Group, IEM Contractor
September 14, 2021	Planning Wrap Up	Planning Group, IEM Contractor
February 1, 2022	Draft Plan Review Workshop	Planning Group, IEM Contractor

In addition to the scheduled planning meetings, separate meetings were held with multiple jurisdictions throughout the planning process to assess planning needs, collect and verify data and information, and provide technical assistance to the jurisdiction planning committees. A total of 44 meetings were held with jurisdictions.

Meeting agendas and formats varied based on whether it was a large group meeting or a one-on-one jurisdiction meeting. These interactions provided a step-by-step approach to accomplishing each planning objective.

Documentation of the planning and jurisdiction meetings, including schedules, agendas, minutes, handouts, and presentations, is provided in **Appendix A**.

2.7. Timeline of Key Activities

Each step in the planning process was built on the foundation of activities conducted by the Planning Group and at other meetings, providing a high level of assurance that the mitigation actions proposed by the participants and the priorities for implementation are valid.

Planning milestones measured the successful outcome of each step in the planning process.

Table 14: Milestones in the Planning Process

Event or Product	Milestone	Method of Completion
Best Practices Research	• Identified methods and practices that informed the plan update, including plan format, content, and presentation	Contractor research and approval of the summary report by the Emergency Managers Group
Jurisdiction Needs Analysis	• Provided multiple opportunities for specific input from each jurisdiction related to methods to improve and enhance the plan	Jurisdiction Needs Questionnaire and follow-up jurisdiction meetings
General Planning Group Meetings	• Developed hazard mitigation planning network • Built components of the plan	Meetings with this group occurred throughout the update process

Event or Product	Milestone	Method of Completion
	• Provided frequent opportunities for input and technical assistance • Marked progress in the plan update process	
Capabilities Assessment	• Analysis of planning and regulatory, administrative and technical, education and outreach, smart growth, funding, and National Flood Insurance Program capabilities	Capabilities Assessment Worksheets completed by jurisdiction representatives
Hazard Profiles and Risk Assessment	• Description of methodology: scope, steps, data sources, and validation • Identification of a comprehensive list of hazards to be addressed in the plan • Qualitative and quantitative examination of the vulnerability of critical community facilities, systems, and neighborhoods to the impacts of future disasters utilizing maps and geographic information system modeling and looking at specific vulnerabilities	Contractor research and Hazus analyses provided initial updated data and information that was reviewed and expanded by jurisdictions completing hazard identification and risk worksheets and reviewing and updating critical assets inventories
Outreach and Education	• Virtual Engagement Plan • Hazard survey for stakeholders • Draft Plan posted for public review and input	Jurisdictions posted Hazard Mitigation Fact Sheet, Hazard Survey, and draft Plan with public information releases
Mitigation Strategy and Implementation Plan	• Goals, objectives, and development of the mitigation strategy	Proposed revision of 2017 goals and objectives were presented to and approved by Planning Group and Emergency Managers Group Contractor worked directly with jurisdictions to review progress on previous actions and develop new actions, along with the Action Plan for Implementation
Plan Maintenance Procedures and Schedule	• Indicators to measure progress in next planning cycle: ▪ Monitoring ▪ Evaluation ▪ Updating	Procedural guidance was expanded with forms to utilize for monitoring and evaluating the plan
Public Input	• Hazard Survey • Comment period for review and input of draft plan	Information was posted by jurisdictions periodically throughout the planning process to solicit public input
Plan Approval	• Plan reviewed by VDEM; FEMA Approvable Pending Adoption (“APA”)	[PENDING]
Plan Adoption	• Plan adopted by all Jurisdictions	[PENDING]

Event or Product	Milestone	Method of Completion
Final Plan Approval	• FEMA letter documenting final approval	[PENDING]

2.8. Public Participation and Input

Public awareness of the Plan and input in the update process is a recognized benefit to jurisdictions in the NOVA region. The planning concept in Figure 14 represents the relationships between the Emergency Managers Group, the Planning Group, stakeholders, and the public.

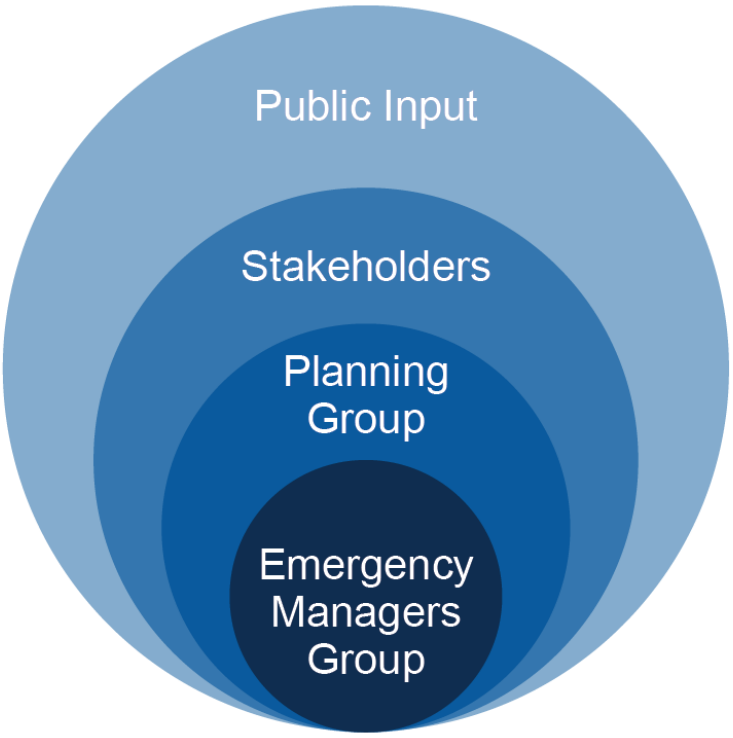


Figure 14: Planning Relationships

2.8.1. Public Engagement

The participants of the Northern Virginia All Hazards Mitigation Plan Update provided a survey link to the general public using public outreach on social media, county or city websites, and other means of outreach to their citizen for their comments and concerns about the natural and non-natural hazards that affect their area. The survey was open from August 8th, 2021, to November 3rd, 2021.

The survey and survey results can be found in **Appendix A, Public Engagement**.

From the 1,119 survey responses, climate change and pandemic were the most concerning hazards for residents in the Northern Virginia Area. Over half of the responses came from Fairfax County, with responses coming from every county and city and nearly every town.

The final draft NOVA HMP was posted on the Northern Virginia Emergency Response System (NVERS) website for public review and comment on September 8, 2022and was kept up until October 8, 2022. Nearly every participating jurisdiction posted regarding the public comment period on their website, and other social media outlets. Several jurisdictions included the public comment period in newsletters going out to every resident within their jurisdiction.

The public comment website went out to several key stakeholders, including George Mason University, and Northern Virginia Community College, as well as surrounding local Emergency Managers of the following jurisdictions, Stafford County, VA, Fauquier County, VA, Frederick County, MD, Clark County, MD, Washington D.C. Homeland Security and Emergency Management Agency, Prince George's County, MD and Montgomery County, MD. The notice also went out to members of several state agencies including the Virginia State Police, Virginia Department of Social Services, and the Virginia Department of Health. The planning documents were also sent to other regional stakeholders at the Northern Virginia Regional Commission and NVERS.

The majority of the comments received were unactionable for a hazard mitigation plan, such as "what is the evacuation plan" while some of the comments were concerning population numbers and other details that were double checked and corrected where needed. All comments were sent to Northern Virginia jurisdictions to allow for direct follow-up on comments or questions received that were not directly related to the plan.

All the jurisdictional outreach for the public comment and public comment is in **Appendix A, Public Engagement.**

2.9. Review and Incorporation of Existing Plans, Studies, Reports, and Technical Information

Table 15: Review and Integration with Other Plans, Programs, and Initiatives

Document	How Information Was Used for the 2022 HMP Update

Arlington County, FEMA Risk MAP Community Coordination & Outreach Meeting, November 2020	• Reference document for jurisdiction annex
	  ▪ Schedule for the adoption of preliminary maps issued 9/18/2020
	• Reference document for flood sections
	  ▪ Image of risk zones on flood maps (Slide 8)

Arlington County, Comprehensive Emergency Management Program, April 2017	• Includes mitigation plan as a component plan (p. 4) • Identifies primary hazards as: natural (flood, wind damage, tornado, severe winter weather, drought, hurricane, and infectious disease) and non-natural (hazardous materials release, transportation accidents, gas pipeline incident, power failure, resource shortage, water contamination/shortage, and "intentional" [human-caused] civil/criminal disturbance, terrorism) (pp. 12–13) • References Threat and Hazard Identification and Risk Assessment (THIRA) as the foundation for vulnerability assessment (p. 12)
Arlington County Community Energy Plan, an element of Arlington County's Comprehensive Plan, September 2019	Reviewed climate action framework for consistency with the NOVA HMP goals and objectives. One goal is linked to the NOVA HMP goals: • Harden key facilities and community resources against power outages and resulting reduction or interruption of vital community services (p. 8)
Climate Resilience Dashboard, Northern Virginia Regional Commission. Website	Reviewed for climate change context in the Northern Virginia region

Document	How Information Was Used for the 2022 HMP Update
Fairfax County Emergency Operations Plan (EOP), June 2019	• Reviewed Hazard Mitigation Section X for consistency with the NOVA HMP goals and objectives. The mitigation goal in the EOP is to "reduce loss of life and property by lessening the impact of disasters" (p. 81) • HMGP project eligibility criteria outlined in EOP integrated into Fairfax County Jurisdiction Annex (p. 82)
Fairfax County Pre-Disaster Recovery Plan (PDRP), April 2020	• Relevant information integrated into the Fairfax County Jurisdiction Annex • The NOVA HMP included by reference in the PDRP • 2017 NOVA HMP hazard risk ranking included as a reference in the PDRP (p. 2-2) • Catastrophic Hazard Identification and Risk Assessment (Table 2.2, p. 2-2) integrated into the Jurisdiction Annex
Flood Risk Management Planning Resources for Washington, DC, January 2018.	References included in the flood hazard section • Includes information on flood risk management resources, mapping current flood risk, and riverine, interior, and coastal flooding
Loudoun County Emergency Operations Plan, July 2019	Reference document for jurisdiction profile • Reviewed THIRA for consistency with 2022 NOVA HMP hazards (pp. 1-12, 1-13)
Loudoun County General Plan, Interim Final Version, December 2020	Reference document for jurisdiction profile • Includes information on the county's growth management land practices for four types of policy areas—urban, suburban, transition, and rural—and joint land management areas and rural historic villages (Chapters 1–3) • Includes maps that address land use, natural and heritage resources, fiscal management, and public infrastructure • The county's comprehensive plan includes the general plan, general plan maps, and a countywide transportation plan
National Capital Planning Commission, 2018–2022 Strategic Plan, September 2017	Reference document for regional goals and consistency with the core responsibilities of the planning commission, including plan and project reviews, comprehensive planning, and federal capital improvements program projects in the NOVA planning region
National Capital Region Climate Change Report, Metropolitan Washington County of Governments, November 12, 2008	Reference document for climate change section • Includes information on the potential impacts of climate change on the Metropolitan Washington Region, which includes the planning area • Includes setting targets for reducing regional emissions and actions to meet these targets
Northern Virginia Emergency Response System, Casebook Scenarios, October 2020	Reference document for high wind/severe storm, cyberattack, acts of violence, terrorism, pandemic, and DC walkout evacuation hazard sections
"Northern Virginia Evacuation Plan" (PowerPoint Presentation), undated	Reference document for Capability Assessments • Includes evacuation concept of operations, enhancements to evacuation operations, key evacuation concepts, and evacuation plan scope (Slides 4–15) • Evacuation plan covers entire planning area

Document	How Information Was Used for the 2022 HMP Update
Region Forward, A Comprehensive Guide for Regional Planning and Measuring Progress in the 21st Century, Greater Washington 2050 Coalition, January 2010	Reference document for consistency with regional goals • "Coalition members found broad agreement on common goals that create a comprehensive vision for the region. The goal categories include land use, transportation, environmental, climate and energy, economic, housing, education, health and human services, and public safety" (p. 1).
Resilient ALX Charter, Alexandria Citizens Corps Council, 2020	Reference document for jurisdiction annex • This project "will take a comprehensive approach to understand areas of risk and develop a sound strategy to prepare for and mitigate against those risks" (City of Alexandria, Virginia Memorandum).
Terrorism Response, A Checklist and Guide for Fire Chiefs and Community Preparedness Leaders, 4th Edition, International Association of Fire Chiefs	Guidance for assessing threats and capabilities based on FEMA's National Preparedness Goal Core Capabilities • Reviewed for the Terrorism section in relation to target hazards, critical infrastructure protection, and response capabilities (p. 15) • References included in the Terrorism section of HMP
Prince William County Emergency Operations Plan 2020	Reviewed for Hazard Mitigation for consistency and incorporation.
Prince William County Comprehensive Plan 2019	The Comprehensive Plan is the blueprint for projected growth and development in the county. Was used to identify growth and future conditions.
Prince William County Strategic Plan July 2021	Reviewed for future conditions and possible

2.10. Future Planning and Mitigation Efforts

The jurisdictions in the Northern Virginia Planning Area remain committed to supporting and expanding the engagement of schools, nonprofits, private businesses, and other partners in mitigation planning and activities. This is achieved by encouraging partnerships during and after the local hazard mitigation planning process and by encouraging active engagement between local emergency management, public and private entities, organizations, and the public.

3. Plan Maintenance and Adoption

Requirements

- **§201.6(c)(4)(i):** [There is a] description of the method and schedule for keeping the plan current (monitoring, evaluating, and updating the mitigation plan within a 5-year cycle).
- **§201.6(c)(4)(iii):** [The plan discusses] how the community will continue public participation in the plan maintenance process.

2022 HMP Update

- Reformatted to include procedural guidance on the method and schedule for monitoring, evaluating, and updating the Plan.
- Expanded to include details on plan monitoring, evaluating, and updating in terms of roles and responsibilities, description of specific methods and schedule, and data forms.
- Developed plan maintenance worksheets and included in Appendix A.

3.1. Overview

The 2022 NOVA HMP is a living document that will guide mitigation actions over time. As conditions and circumstances change, new information may become available, and actions may progress over the life of the Plan. The actions and plan contents may be adjusted as necessary to maintain their relevance and effectiveness.

Periodic revisions and updates of the Plan are required to ensure the goals of the Plan remain current while considering potential changes in hazard vulnerability and mitigation priorities. In addition, revisions may be necessary to ensure the Plan is in full compliance with applicable federal and commonwealth regulations. Periodic evaluation of the Plan will also ensure specific mitigation actions are being reviewed and carried out according to each participating jurisdiction's individual Mitigation Action Plan for Implementation and Integration.

Implementation and maintenance of the Plan work in parallel to ensure the success of the mitigation strategy. This section outlines the process jurisdictions will follow to implement the Plan and integrate the information from the 2022 NOVA HMP into other planning mechanisms. This section provides the overall strategy for plan maintenance and outlines the method and schedule for monitoring, evaluating, and updating the Plan. The implementation and maintenance processes will serve to periodically assess project status, identify benchmarks, make appropriate adjustments as needed, and ensure the planning process is ongoing and progress in risk reduction is being made. The scope of this section includes the following plan maintenance steps:

- Monitoring the Plan,
- Evaluating the Plan,
- Updating the Plan,
- Integration and continued public participation.

This section includes procedures to implement each phase of the Plan maintenance process by assigning responsibility, identifying the method and schedule, and providing the sequenced format for collecting, analyzing, and reporting information that will keep the Plan up to date.

Plan maintenance activities take place at two levels. This section describes how the 2022 NOVA HMP Planning Group will carry out the Plan maintenance functions related to the **Base Plan** and its supporting appendices and attachments. Concurrently, each jurisdiction has the authority and responsibility to maintain its **Jurisdiction Annex** to the Plan and may choose to establish an internal schedule consistent with the regional planning area's schedule. For example, a jurisdiction may determine a semi-annual review of its mitigation actions is appropriate to monitor progress, particularly if several short-term actions are being implemented and completed simultaneously.

Maintenance of Volume II: Non-Natural Hazards, of this Plan, may take place in concert with the maintenance activities of the **Base Plan** and **Jurisdiction Annexes**, or the NOVA Planning Group may determine an alternative method and schedule for maintenance of the separate volume.

If a jurisdiction no longer wishes to actively participate in the development and maintenance of the plan, it must notify the NOVA HMP Coordinator and the Virginia Department of Emergency Management (VDEM) in writing.

3.1.1. Plan Maintenance Concept

The Plan maintenance process provides regional and community officials an opportunity to evaluate actions that have been successful and to execute documentation of potential losses avoided due to the implementation of specific mitigation measures. This process also provides the opportunity to address mitigation actions that may not have been successfully implemented as assigned. The Northern Virginia Emergency Managers will be responsible for reconvening the Planning Group and conducting reviews of the Plan in coordination with VDEM, as described in the method and schedule in this section.

3.1.2. Plan Review and Reporting Schedule

At a minimum, the NOVA HMP will be reviewed annually and following a disaster declaration for any of the planning area jurisdictions. Details of the review meetings may include the following:

- Meetings will be held, at a minimum, once a year.
- Meetings will be held within three months after a federal disaster declaration or significant hazard event for Plan review, revisions, and/or project prioritization.
- Meetings will be held when required or needed due to changes in federal or Commonwealth legislation and/or regulations that impact hazard mitigation in the planning area.

The NOVA HMP will be reviewed annually to assess the effectiveness of the Plan and to identify any required or recommended changes or amendments. A report will be prepared to document the results of the monitoring and evaluation steps, including the status of proposed mitigation actions and funding opportunities that have occurred since the previous plan review. In addition, the report will identify any obstacles or reasons for delays in the completion of mitigation actions, along with recommended strategies to overcome them.

Following a disaster declaration, the NOVA HMP Planning Group will reconvene, and the Plan will be revised as necessary to reflect lessons learned and to address specific circumstances arising from the event. It is the responsibility of the Northern Virginia Emergency Managers to reconvene the Planning Group and to ensure the appropriate stakeholders are invited to participate in the Plan revision and update process following the declaration of the disaster event.

Any necessary revisions to the NOVA HMP **Base Plan** elements shall follow the plan amendment process outlined in state and Federal Emergency Management Agency (FEMA) guidance. For changes and updates to jurisdictional Action Plans for Implementation and Integration, appropriate local designees will assign responsibility for the completion of the task.

Administrative changes, as defined in the Foreword of the Plan, may be made at any time by the Administrative Agency's NOVA HMP Coordinator, or his/her designee and documented in the Record of Changes.

Mitigation Actions may be changed, updated, removed, or added by a jurisdiction at any time, as long as the change or addition is approved by the local Jurisdiction Planning Committee.

3.1.3. Plan Amendment Process

Participating jurisdictions have the authority to approve and adopt changes to their own Action Plan for Implementation and Integration without approval from the NOVA HMP Planning Group; however, the Planning Group should be advised of all changes as a courtesy and for consideration of changes or modifications to the regional **Base Plan**. The Planning Group will be responsible for verifying that the proposed change will not impact the jurisdiction's compliance with current Commonwealth and Federal mitigation planning requirements. Changes to either the regional **Base Plan** or local Action Plan for Implementation and Integration, other than administrative changes—e.g., agency name changes or corrections that do not change the hazard risks, vulnerabilities, or intent of the mitigation strategy—will necessitate the adoption of these changes by the appropriate governing body. The changes will also be submitted to VDEM and FEMA for approval and record keeping.

The Planning Group and its participating jurisdictions will forward information on any proposed change(s) to all interested parties including, but not limited to, all impacted county and municipal departments, individuals, and businesses. When a proposed amendment or amendments may directly impact specific private individuals or properties, each jurisdiction will:

- Follow existing local, state, or federal notification requirements, which may include published public notices as well as direct mailings.
- Forward information on any proposed plan amendments to VDEM and FEMA for approval.
- Disseminate the information to seek input on the proposed amendment(s) for no less than a 45-day review and comment period.
- At the end of the 45-day review and comment period, forward the proposed amendment(s) and all comments to the Planning Group for final consideration.

The Planning Group will review the proposed amendment(s) along with the comments received, and if appropriate, will submit a recommendation for the approval and adoption of the change(s) to the Plan to each participating governing body within 60 days. In determining whether to recommend approval or denial of a plan amendment request, the following factors will be considered by the Planning Group:

- There are errors, inaccuracies, or omissions made in the identification of issues or needs in the Plan.
- New issues or needs have been identified that are not adequately addressed in the Plan.
- There has been a change in information, data, or assumptions from those on which the Plan is based.
- There has been a change in local capabilities to implement proposed hazard mitigation activities.

Upon receiving the recommendation from the NOVA HMP Planning Group and prior to the adoption of the amended Plan the governing body will review the recommendation from the group, including the factors

listed above, and any oral or written comments received at the public hearing. Following that review, the governing body will make one of the following recommendations for action to the NOVA Emergency Managers:

- Adopt the proposed amendment(s) as presented.
- Adopt the proposed amendment(s) with modifications.
- Refer the amendment(s) request back to the Planning Group for further revision.
- Defer the amendment(s) request back to the Planning Group for further consideration and/or additional hearings.

To establish a more clearly defined system of plan maintenance that will continue in future planning cycles, the roles and responsibilities and the monitoring procedure and schedule, including the step-by-step actions and specific tasks associated with each action to maintain the plan, are defined.

3.2. Method and Schedule for Monitoring the Plan

This plan monitoring step tracks the implementation of the Plan over time.

Table 16: NOVA HMP Monitoring Roles and Responsibilities

Stakeholder	Roles and Responsibilities
NOVA HMP Coordinator/Designee	• Coordinate and facilitate the monitoring process. • Initiate and maintain a schedule of monitoring activities. • Collect data and disseminate reports. • Maintain records and documentation of all monitoring activities.
NOVA HMP Planning Group/Jurisdiction Representatives	• Participate in the monitoring process as requested by the NOVA HMP Coordinator. • Assist in collecting and analyzing data. • Assist in disseminating reports to stakeholders and the public. • Maintain records and documentation of all jurisdictional monitoring activities. • Promote the mitigation planning process with the public and solicit public input.

The following steps describe how the NOVA HMP planning area and its jurisdictions will monitor the progress of mitigation plan implementation annually and/or following a Federally Declared Disaster or significant event.

3.2.1. Hazard Mitigation Plan Monitoring Procedure and Schedule

Step 1: NOVA HMP Coordinator/Designee – Initiate monitoring process

- Notify the NOVA HMP Planning Group's jurisdiction representatives to facilitate an annual or post-disaster review.
  - Disseminate the Mitigation Action Monitoring Form* for mitigation action updates to Planning Group/jurisdiction representatives, along with the current list of mitigation actions in the Plan.
  - Disseminate the Mitigation Action Worksheet Form to representatives of stakeholder agencies with potential new mitigation actions.

- Notify NOVA HMP Planning Group's jurisdiction representatives to facilitate an annual or post-disaster review.
  - Disseminate the Mitigation Action Monitoring Form* for mitigation action updates to Planning Group/jurisdiction representatives, along with the current list of mitigation actions in the Plan.
  - Disseminate the Mitigation Action Worksheet Form to representatives of stakeholder agencies with potential new mitigation actions.

Step 2: NOVA HMP Coordinator/Designee and Planning Group/Jurisdiction Representatives – Collect and assess the status of current actions and identify new actions

- Assess progress for current actions, including implemented and funded actions and any new opportunities for mitigation actions.
  - Have any mitigation actions been completed?
  - Are different or additional resources now available?
  - Are mitigation actions being implemented and monitored?

Step 3: NOVA HMP Coordinator/Designee and Planning Group/Jurisdiction Representatives – Assess new opportunities for mitigation

- Has a major disaster occurred that presents opportunities for mitigation?
- Is there a new initiative, agency priority, existing planning mechanism, or information that is not represented in current actions?

Step 4: NOVA HMP Coordinator/Designee – Prepare and disseminate the status report to all planning area jurisdictions and stakeholders, including elected officials

- The status report may include:
  - Status of current and implemented actions.
  - Proposed new actions.[35]
  - Potential funding sources.
  - New opportunities for mitigation, including actions in development, new programs, etc.

Each jurisdiction participating in the Plan has identified an individual (by position or title and agency) who is responsible for monitoring the jurisdiction's actions and opportunities during the planning cycle. Jurisdiction Annexes provide the primary and alternate contacts for mitigation planning.

[35] *The Mitigation Action Monitoring Form is provided in **Attachment A**. Jurisdictions may, annually or following a major disaster, update existing actions and/or add new mitigation actions to their current list of prioritized actions by using the Action Worksheets and Ranking System for Prioritizing Actions. This step does not require amendment to the Base Plan or Jurisdiction Annex.*

3.3. Method and Schedule for Evaluating the 2022 Plan

This plan evaluation step assesses the plan's effectiveness in achieving its stated purpose and goals.

Table 17: NOVA HMP Evaluation Roles and Responsibilities

Stakeholder	Roles and Responsibilities
NOVA HMP Coordinator/Designee	• Coordinate and facilitate the evaluation process. • Maintain a schedule of evaluation activities. • Collect data and disseminate reports. • Maintain records and documentation of all evaluation activities.
NOVA HMP Planning Group/Jurisdiction Representatives	• Participate in the evaluation process. • Assist in collecting and analyzing information. • Assist in disseminating reports to stakeholders and the public. • Maintain records and documentation of all jurisdictional evaluation activities. • Promote the mitigation planning process with the public and solicit public input.

The following process describes the steps that NOVA HMP planning jurisdictions will take annually and/or following a Federally Declared Disaster or significant event to evaluate the effectiveness of the Plan.

Table 18: NOVA HMP Evaluation Procedure and Schedule

Action	Responsible Party	Tasks	Deliverable or Outcome
Initiate Annual Review	NOVA HMP Coordinator (or designee)	Notify lead agency/individual in each jurisdiction to facilitate annual review.	Work plan, schedule, and assigned resources to implement the plan review process.
Invite Planning Group and Key Stakeholders	NOVA HMP Coordinator (or designee)	Invite Planning Group members, key stakeholders, and others to participate in the plan evaluation process.	Invitation to participate, list of invited jurisdictions, existing and new stakeholders, and other key planning partners and public notice of annual evaluation.
Review Policies, Regulations, and Studies	NOVA HMP Coordinator (or designee) and Planning Group	Research new or updated laws, policies, regulations, initiatives, and studies that contribute to the hazard risk assessment or identified mitigation actions.	Status update for existing and new policies, regulations, initiatives, and/or studies.
Review Funding Programs and Planning Mechanisms	NOVA HMP Coordinator (or designee) and Planning Group	Assess changes in local, state, and federal agencies and their funding procedures, new grant programs or areas of focus and their potential integration into existing planning mechanisms.	Status update on existing and new funding procedures, grant programs, new areas of focus, and progress on integration into planning mechanisms.

Action	Responsible Party	Tasks	Deliverable or Outcome
Hazard Information	NOVA HMP Coordinator (or designee) and Planning Group	Research new or updated data and information that can contribute to risk assessments, loss estimates, or vulnerabilities in assets for participating jurisdictions.	Status update on recent disasters, hazard impacts and losses, lessons learned, and status of jurisdictional facilities and infrastructure. Annual update of NOVA HMP to reflect new risk assessment and capability data gathered from review of hazard events and impacts.
Mitigation Actions	NOVA HMP Coordinator (or designee) and Planning Group	Assess progress in previously implemented actions that reduce vulnerability and losses and any new opportunities for mitigation actions.	Status update on completed actions, pending actions, and implementation status of actions collected through monitoring procedure.
Outcomes	NOVA HMP Coordinator (or designee)	Maintain and complete documentation of the NOVA HMP review process, including any needed Plan updates, and prepare summary report.	Summary report of Mitigation Strategy Annual Update, including results of annual monitoring and evaluation process and Appendix A - *Plan Evaluation Checklist.*

Each jurisdiction participating in the Plan has identified an individual by position or title and agency who is responsible for evaluating the effectiveness of the jurisdiction's plan at achieving its purpose and goals during the planning cycle. Jurisdiction Annexes provide the primary and alternate contacts for mitigation planning.

3.4. Method and Schedule for Updating the 2022 Plan

This plan maintenance step reviews and revises the Plan on an established schedule to reflect changes in hazard risk, priorities, and development, as well as progress in local mitigation efforts.

The Plan review and revision process are ongoing throughout the five-year life cycle of the Plan. The monitoring and evaluation activities that are conducted, at a minimum, annually and following a major disaster, will assist in maintaining the currency of multiple components of the plan, such as the hazard identification and risk assessment and mitigation actions and priorities.

The end date for the completion of the Plan update will be five years from the date the FEMA "approvable pending adoption" Plan is adopted by the first jurisdiction, as confirmed by FEMA by letter. It is anticipated that the first adoption will occur in 2022, which would set a tentative date for Plan expiration in 2027.

Table 19: NOVA HMP Update Roles and Responsibilities

Stakeholder	Roles and Responsibilities
NOVA HMP Coordinator/Designee	• Coordinate and facilitate the Plan review, revision, and update process. • Maintain schedule of all Plan update activities. • Collect data and disseminate reports. • Maintain records and documentation of all monitoring, evaluation, and update activities. • Identify and implement opportunities for public participation and input in the planning process, including review of the revised draft plan.
NOVA HMP Planning Group/Jurisdiction Representatives	• Represent the jurisdiction and participate in the planning cycle, including Plan review, revision, and update process. • Collect and report data to the NOVA HMP Coordinator. • Maintain records and documentation of all jurisdictional Plan review and revision activities. • Promote the mitigation planning process with stakeholders and the public and solicit public input.

Following the five-year review, any necessary revisions will be implemented according to the reporting procedures and Plan amendment process outlined by state and FEMA guidance. Upon completion of the review and update/amendment process, the *Northern Virginia Hazard Mitigation Plan* will be submitted to the State Hazard Mitigation Officer for review and forwarded by VDEM to FEMA for approval.

The Plan update process and schedule are designed to focus on various components of the Plan throughout the five-year cycle. Based on the schedule described, all parts of the Plan will have been reviewed at the end of the five-year cycle, potentially reducing the time and resource burden in the final planning year.

Table 20: NOVA HMP Plan Five-Year Update Process and Schedule

Schedule	Plan Update Processes and Actions
Monitoring and Evaluation Activities – Ongoing throughout the five-year planning cycle	• Monitoring and evaluation results, meeting documentation, and other pertinent documents will be collected throughout the five-year life cycle of the Plan and used in the next NOVA HMP update. • Multiple meetings with elected officials, the NOVA HMP Planning Group, local jurisdictions, state and federal agencies, and interested parties will be conducted. • Activities, meetings, and interactions will be tracked and documented throughout the planning cycle. • The initial review of the NOVA HMP to kick-off the Plan update process will be conducted using the most recent version of the NOVA HMP that has incorporated annual and periodic revisions as its basis. • Complete the *Planning Considerations Worksheet* (**Attachment A**) to identify significant changes in planning capabilities or resources that have occurred since the previous update.

Schedule	Plan Update Processes and Actions
Updating the Risk Assessment – Conducted in the 1st quarter of the fifth year of the planning cycle	• NOVA HMP Coordinator and Planning Group/jurisdiction representatives will identify key stakeholders to invite to participate and contribute to the updated risk assessment. • Monitoring and evaluation results will be incorporated. • Changes since the previous Plan approval will be identified. • Each hazard will be assessed and updated to include new data since the date of plan approval and adoption and subsequent updates. • New hazard occurrences and potential changes in low-ranked hazards will be identified and assessed. • Any significant changes in jurisdictional risk assessments will be noted during Plan review and integrated into the updated NOVA HMP Base Plan.
Reviewing and Updating the Goals and Objectives – Conducted in the 2nd quarter of the fifth year of the planning cycle	• NOVA HMP Coordinator will coordinate with Planning Group/jurisdiction representatives and key partners to assess the status of current mitigation goals and objectives for potential revision. • Status of integration of mitigation goals and objectives with existing planning mechanisms will be assessed. • Any significant changes in mitigation goals, especially those that are inconsistent with the current Plan goals, will be assessed and incorporated as appropriate in the updated HMP. • Monitoring and evaluation results will be utilized to modify the goals and objectives and describe achievements.
Reviewing and Updating Mitigation Actions – Conducted in the 3rd quarter of the fifth year of the planning cycle	• NOVA HMP Coordinator will coordinate with Planning Group/jurisdiction representatives and key partners to obtain an update on the status of actions. • Monitoring and evaluation results will be utilized to assess the status and effectiveness of mitigation actions in meeting the goals and reducing risks. • Plan maintenance data from the implemented activities will be used to describe progress in the previous five years.
Compiling and Reviewing Information – Conducted in the 3rd quarter of the fifth year of the planning cycle	• NOVA HMP Coordinator and Planning Group/jurisdiction representatives will compile data and develop the updated HMP. • Draft will be made available for stakeholder review and input. • Draft will be made available for public review and comment. • All comments and suggestions will be incorporated, and the final draft completed.
FEMA Review – Conducted in the 4th quarter of the fifth year of the planning cycle	• FEMA review of draft HMP update.
Plan Adoption –	• Updated HMP will be adopted.

Adherence to the monitoring, evaluation, and update process schedule will ensure the Plan is kept current throughout its five-year cycle.

3.4.1. Integrating Mitigation into Existing Plans and Procedures

An ongoing responsibility of NOVA HMP Planning Group members and jurisdictional representatives is to identify additional stakeholders and existing planning mechanisms that can assist in integrating mitigation planning into short- and long-term community development and resiliency planning. This involves establishing hazard mitigation as a community planning priority that can be supported through the same community capabilities defined in **Section 7, Capabilities Assessment**:

- Planning and regulatory,
- Administrative and technical,
- Safe growth,
- Fiscal and resources,
- Education and outreach,

Each step in the planning cycle includes ongoing opportunities to identify existing planning processes that will provide a platform for the integration of hazard mitigation planning.

Specific planning initiatives that provide the opportunity to integrate hazard mitigation are described in the jurisdiction *annexes.*

3.4.2. Continued Public Involvement

A critical part of plan maintenance is continuing to identify and provide opportunities for stakeholder and public involvement throughout the planning process and during the implementation of the Plan. Significant changes or amendments to the Plan may require a public hearing prior to implementing adoption procedures.

Additional efforts to involve the public in the maintenance, evaluation, and revision process will be made as necessary. These efforts may include:

- Advertising proposed changes to the NOVA HMP to the public.
- Utilizing the Planning Group and participant websites to advertise any maintenance and periodic review activities taking place.
- Keeping copies of the Plan accessible via websites accessible to the public.

References to opportunities for stakeholder and public involvement are addressed in Plan maintenance steps described in the monitoring, evaluating, and update method and schedule, as previously defined in this section.

3.4.3. Implementation of the Plan

The systems and procedures described in this section support the implementation of this Plan through the following measures:

- Annual review method and schedule that monitors and evaluates all elements of the Plan and tracks the implementation of the Plan over time.
- Incorporation of the Plan into existing planning mechanisms that support long-term resiliency planning.
- Documentation of progress in risk reduction through prioritizing and implementing local mitigation actions.

To assist with the Plan maintenance process, the following worksheets are provided as attachments in **Appendix A** as tools to monitor, evaluate, and update the plan:

- **Attachment A: Mitigation Action Monitoring Worksheet**
- **Attachment B: Plan Evaluation Checklist**
- **Attachment C: Planning Considerations Worksheet**

4. Hazard Identification and Risk Assessment Methodology

Requirements

§201.6(c)(2)(i): [The risk assessment shall include a] description of the type, location, and extent of all-natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and 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. All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of the following:

- **§201.6(c)(2)(ii)(A):** (A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;
- **§201.6(c)(2)(ii)(B):** (B) An estimate of the potential dollar losses to vulnerable structures identified in…this section and a description of the methodology used to prepare the estimate.
- **§201.6(c)(2)(ii)(C):** (C) A general description of land uses and development trends within the community so that mitigation options can be considered in future land-use decisions.

§201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks identified for the entire planning area.

2022 HMP Update

- Consolidated hazard analysis methodology into a separate section.
- Updated description of the methodology.

4.1. Overview

The foundation of the *2022 Northern Virginia Hazard Mitigation Plan* (HMP) is the hazard risk assessment. This assessment was built off the analysis of previous regional and commonwealth hazard mitigation plans, historical and statistical data, and other local plans that impact hazard risk, then updated to include recent data and shifts in hazard risk and vulnerability. To define effective mitigation actions to make the planning area more resilient to the impacts of future disasters, it is necessary to understand the particular hazards that threaten Northern Virginia and how they disrupt communities. It is also necessary to understand how the communities are vulnerable to the impacts of the identified hazards and the scope or extent of that vulnerability.

The purpose of this section is to provide, on a planning area-wide basis, an understanding of the risks posed by the hazards that threaten the Northern Virginia region. This section of the Plan presents the hazard identification and risk assessment methods, which include detailed descriptions of natural hazards that are known or are considered to be a threat to the people, property, infrastructure, environment,

economy, or disaster operations of the participating jurisdictions. Non-natural hazard identification and risk assessment information is covered in Volume II of the HMP.

The following plans, studies, and documents provided essential hazard information described in this Plan update:

- Review of the 2018 Virginia State Hazard Mitigation Plan.
- Review of the 2017 Northern Virginia Hazard Mitigation Plan.
- Review of historical data of events that have occurred since the 2017 HMP was adopted, including input from subject matter experts and lessons learned from previous years.
- Assessment of current data archives provided by the NOAA National Centers for Environmental Information Storm Events Database.
- Analysis of specific hazard risk and vulnerabilities based on Hazus, Version 4.2, Level 1 model scenarios for earthquakes, floods, and high winds.
- Review of vulnerability and risk analyses contained in local plans for each jurisdiction, as applicable.
- Hazard identification surveys and risk ranking questionnaires completed by participants.
- Results and feedback from a hazard mitigation survey that was distributed to the public in all participating jurisdictions.
- Review of climate change studies and publications from various local, commonwealth, national, and international sources.
- Review of past Federal Disaster Declarations.
- Research on historical records, predictive models, and other verified data collected from a broad range of sources.

The hazard risk and vulnerability data presented in this Plan should also be used in the development and update of other local and commonwealth plans to provide a consistent foundation for all policies, plans, and programs that address hazards and the potential for reduction of the risk, impacts, consequences, and costs of disasters.

This section presents the hazards of highest concern, identified through a comprehensive risk assessment and consequence analysis. Hazards are described in terms of their characteristics, location and extent, history/previous events, probability of future occurrence, impacts and consequences, repetitive losses associated with the hazard (when applicable), and an overall analysis of vulnerability. Hazards that are considered to have a minimal potential for occurrence or minimal impacts/consequences were excluded from the hazard profile and did not receive further consideration in relation to vulnerability or mitigation actions.

For the 2022 HMP update, the risk assessment methodology was based on a quantitative analysis of risk developed to meet hazard mitigation planning criteria for FEMA's natural hazard planning requirements under Title 44 C.F.R., Part 201.6.

In addition to guiding mitigation planning, the detailed analysis of specific impacts and consequences factors provides guidance for all prevention, preparedness, response, and recovery plans; actions; and resources when a hazard occurs. For this hazard and risk assessment exercise to be truly successful, the results must dually inform and be informed by other jurisdictional planning efforts such as land use, transportation, capital projects, and comprehensive plans. A synergistic focus among planning initiatives will facilitate key decision-making and increase the efficiency and effectiveness of risk reduction efforts.

4.1.1. Definitions

- **Risk:** Potential for damage, loss, or other impacts created by the interaction of hazards with community assets.
- **Vulnerability:** Characteristics of community assets that make them susceptible to damage from a given hazard or threat.
- **Exposure:** People and property within the area the potential hazard could affect.
- **Risk assessment:** A product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision-making.
- **Extent:** The strength or magnitude of the hazard, which can be described in a combination of ways, depending on the hazard:
  - The value of an established scientific scale or measurement system.
  - Other measures of magnitude, such as water depth and wind speed.
  - The speed of onset, including the amount of warning time that allows for preparation.
  - The duration of the hazard event; for most hazards, the longer the duration, the greater the extent.
- **Probability:** The likelihood of the hazard occurring in the future, as described by historical frequencies, statistical probabilities, or general descriptions based on defined qualitative rankings.
- **Impacts:** How a hazard affects a particular area. What is at risk?
- **Consequences:** The vulnerabilities that follow from the set of conditions resulting from the hazard impacts.

4.2. Hazard Identification and Risk Assessment Process Methodology

The Planning Group is tasked with identifying natural hazards that impact the Northern Virginia region. In presenting these hazard profiles, it is important to describe how the decision to include these hazards was made. Non-natural hazard information is covered in Volume II of the Plan.

4.2.1. Step 1: Hazards for Initial Consideration

The initial step in identifying hazards for the 2022 NOVA HMP update began with reviewing the hazards included in the 2017 NOVA HMP, the 2018 Virginia COV-SHMP, and current FEMA hazard mitigation planning guidance. The following hazards were initially considered:

4.2.1.1. Natural Hazards

- Avalanche
- Dam Failure
- Drought
- Earthquake
- Extreme Temperatures

- Flood/Flash Flood
- Hail
- High Wind/Severe Storm (includes Hurricane and Tropical Storm)
- Landslide
- Lightning
- Non-Rotational Wind
- Sea Level Rise
- Sinkholes/Karst/Land Subsidence/Geological
- Solar Storm
- Storm Surge
- Tornado
- Tsunami
- Volcano
- Wildfire
- Winter Storm

4.2.2. *Step 2: Hazard Elimination*

The second step taken by the planning team was to identify which hazards are not likely to occur or significantly impact the planning area. Given Northern Virginia's location and geographical makeup, several hazards were precluded from occurring. There is no documentation or physical evidence to support that the following hazards have or will occur to a significant scale within the bounds of the planning area.

- Avalanche
- Tsunamis
- Volcanoes

Hail, lightning, non-rotational wind, and storm surge are addressed under high wind/severe storm since these hazards often occur simultaneously. Planning for these hazards in combination with one another allows for a more comprehensive mitigation strategy.

Sea level rise does not impact all jurisdictions in the planning area as most plan participants are located inland. Therefore, impacts from this hazard are addressed in the climate change section.

The planning group chose not to include solar storm in this update; however, including this hazard is a planning consideration for the next update as the impacts from this hazard become more well researched and documented.

4.2.3. Step 3: Hazards Included in the 2022 HMP

The Planning Group determined that all 11 hazards profiled in the 2017 HMP should be retained and the same methodology for assessing and ranking natural hazards in terms of probability of occurrence and potential impacts should be employed. A few planning participants opted not to include select hazards

that were determined to not impact their jurisdiction. These exclusions are noted in the individual jurisdiction annexes, as appropriate.

It was determined by the Emergency Managers Group and the Planning Group that non-natural hazards should be included in a separate volume of the HMP. This decision was made so jurisdictions participating in the Emergency Management Accreditation Program (EMAP) could meet program requirements relating to hazard mitigation plans. Volume II of the HMP contains hazard profiles, mitigation strategies, and plan maintenance procedures for non-natural hazards identified as impacting the NOVA region. This volume of the HMP will be distributed on a limited, need-to-know basis, as determined by planning participants.

Table 21: Summary of Hazards Profiled in the 2022 HMP

Hazard	Justification for Inclusion	Information in the 2022 HMP
Dam Failure	• Numerous dams throughout the region. • Dam maintenance issues and extreme weather events could cause failures. • Numerous Federal Disaster Declarations for flooding.	• Full profile/risk assessment and vulnerability analysis.
Drought	• History of previous occurrences. • Potential for environmental impacts. • Potential to increase in severity due to climate change.	• Full profile/risk assessment and vulnerability analysis.
Earthquake	• History of damage experienced due to events in nearby locations.	• Full profile/risk assessment and vulnerability analysis.
Extreme Temperatures	• History of previous occurrences. • Potential for impacts on populations. • Potential to increase in severity due to climate change.	• Full profile/risk assessment and vulnerability analysis.
Flood/Flash Flood	• Losses from previous floods. • History of damaging floods and flash floods. • Numerous dams throughout the region. • Dam maintenance issues and extreme weather events could cause failures. • Numerous Federal Disaster Declarations for flooding. • Potential significant impact to critical infrastructure, property, populations, and the environment. • Potential to increase in severity due to climate change.	• Full profile/risk assessment and vulnerability analysis.
High Wind/ Severe Storm (including Hurricane and Tropical Storm)	• History of frequent occurrences. • Previous disaster declarations. • Potential for loss of life, environmental impacts, and property and critical infrastructure impacts.	• Full profile/risk assessment and vulnerability analysis.

Hazard	Justification for Inclusion	Information in the 2022 HMP
Karst/Sinkhole/Land Subsidence	• History of previous occurrences. • Previous impact on infrastructure. • Potential for loss of life and impact on critical infrastructure and property. • Potential to increase in severity due to increases in rain and flooding events.	• Minimal profile/risk assessment.
Landslide	• Potential for loss of life and impact on critical infrastructure. • Potential to increase in severity due to increases in rain and flooding events.	• Minimal profile/risk assessment.
Tornado	• History of previous occurrences. • Potential for loss of life, environmental impacts, and property and critical infrastructure impacts.	• Full profile/risk assessment and vulnerability analysis.
Wildfire	• Potential for loss of life, environmental impacts, and property and critical infrastructure impacts	• Full profile/risk assessment and vulnerability analysis.
Winter Weather	• History of previous occurrences. • Potential for loss of life and damage to infrastructure. • Previous disaster declarations. • Potential to increase in severity due to climate change.	• Full profile/risk assessment and vulnerability analysis.

4.2.4. Hazard Risk Ranking Methodology

The risk each jurisdiction faces for each hazard was quantified for ease of hazard ranking and risk comparison as well as for planning purposes.

The process included a review of hazard probability and consequences, which resulted in an overall risk score for each hazard. Based on the overall risk score, hazards were ranked as low, medium, or high. Below is the layout of this process. Detailed hazard rankings are provided in the jurisdiction annexes.

Table 22: Layout of Hazard Risk Ranking Summary Per Jurisdiction

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
	1-4	1-5	1-9	H/M/L

Total Probability Score

Probability is the likelihood of the hazard occurring in the future. Using historical frequencies, hazard likelihood was described using general descriptions, and these descriptions were given a numerical value 1-4. The score and description of hazard probability are described in the following table.

Table 23: Probability Criteria

Probability of Future Occurrence		
Ranking	**Level**	**Criteria**
1	Unlikely	Recurrence interval of less than 1 event per year
2	Occasional	Recurrence interval of 1–3 events per year
3	Likely	Recurrence interval of 3–5 events per year
4	Highly Likely	Recurrence interval of more than 5 events per year

Total Consequence Score

The total consequence score was calculated by assigning numbers 1–5 to the identified impact and consequences categories below using the following criteria for each hazard.

Table 24: Impact and Consequence Criteria

Impact - People	
Risk of deaths and injuries from the hazard:	
1	Deaths very unlikely, injuries are unlikely.
2	Deaths unlikely, injuries are minimal.
3	Deaths unlikely, injuries may be substantial.
4	Deaths possible, injuries may be substantial.
5	Deaths probable, injuries will likely be substantial.

Impact - Residential Property	
Amount of residential property damage from the hazard:	
1	Less than $1,000 in damages.
2	$1,000–$50,000 in damages.
3	$51,000–$500,000 in damages
4	$501,000–$2,000,000 in damages.
5	More than $2,000,001 in damages.

Impact - Commercial Property	
Amount of business property damage from the hazard:	
1	Less than $5,000 in damages.
2	$5,001 to $100,000 in damages.
3	$100,001 to 5,000,000 in damages.
4	$5,000,001 to $10,000,000 in damages.
5	More than $10,000,001 in damages.

Impact - Environment	
Amount of environmental impacts from the hazard:	
1	Impact to limited area with no immediate environmental harm or long-term effects.
2	Impact to wider area with limited environmental harm but no long-term effects.
3	Impact to major area; some immediate environmental harm noted; expected long-term effects.
4	Impact to major area; immediate environmental harm noted with long term effects.
5	Major impact with potential for significant harm to the environment and long-term effects.

Impact - Program Operations/Resources	
Ability to continue critical program operations and maintain resource availability needed to respond to the hazard:	
1	No impact to operations/resources.
2	Reduction or loss of operations/resources for less than 24 hours.
3	Reduction or loss of operations/resources for between 24 and 48 hours.
4	Reduction or loss of operations/resources for up to one week.
5	Reduction or loss of operations/resources for more than one week.

Consequences - Population	
How the hazard impacts basic needs and social services for the population:	
1	No impact to needs and services for the population.
2	Temporary need for shelter, food, and water for less than 24 hours.
3	Temporary need for shelter, food, and water for between 24 and 48 hours.
4	Short-term shelter, food, water, transportation, and social services for up to one week.
5	Long-term emergency housing, food, water, and other needs and services for more than one week.

Consequences - Responders	
Types of consequences for community's first responders, considering operational, physical, or psychological factors:	
1	No potential consequences anticipated.
2	Consequences are somewhat probable based on previous occurrences, losses, or hazard/threat assessment.
3	Consequences are moderately probable based on previous occurrences, losses, or hazard/threat assessment.
4	Consequences are likely based on previous occurrences, losses, or hazard/threat assessment.
5	Consequences are highly likely based on previous occurrences, losses, or hazard/threat assessment.

Consequences - Continuity of Operations/Delivery of Services	
Ability to continue essential program functions and services needed to respond to the hazard:	
1	No impact on essential functions/services.
2	Reduction or loss of essential functions/services for less than 24 hours.

Consequences - Continuity of Operations/Delivery of Services	
Ability to continue essential program functions and services needed to respond to the hazard:	
3	Reduction or loss of essential functions/services for between 24 and 48 hours.
4	Reduction or loss of essential functions/services for up to one week.
5	Reduction or loss of essential functions/services for more than one week.

Consequences - Property, Facilities, and Infrastructure	
Types of consequences to community's property, facilities, and infrastructure, considering operational or physical factors:	
1	No consequences anticipated.
2	Consequences are somewhat probable based on previous occurrences, losses, or hazard/threat assessment.
3	Consequences are moderately probable based on previous occurrences, losses, or hazard/threat assessment.
4	Consequences are likely based on previous occurrences, losses, or hazard/threat assessment.
5	Consequences are highly likely based on previous occurrences, losses, or hazard/threat assessment.

Consequences - Environment	
Types of consequences to the natural environment including land, water, air, and mineral assets:	
1	No potential consequences anticipated.
2	Consequences are somewhat probable based on previous occurrences, losses, or hazard/threat assessment.
3	Consequences are moderately probable based on previous occurrences, losses, or hazard/threat assessment.
4	Consequences are likely based on previous occurrences, losses, or hazard/threat assessment.
5	Consequences are highly likely based on previous occurrences, losses, or hazard/threat assessment.

Consequences - Economic Condition/Loss (Direct and Indirect)	
Amount of loss to community's economic conditions through business or industry closures or loss of workforce:	
1	No impact to community's economy.
2	Temporary business or industry closures, with minimal impact of less than 10% of the economy affected.
3	Short-term business/industry closures of less than 24 hours, with more than 10% but less than 25% of the economy impacted.
4	Long-term or permanent business/industry closures, with more than 25% but less than 50% of the community's economy impacted.
5	More than 50% of the community's economy impacted.

Consequences - Public Confidence in Governance	
Types of consequences related to level of public confidence in governance:	
1	Public highly confident in governance and will heed warnings and messages. No consequences anticipated.

Consequences - Public Confidence in Governance	
Types of consequences related to level of public confidence in governance:	
2	Public significantly confident and likely to heed warnings and messages. Some consequences may occur.
3	Public somewhat confident and will probably heed warnings and messages. Consequences may be expected.
4	Public confidence is questionable. It is unknown how public will respond to official information and warnings.
5	Public confidence is known to be low. Lives may be at risk if timely, accurate, and clear information and warnings are not issued.

The total number for all five impact categories combined was divided by five to find the average, and the total number for all consequence categories was divided by seven to find the average. Then the average impact score and the average consequence score were added together to create the total consequence score.

Overall Risk Score

To quantify the total overall risk a hazard posed to each jurisdiction, the total probability score and the total consequence score were combined to create the total overall risk score. This score determined whether the hazard risk was ranked low, medium, or high.

- **Low:** Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

Members of the Planning Group consulted event history, a variety of data sources, and internal stakeholders to determine the numbers that should be assigned to each category for each hazard for each jurisdiction. Each jurisdicition took the Overall Risk Score into consideration when identifying the Hazard Ranking. Even though some hazards ranked lower overall, jurisdictions felt they should ranked higher.

The three highest ranked natural hazards in the planning area were winter storm, flood, and high wind/severe storm. Although there were some slight variations among jurisdictions as to where in the top three these hazards ranked, these were the top three hazards for all participants

In addition to the risk ranking, Hazus data was used to determine risk, impact, and consequences from earthquake, flood, and high wind/hurricane. Other valuable local data sources were used in conjunction with the risk ranking to conduct a holistic risk assessment for each hazard and each jurisdiction.

The Planning Group opted to use data from the 2011 5.8 magnitude earthquake event that impacted the region to quantify the risk. This earthquake, with an epicenter near the town of Mineral in Louisa County—approximately 61 miles from the southernmost boundary of the planning area—was one of the highest magnitude earthquakes to occur east of the Rocky Mountains. It is representative of a realistic event that could impact the planning area in the future. The population vulnerability, geographic extent, probability of future occurrence, impacts, and consequences experienced by the NOVA region as a result of the earthquake informed the numbers chosen for each jurisdiction's hazard risk ranking. Therefore,

earthquake is ranked as a medium risk hazard for all jurisdictions with the exception of Arlington County, which chose to rank earthquake as a low risk hazard.

If a jurisdiction does not experience a hazard, zeros were used in the risk ranking to represent the lack of risk. These hazards are shown as “N/A” in Table 25.

Table 25: Hazard Risk Ranking Summary

Jurisdiction	Hazard										
	Dam Failure	Drought	Earthquake	Extreme Temperatures	Flood	High Wind/Severe Storm	Karst/Sinkhole/ Land Subsidence	Landslide	Tornado	Wildfire	Winter Weather
Arlington County	N/A	Medium	Low	Medium	High	High	Low	N/A	Medium	Low	High
City of Alexandria	Medium	Medium	High-Medium	Medium	High	High	Low	Low	Medium	Low	High
City of Fairfax	Medium	Medium	Medium	Medium	High	High	Low	Low	Medium	Low	High
City of Falls Church	Medium	Medium	Medium	Medium	High	High	Low	Low	Medium	Low	High
City of Manassas	Medium	Medium	Medium	Medium	High	High	Low	Low	High	Low	High
City of Manassas Park	Low	Medium	Medium	Medium	High	High	Medium	Low	Medium	Low	High
Fairfax County	Medium	Medium	Medium	Medium	High	High	Low	Low	Medium	Low	High
Town of Clifton	High	Medium	Medium	Medium	High	High	Low	Low	Medium	Low	High
Town of Herndon	High	Medium	Medium	Medium	High	High	Low	Low	Medium	Low	High
Town of Vienna	High	Medium	Medium	Medium	High	High	Low	Low	Medium	Low	High

Jurisdiction	Hazard										
	Dam Failure	Drought	Earthquake	Extreme Temperatures	Flood	High Wind/Severe Storm	Karst/Sinkhole /Land Subsidence	Landslide	Tornado	Wildfire	Winter Weather
Loudoun County	Medium	Medium	Medium	Medium	High	High	Low	Low	High	Low	High
Town of Leesburg	Medium	Medium	Medium	Medium	High	High	Low	Low	High	Low	High
Town of Lovettsville	Medium	Medium	Medium	Medium	High	High	Low	Low	High	Low	High
Town of Middleburg	Medium	Medium	Medium	Medium	High	High	Low	Low	High	Low	High
Town of Purcellville	Medium	Medium	Medium	Medium	High	High	Low	Low	High	Low	High
Town of Round Hill	Medium	Medium	Medium	Medium	High	High	Low	Low	High	Low	High
Prince William County	High	Medium	Medium	Medium	High	High	Low	Low	Medium	Low	High
Town of Dumfries	Medium	Medium	Medium	Medium	High	High	Low	Low	Medium	Low	High
Town of Haymarket	Medium	Medium	Medium	Medium	High	High	Low	Low	Medium	Low	High
Town of Occoquan	High	Medium	Medium	Medium	High	High	Medium	Low	High	Low	Medium

4.2.4.1. Step 4: Hazard Profiles

Individual profiles of each hazard addressed in this Plan are presented in **Sections 5.1** through **5.11**.

Table 26: Hazard Profile Elements

<table>
<tr><th>Hazard Profile Element</th><th>Description</th></tr>
<tr><td>Hazard Definition and Characteristics</td><td>The hazard is defined or described in relation to its general characteristics, including specific types, as applicable.</td></tr>
<tr><td>Location</td><td>In general, the entire planning area is susceptible to most natural hazards profiled in the plan, such as winter storm, flood, and severe storm. Impacts of other types of hazards, such as dam failure, karst/sinkhole/land subsidence, landslide, and wildfire, occur in more localized areas in the region. Potential impact areas for each hazard profiled in this Plan are described in the jurisdiction annexes.</td></tr>
<tr><td>Extent and Previous Occurrences</td><td>Information on historical occurrences, including federally declared disasters and the extent of the loss of life, injuries, and damages are described in this sub-section. Extent also considers other measures of magnitude, such as water depth, speed of onset, or duration of the event. For most hazards, the longer the duration, the greater the extent of the impact.</td></tr>
<tr><td>Probability of Future Events</td><td>Discussion of the likelihood of the hazard occurring in the future and changes in hazard trends and patterns. For the purpose of this plan, the National Center for Environmental Information (NCEI), Storm Events Database (NOAA) serves as the primary data source for documenting previous weather occurrences and calculating future probabilities.

<table><tr><th>Level</th><th>Criteria</th></tr><tr><td>Unlikely</td><td>Recurrence interval of less than 1 event per year</td></tr><tr><td>Occasional</td><td>Recurrence interval of 1–3 events per year</td></tr><tr><td>Likely</td><td>Recurrence interval of 3–5 events per year</td></tr><tr><td>Highly Likely</td><td>Recurrence interval of more than 5 events per year</td></tr></table></td></tr>
<tr><td>Risk Assessment</td><td>An assessment of risks associated with hazards is presented. Hazard risks to the population, built environment, community lifelines, natural environments, and the economy are evaluated. Additionally, a summary table of how each jurisdiction ranked the hazard—low, medium, or high—is shown for easy risk comparison throughout the region.</td></tr>
</table>

Hazard Profile Element	Description
Vulnerability Analysis	An analysis of vulnerability, including impacts and consequences, was completed. This includes the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas and a description of potential dollar losses from damage to vulnerable structures. The FEMA Hazus program was used to model 2,500-year return event scenarios for flood, earthquake, and high wind/hurricane. This analysis delivers in-depth information about estimated direct economic losses and dollar exposure, anticipated sheltering needs and debris generation, and risk to existing buildings and infrastructure, community lifelines, and critical facilities. Potential impacts from climate change are also briefly discussed. An in-depth profile of climate change is presented in Section 6.
Future Population and Development Trends	Discussion on the impact of development in hazard-prone areas throughout the planning area related to each hazard.
Factors for Consideration in the Next Planning Cycle	Describes specific points to consider in relation to each hazard when conducting plan maintenance for monitoring, evaluating, and updating the Plan.
Data Sources	Data sources for each hazard section are provided in the footnotes.

4.3. General Hazard Information

This section of the Plan provides general information that may be applicable to all hazards having the potential to impact jurisdictions in the planning area. Individual characteristics of specific hazards are further described in the individual hazard sections.

4.3.1. Declarations

4.3.1.1. FEMA Declarations

As of December 2021, the planning area has been subject to 24 major disaster declarations since 1972.[36] Twenty-one of these declarations have been for natural hazards and three have been for non-natural hazards: one for the September 11, 2001 terrorist attacks and two for the coronavirus (COVID-19) pandemic. Both COVID-19 declarations, DR-4512-VA and EM-3448-VA, have an incident period start date of January 20, 2020 and were deemed to be ongoing at the conclusion of the HMP planning process in 2022.

[36] FEMA. (n.d.). *Virginia*. https://www.fema.gov/locations/virginia

Table 27: Major Disaster Declarations Including Northern Virginia by Type, 1972–December 2021[37]

Date	Disaster Number	Disaster Type	Declared Jurisdiction(s)*
June 29, 1972	DR-339-VA	Tropical Storm Agnes	Arlington, Fairfax, Loudoun, and Prince William Counties, Cities of Fairfax and Falls Church
October 7, 1972	DR-358-VA	Severe Storms and Flooding	City of Alexandria
October 10, 1972	DR-359-VA	Severe Storms and Flooding	City of Alexandria
November 10, 1985	DR-755-VA	Severe Storms and Flooding	City of Alexandria
February 2, 1996	DR-1086-VA	Blizzard of 1996 (Severe Snowstorm)	All jurisdictions
October 23, 1996	DR-1133-VA	Hurricane Fran and Severe Storm Conditions	Prince William County
October 12, 1999	DR-1923-VA	Hurricane Floyd	Fairfax County, City of Fairfax
February 28, 2000	DR-1318-VA	Severe Winter Storm	Arlington, Fairfax, Loudoun, and Prince William Counties, Cities of Fairfax and Manassas
September 11, 2001	DR-1392-VA	Terrorist Attack	Arlington County
March 27, 2003	DR-1458-VA	Severe Winter Storm, Snowfall, Heavy Rain, Flooding, and Mudslides	All jurisdictions
September 18, 2003	DR-1491-VA	Hurricane Isabel	All jurisdictions
September 12, 2005	EM-3420-VA	Hurricane Katrina Evacuation	All jurisdictions
July 13, 2006	DR-4027-VA	Severe Storms, Tornadoes, and Flooding	Arlington and Fairfax Counties, City of Alexandria
February 16, 2010	DR-1905-VA	Severe Winter Storms and Snowstorms	All jurisdictions
April 27, 2010	DR-1874-VA	Severe Winter Storms and Snowstorms	Arlington, Fairfax, and Prince William Counties, Cities of Fairfax, Falls Church, Manassas, and Manassas Park

[37] FEMA. (n.d.). *Virginia*. https://www.fema.gov/locations/virginia

Date	Disaster Number	Disaster Type	Declared Jurisdiction(s)*
September 3, 2011	DR-4024-DR	Hurricane Irene	City of Alexandria
November 17, 2011	DR-1874-VA	Remnants of Tropical Storm Lee	Fairfax and Prince William Counties, Cites of Alexandria and Falls Church
July 27, 2012	DR-4072-VA	Severe Storms and Straight-line Winds	Arlington and Fairfax Counties, Cites of Fairfax and Falls Church
October 20, 2012	EM-3359-VA	Hurricane Sandy	Arlington, Fairfax, Loudoun, and Prince William Counties, Cities of Alexandria, Falls Church, and Manassas Park
November 26, 2012	DR-4092-VA	Hurricane Sandy	Arlington, Loudoun, and Prince William Counties, Cities of Fairfax, Falls Church, and Manassas
April 19, 2016	DR-4262-VA	Severe Winter Storm and Snowstorm	All jurisdictions
September 11, 2018	EM-3403-VA	Hurricane Florence	All jurisdictions
March 12, 2020	EM-3448-VA	COVID-19 Pandemic	All jurisdictions
April 2, 2020	DR-4512-VA	COVID-19 Pandemic	All jurisdictions

*Towns are included in county declarations.

4.4. Population Vulnerability

4.4.1. Social Vulnerability Index

Residents of Northern Virginia may be at risk of certain localized hazards, such as dam failure and flooding, depending on their proximity to hazard-prone areas. In addition, hazards that can impact the entire planning area, e.g., extreme temperatures, high wind/severe storm, and winter weather, may put residents at risk. Although residents may potentially experience hazard risk, not all residents are equally vulnerable to the impacts of these risks. A number of factors, including poverty, lack of access to transportation, and crowded housing, may weaken a community's ability to prevent human suffering and financial loss in the case of a disaster.

Information about specific at-risk populations is addressed in each hazard section; however, this section provides insight into what factors create higher hazard vulnerability for populations.

There are multiple methodologies and tools available to identify and measure the extent of population vulnerability in relation to hazards. For the purpose of this plan, the Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is presented as one tool that provides a quantifiable ranking to indicate potential levels of vulnerability when hazards impact jurisdictions.

The most recent SVI information comes from 2018. Social and economic factors can change rapidly and jurisdictions in the planning area should remain aware of the potentially shifting vulnerabilities in their communities. This is especially important in light of the social and economic upheaval caused by the COVID-19 pandemic, which has caused dramatic short-term impacts on many populations, for which the long-term impacts are not yet clear.

CDC Social Vulnerability Index[38]

What is social vulnerability?

Every community must prepare for and respond to hazardous events. The degree to which a community exhibits certain social conditions, including poverty, a low percentage of vehicle access, or crowded households, may affect that community's ability to prevent human suffering and financial loss in the event of a disaster. These factors describe a community's social vulnerability.

What is the CDC Social Vulnerability Index?

The CDC Agency for Toxic Substances and Disease Registry's Geospatial Research, Analysis & Services Program (GRASP) created the CDC Social Vulnerability Index to help public health officials and emergency response planners identify and map the communities that will most likely need support before, during, and after a hazardous event. SVI indicates the relative vulnerability of every United States Census tract. Census tracts are subdivisions of counties for which the Census collects statistical data. SVI ranks the tracts on 15 social factors, including unemployment, minority status, and disability, and further groups them into four related domains:

- Socio-economic status
- Household composition and disability
- Minority status and language
- Housing and transportation

[38] Centers for Disease Control and Prevention. (2020, January 31). CDC SVI 2018 Documentation. https://svi.cdc.gov/Documents/Data/2018_SVI_Data/SVI2018Documentation.pdf

How can SVI help communities be better prepared for hazardous events?

SVI provides specific socially and spatially relevant information to help officials and local planners better prepare communities to respond to emergency events such as severe weather. SVI can be used to:

- Allocate emergency preparedness funding according to community need.
- Estimate the amount and type of needed supplies such as food, water, medicine, and bedding.
- Decide how many emergency personnel are required to assist people.
- Identify areas in need of emergency shelters.
- Create an evacuation plan that accounts for those who have special needs, such as those without vehicles, older adults, or people who have a primary language other than English.
- Identify communities that will need continued support to recover following an emergency or natural disaster.
- Identify appropriate mitigation actions to lower hazard risk for vulnerable populations.

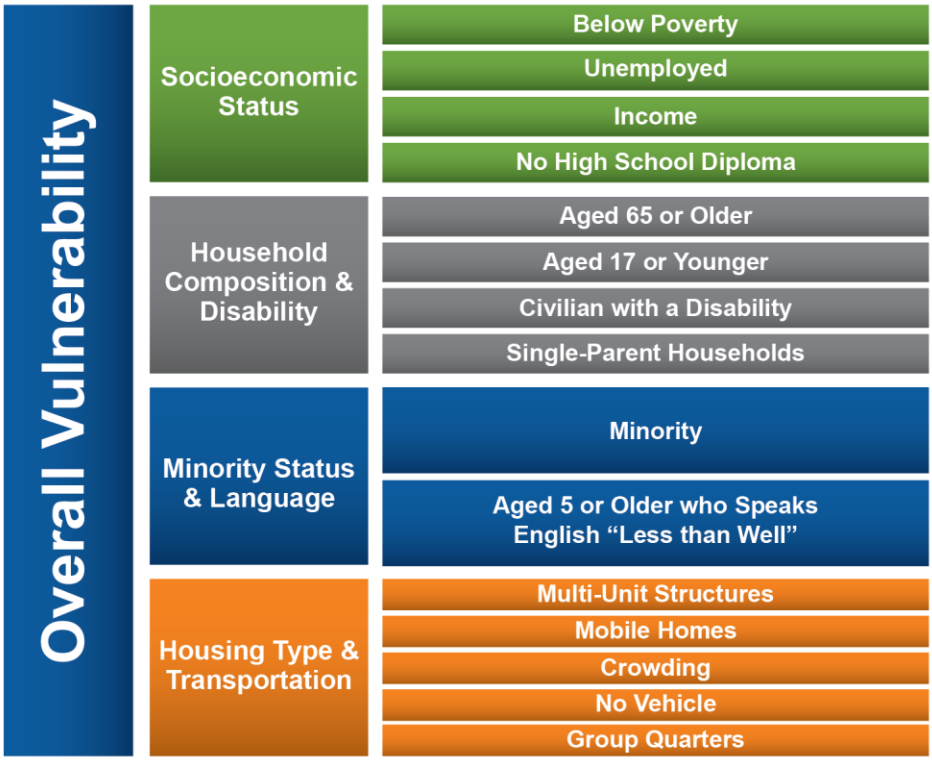


Figure 15: CDC Social Vulnerability Index Variables (2018)[39]

[39] Centers for Disease Control and Prevention. (2020, January 31). *CDC SVI 2018 Documentation*. https://svi.cdc.gov/Documents/Data/2018_SVI_Data/SVI2018Documentation.pdf

Table 28: CDC Social Vulnerability Index, by Jurisdiction (2018)[40]

Jurisdiction*	Overall SVI Score	Social Vulnerability Level
Arlington County	0.1401	Low
City of Alexandria	0.2003	Low
City of Fairfax	0.2411	Low
City of Falls Church	0.1389	Low
City of Manassas	0.4446	Low to Moderate
City of Manassas Park	0.528	Moderate to High
Fairfax County	0.1876	Low
Loudoun County	0.0904	Low
Prince William County	0.3022	Low to Moderate

*Towns are included in county SVI information.

SVI data was utilized at the lowest available level of detail, which is the Census tract. Figure 16 shows the SVI index, a percentile calculation that takes each of the 15 factors into account.

[40] Agency for Toxic Substances and Disease Registry. (2018, October 9). *CDC's Social Vulnerability Index (SVI)*. https://svi.cdc.gov/map.html

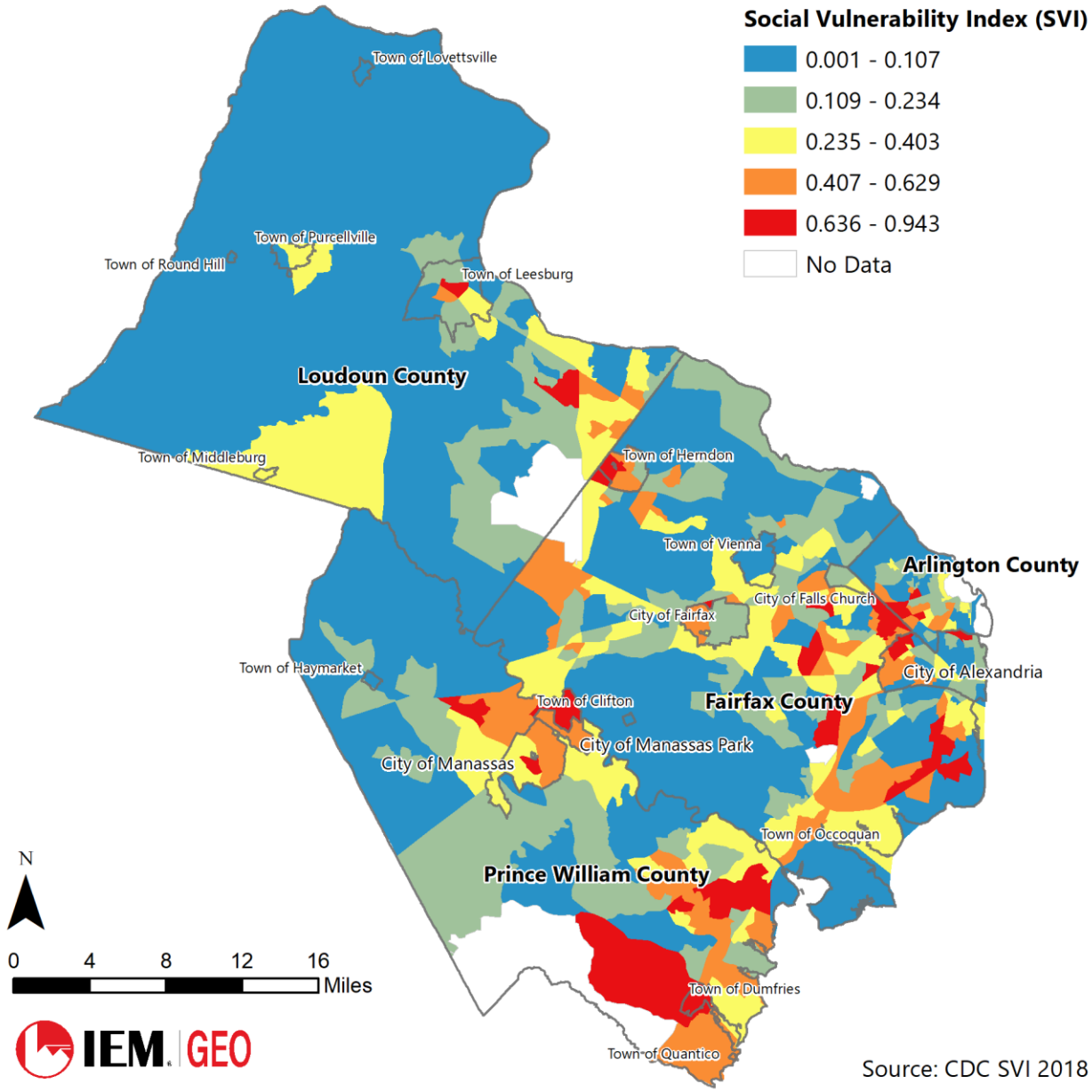


Figure 16: CDC Social Vulnerability Index Variables by Census Tract

Based on the CDC SVI scores, Prince William County including the Cities of Manassas and Manassas Park and the towns of Dumfries, Haymarket, Occoquan, and Quantico, have the highest level of vulnerability.

4.4.2. Community Resilience Estimates

Community resilience is the capacity of individuals and households within a community to absorb the external stresses of a disaster.[41] The 2019 Community Resilience Estimates (CRE) are produced using

[41] United States Census Bureau. (2021, August 10). *2019 Community Resilience Estimates Quick Guide*. https://www2.census.gov/programs-surveys/demo/technical-documentation/community-resilience/cre_quickguide_2019.pdf

the information on individuals and households from the 2019 American Community Survey (ACS) and the Census Bureau's Population Estimates Program (PEP). According to the United States Census Bureau, the CRE estimates community resilience to disasters by using small area estimation (SAE) techniques to combine data from several sources and produce high-quality estimates:[42]

- American Community Survey (ACS) microdata
  - Analysis is performed on the individual and household level restricted ACS microdata to determine the number of individual risk factors.
- Population Estimates Program
  - This program utilizes age, sex, and race and ethnicity data from the Census Bureau's Population Estimates Program.

The CRE was mapped at the lowest available detail, which is the Census tract. The CRE encompasses the following risk factors:

- Income-to-poverty ratio
- Households with broadband Internet
- Households without a vehicle
- Single or no caregiver
- Unit level crowding
- Age greater than 65
- Communication barriers
- No health insurance
- Disability
- No one in household employed full time

Figure 17 shows the percentage of the population that contains three or more risk factors. This population represents the highest risk group.

[42] United States Census Bureau. (2021, October 8). *Methodology*. https://www.census.gov/programs-surveys/community-resilience-estimates/technical-documentation/methodology.html

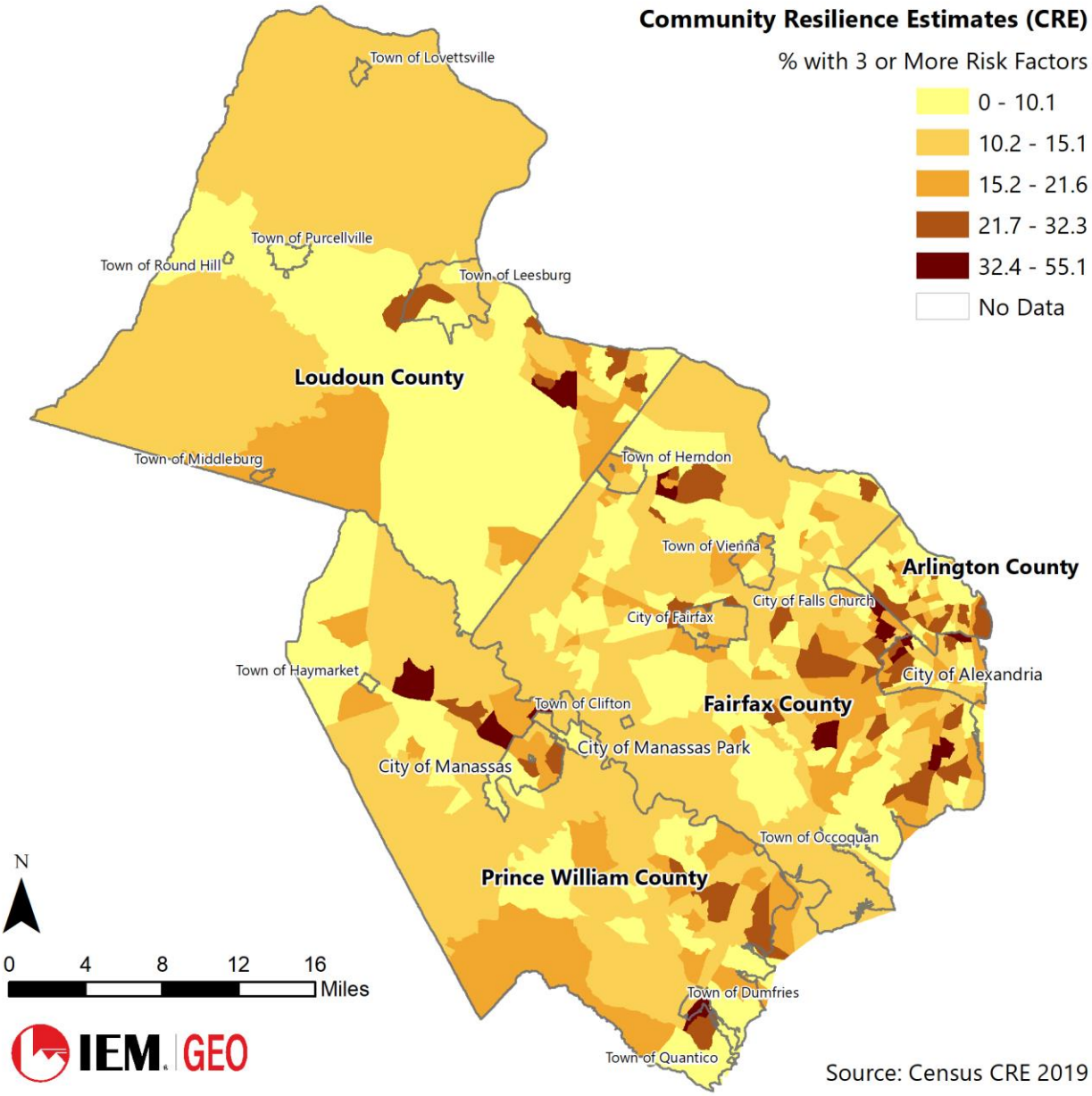


Figure 17: Community Resilience Estimates

4.5. FEMA Community Lifelines

FEMA developed the community lifelines construct to increase effectiveness in disaster operations and better position the jurisdictions to respond to incidents. Lifelines are the most fundamental services in a community that, when stabilized, enable all other aspects of society. A lifeline enables the continuous operation of critical business and government functions and is essential to human health and safety or economic security. There are seven FEMA-identified lifeline categories, each of which has its own

components: safety and security; food, water, and shelter; health and medical; energy (power and fuel); communications; transportation; and hazardous materials.[43]

The goals and objectives of FEMA's Strategic Plan promote using mitigation to reduce the risk to community lifelines before a disaster and to quickly stabilize a community after a disaster by preventing cascading impacts.[44] FEMA's Building Resilient Infrastructure and Communities grant program focuses on projects and initiatives that reduce the likelihood that community lifelines will fail as a result of an incident.

During the HMP planning process, the vulnerability of these lifelines were analyzed in relation to each hazard to determine any gaps and opportunities for mitigation that may exist and be identified in the jurisdictional annexes. Vulnerability analyses for earthquake, flood, and high wind/hurricane were based on Hazus data; therefore, data from additional sources were added to complete the analysis of lifeline categories.

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

[43] United States Department of Homeland Security. (2019, November). *Community Lifelines Fact Sheet*. https://www.fema.gov/sites/default/files/2020-05/LifelinesFactSheetandPosterv2.pdf
[44] FEMA. (2020, July 22). *Building Resilient Infrastructure and Communities (BRIC) and Community Lifelines*. https://www.fema.gov/sites/default/files/2020-07/fema_bric_session-4_community-lifelines.pdf

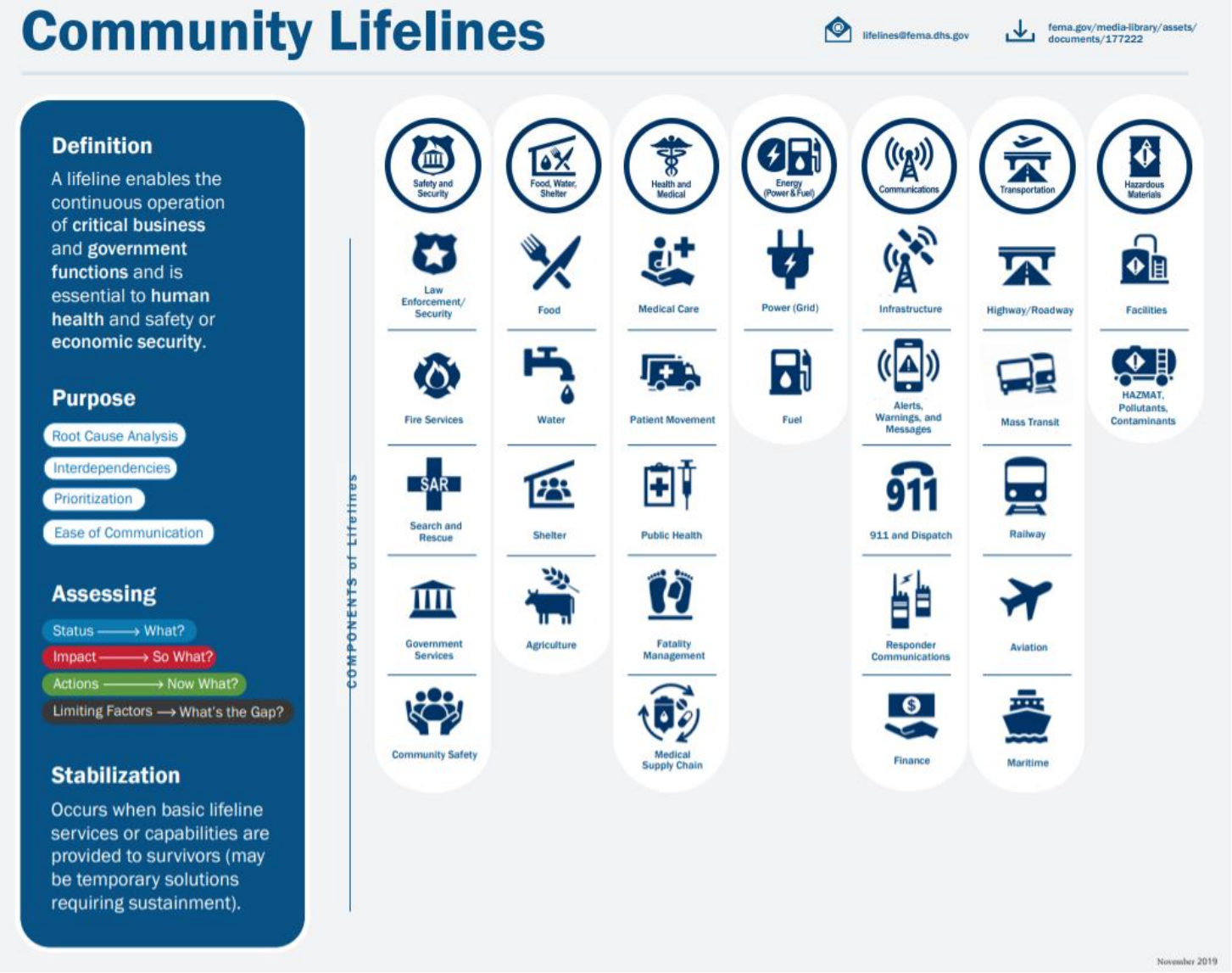


Figure 18: FEMA Community Lifelines[45]

[45] United States Department of Homeland Security. (2019, November). *Community Lifelines Fact Sheet*. https://www.fema.gov/sites/default/files/2020-05/LifelinesFactSheetandPosterv2.pdf

5. Hazard Profiles, Risks, and Vulnerability

5.1. Dam Failure

2022 HMP Update

The dam failure hazard was reviewed, and a new analysis was performed that included but was not limited to the following:

- Enhancing and reformatting the Dam Failure profile to include consideration of requirements for the High Hazard Potential Dam (HHPD) Grant Program
- Enhancing hazard characteristics
- Confirming the number of dams in the planning area and their level of concern as being classified as high, significant, or low hazard dams, based on the Virginia Department of Conservation and Recreation (DCR) Dam Safety Inventory System (DSIS)
- Updating hazard incident occurrence throughout the planning area
- Updating data sources
- Adding factors for consideration in the next planning cycle

Table 29: Dam Failure Profile

<table>
<tr><th colspan="5">Dam Failure</th><th>Overall Vulnerability</th></tr>
<tr><th colspan="5">Definition, Key Terms, and Overview</th><td rowspan="4">Medium</td></tr>
<tr><td colspan="5">Dam: A barrier constructed across flowing water to obstruct, direct, or slow down the flow, typically creating a lake or reservoir.

Dam failure: A catastrophic type of failure characterized by the sudden, rapid, uncontrolled release of impounded water or the likelihood of such an uncontrolled release. A systematic failure of the dam structure results in an uncontrolled release of water, which can cause flooding that exceeds the 100-year floodplain boundaries.</td></tr>
<tr><th>Frequency</th><th>Probability</th><th colspan="3">Potential Magnitude</th></tr>
<tr><td rowspan="2">Low</td><td rowspan="2">Unlikely</td><th>Injuries/Deaths</th><th>Infrastructure</th><th>Environment</th></tr>
<tr><td>Moderate</td><td>Moderate</td><td>Moderate</td></tr>
</table>

5.1.1. Hazard Profile

Worldwide interest in dam and levee safety has risen significantly in recent years. Aging infrastructure, new hydrologic information, and population growth in floodplain areas downstream from dams and near levees have resulted in an increased emphasis on safety, operation, and maintenance. The distinction between dams and levees is their purpose: dams are constructed to impound water behind them, and

levees are constructed to keep water out of the land behind them. This section does not address levee failure, as there are no major levees located in the Northern Virginia region.

There are about 91,000 dams in the United States today,[46] and the majority of them are privately owned. Public owners include the commonwealth, local authorities, and federal agencies. Benefits provided by dams include water supplies for drinking, irrigation, and industrial uses, as well as flood control, hydroelectric power, recreation, and navigation.

A primary cause of dam failure is overtopping, which occurs in approximately 34% of all dam failures in the United States. Overtopping occurs when water spills over the top of the dam, frequently because of inadequate spillway design, debris blocking spillways, foundation failure, piping (water escaping through narrow channels under the dam), or insufficient maintenance. Other conditions that lead to dam failure include the following:

- Prolonged periods of rainfall and flooding, which cause most failures
- Inadequate spillway capacity, resulting in excess overtopping of the embankment
- Internal erosion caused by embankment or foundation leakage, also called piping
- Improper maintenance, including failure to remove trees, repair internal seepage problems, or maintain gates, valves, and other operational components
- Improper design or use of improper construction materials
- Failure of upstream dams in the same drainage basin
- Landslides into reservoirs, which cause surges that result in overtopping
- High winds, which can cause significant wave action and result in substantial erosion
- Destructive acts of terrorists

Dam failure may also be triggered by an earthquake that occurs within or outside the planning area. An earthquake can cause longitudinal cracks at the tops of embankments, leading to structural failure. While several dams in the region received damage from the earthquake in 2011, there was no dam failure.

When a dam fails, the energy of the water stored behind the dam can cause rapid and unexpected flooding downstream, resulting in loss of life and major property damage. There can also be devastating effects on water supply and power generation if the water behind the dam serves one of those purposes. The terrorist attacks of September 11, 2001, generated increased focus on protecting the country's water infrastructure, including ensuring the safety of dams.

Dams are classified according to their potential impact on the population or property. The NID and the VA DCR use the same classification to categorize the hazard potential of dams—high, significant, or low. This classification may change over time, as it is tied to how the failure of the dam may lead to loss of life and property downstream. The classifications are described by the DCR as follows:[47]

- **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.

[46] United States Army Corps of Engineers. (n.d.). *National Inventory of Dams*. https://nid.sec.usace.army.mil/#/
[47] Virginia Department of Conservation and Recreation. (2021, February 26). *Dam Safety Program*. https://www.dcr.virginia.gov/dam-safety-and-floodplains/dam-safety-index

There is a classification called special criteria, which apply to dams that, upon failure, would cause damage only to the property of the dam owner.

These hazard classifications are not related to the physical condition or structural integrity of the dam or the probability of its failure, but strictly to the potential for adverse downstream effects from failure or incorrect operation of the dam or its facilities. There are no dam failure inundation maps available for the NOVA region that can be included in this Plan.

Because dams represent a risk to public safety, they require ongoing maintenance, monitoring, safety inspections, and sometimes rehabilitation to continue safe service. Unless specifically excluded, all dams in Virginia are regulated. More than 2,900 dams are regulated in the Commonwealth.

Table 30: Hazard Profile Summary

Dam Failure **Assessment: Medium Risk Hazard**	**Location**	Specific local locations	**Potential Cascading Effects** • Rapid unexpected flooding downstream, resulting in loss of life and property damage • Devastating effects on water supply and power generation • Damage to homes, businesses, environmental assets, and people living in the flood inundation zone
	Extent	Low to Moderate	
	Duration	Several minutes to several days	
	Probability	Unlikely	
	Seasonal Pattern	No seasonal pattern	
	Speed of Onset	There may be a sudden failure, or one may occur slowly, if there is infrastructure deterioration that goes unnoticed if regular assessments are not conducted	
	Warning Time	Minutes or hours	
	Repetitive Loss	Potentially, if there are previously damaged structures in the inundation area	

5.1.1.1. Location

The Commonwealth's regulatory agency for dams is the DCR. Through its Dam Safety and Floodplain Management Program, DCR maintains the Dam Safety Inventory System (DSIS), which presents information about all the dams in Virginia that DCR tracks. In addition to high hazard dams, the DCR observes and regulates numerous smaller dams (e.g., farm pond impoundments) that present less severe hazard threats. The DCR maintains data on all commonwealth-regulated dams in the NOVA region, including information on the potential impacts of failure. Based on the DSIS, there are 310 dams within the planning area. Of those, 57 are identified as high hazard dams: 28 in Fairfax County, 14 in Loudoun County, and 15 in Prince William County.

There is some discrepancy between national and local records for the number of dams and their classification in the planning area. National Inventory of Dams (NID) records show there are 213 dams located in the NOVA region, with 58 classified as high hazard potential dams.[48] Of those 58, 30 are in

Fairfax County, 14 are in Loudoun County and 14 are in Prince William County. Two are located in the City of Manassas. One of those is considered a high hazard potential dam and is included in the Prince William County count. The hazard risk assessment in this section is based on DSIS data.

The locations of these high hazard potential dams within the planning area are documented in a series of DCR Dam Safety Data Sheets from the DSIS, which are compiled alphabetically in Appendix C. The data sheets include general characteristics or each dam, inspection dates and condition, and other reference information. The location of each dam is described including an address, directions to the dam for emergency response, and a map.

5.1.1.2. Extent

While dams offer many benefits, they can also pose a risk to communities if they are 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 significant damage to property downstream of the dam. Such properties may be quickly submerged in floodwaters, and residents may become trapped by rapidly rising water. The failure of a dam can put large numbers of people and significant amounts of property in harm's way.

Dam owners are required to have dam break inundation zone maps that meet the standards of the Virginia Impounding Structure Regulations. Properties determined to be within the inundation zone are recorded in the dam safety emergency action plan. This information is summarized from the DSIS Dam Safety Data Sheets compiled in Appendix C. These data sheets provide a count of downstream assets that have the potential to be impacted by dam failure. Table 31 provides a summary of how many assets are at risk to potential dam failure, including the number of residences, businesses, transportation and utility systems and other assets located in an inundation area downstream of the dam.

5.1.1.3. Previous Occurrences

Most failures occur because of poor maintenance of the dam combined with major rainfall, such as that which occurs during hurricanes and thunderstorms. There have been no reports of dam failure since the 2017 HMP; but prior to, there were a few notable events throughout Virginia:

- In 1995, torrential rains burst the Timberlake Dam in Campbell County, killing two people downstream in the flooding.
- Following Hurricane Floyd in 1999, 13 dam failures were reported across the eastern portion of the Commonwealth, causing significant damage.
- The Barcroft Dam in Fairfax County failed during heavy rains associated with Hurricane Agnes in June 1972. Although it caused no loss of life, that dam failure damaged the Holmes Run area, most notably the destruction of an overpass at Van Dorn Street and Holmes Run. This event caused $300,000 in damage and cost an additional $200,000 to clear 29 acres of trees and debris from the stream. The dam, which was built in 1913, also suffered major damage and had to be rebuilt to restore Lake Barcroft, a recreational area for community residents.

Table 31: Summary of Dam Hazard[49]

Community	Name of Dam	Classification	Dam Type	Year Built	Primary Purpose	Top Height (Feet)	Top Capacity (Acre Feet)	Emergency Action Plan Status (Last Approval Date)	Most Recent Condition Assessment	Summary Impacts
Arlington County	none									
City of Alexandria	none									
City of Fairfax	none									
City of Falls Church	none									
City of Leesburg	none									
City of Manassas	Winters Branch Dam	S	Earth	1/1/1997	Stormwater Management	26.5	175	9/14/2015 (Expired 9/14/2021)	Satisfactory	30 homes, 2 businesses, 1 utility, 2 roadways
City of Manassas	Innovation at Prince William Pond 3	H	Earth	NA	Stormwater management	16	109	2/10/2016 (Expired 2/10/2022)	Satisfactory	3 Businesses, 1 Road
Fairfax County	Barcroft	H	Gravity	1/1/1915	Recreation	69	3020	1/4/2021 (Active)	Satisfactory	5477 Homes, 52 Businesses, 1 School, 2 Railroads, 1 Utility, 1 Park, 1 Golf Course. 6 roadways
Fairfax County	Burke Center Section 11B	H	Earth	NA	Stormwater Management	34.9	84.82	5/6/2021 (Active)	Satisfactory	2 Homes

[49] Virginia Department of Conservation and Recreation, Dam Safety Inventory System, Jan 2023

Community	Name of Dam	Classification	Dam Type	Year Built	Primary Purpose	Top Height (Feet)	Top Capacity (Acre Feet)	Emergency Action Plan Status (Last Approval Date)	Most Recent Condition Assessment	Summary Impacts
Fairfax County	Burke Lake	H	Earth	1/1/1960	Recreation	49.5	4589.4	12/8/2011 (Active)	Fair	459 Homes, 16 Businesses, 1 Schools, 1 Critical Infrastructure, 1 Railroad, 1 Utility, 4 Parks, 7 Roadways
Fairfax County	Carrington Regional Dam	H	Earth	NA	Stormwater Management	25	55	11/30/2016 (Expired 11/30/2022)	Satisfactory	6 Homes
Fairfax County	Crosspointe Lake Dam	H	Earth	1/1/1900	Stormwater Management, fish, small farm pond	20	88	NA	Fair	0
Fairfax County	Daddy Long Lake Dam	S	Earth	NA	Fish & Wildlife, Recreation	15	53.03	NA	NA	0
Fairfax County	Dulles Corner Lake	S	Earth, Concrete	1/1/1990	Other	20.4	116	10/14/2014 (Active)	Satisfactory	0
Fairfax County	East Market Pond	S	Earth	NA	Stormwater Management	12	53.99	NA	NA	0
Fairfax County	Emergency Sewage Retention Pond No. 1	S	Earth	NA	Other	20.5	140	NA	NA	0
Fairfax County	Emergency Sewage Retention Pond No. 2	S	Earth	NA	Other	25	140	NA	NA	0
Fairfax County	F.P. Griffith Water Plant Lorton Quarry	S	Other	NA	Other	20	253	NA	NA	0

Community	Name of Dam	Classification	Dam Type	Year Built	Primary Purpose	Top Height (Feet)	Top Capacity (Acre Feet)	Emergency Action Plan Status (Last Approval Date)	Most Recent Condition Assessment	Summary Impacts
Fairfax County	Fair Lakes Dam #1	H	Earth	NA	Stormwater Management	25	99.43	8/1/2019 (Active)	Satisfactory	1 Park, 1 Roadway
Fairfax County	Fair Lakes Land Bay 2 SWM BMP	H	Earth	NA	Stormwater Management	21	56.1	2/28/2018 (Active)	Satisfactory	6 Homes
Fairfax County	Fairview Lake Dam	H	Gravity	1/1/1986	Stormwater Management	26.5	785	3/14/2019 (Active)	Satisfactory	223 Homes
Fairfax County	Hampton Forest Section 4	H	Earth	NA	Stormwater Management	16.4	72.5	12/12/2016 (Expired 12/12/2022)	Satisfactory	6 Homes
Fairfax County	Island Creek Dam	S	Earth	NA	Stormwater Management, fish, small farm pond	39.5	70.07	NA	NA	0
Fairfax County	Kings Park West Section 18 Dam	S	Earth	3/10/1976	Stormwater Management	25.6	70.9	6/1/2007 (Expired 6/1/2013)	Satisfactory	0
Fairfax County	Kingstowne BMP Basin #2	S	Earth	NA	Stormwater Management	16	44.8	NA	NA	0
Fairfax County	Kingtowne Lake Dam	H	Earth	1/1/1988	Recreation	64.2	320	8/25/2003 (Expired 8/25/2009)	NA	73 Homes, 3 Roadways
Fairfax County	Kingstowne SWM Dp #4 Regional	H	Earth	NA	Stormwater Management	42.9	140	7/31/2020 (Active)	Satisfactory	31 Homes, 1 Business, 1 Roadway
Fairfax County	Lake Accotink Dam	H	Earth	1/1/1920	Recreation	28	2963	6/27/2017 (Active)	Fair	220 Homes, 5 Businesses, 1 School, 2 Railroads, 5 Roadways
Fairfax County	Lake Anne Dam	H	Earth	1/1/1962	Recreation, Stormwater Management	47	745	2/28/2018 (Active)	Satisfactory	17 Homes, 7 Roadways, 1

Community	Name of Dam	Classification	Dam Type	Year Built	Primary Purpose	Top Height (Feet)	Top Capacity (Acre Feet)	Emergency Action Plan Status (Last Approval Date)	Most Recent Condition Assessment	Summary Impacts
										dam downstream
Fairfax County	Lake Audubon Dam	H	Earth	1/1/1979	Recreation, Stormwater Management	46	1364	3/22/2019 (Active)	Satisfactory	61 Homes, 7 Roadways
Fairfax County	Lake Fairfax Dam	H	Earth	1/1/1956	Recreation	32	487	9/13/2012 (Expired 9/13/2018)	Satisfactory	11 Homes, 1 Park, 3 Roadways
Fairfax County	Lake Newport Dam	H	Earth	1/1/1981	Recreation, Stormwater Management	32	240	3/22/2019 (Active)	Satisfactory	304 Homes, 12 Roadways, 1 dam downstream
Fairfax County	Lake Thoreau Dam	H	Earth	1/1/1971	Recreation, Stormwater Management	56	1406	3/22/2019 (Active)	Satisfactory	344 Homes, 11 Roadways, 1 dam downstream
Fairfax County	No 2 Dam of 4 Kingstowne Park Impoundments	S	Other	1/1/1800	Tailings, Recreation	25	55.36	NA	NA	0
Fairfax County	North Twin Lake Dam	S	Earth	1/1/1950	Recreation	25.9	164.2	4/29/2019 (Active)	Satisfactory	1 Park, 1 Golf Course, 3 Roadways, 1 dam downstream
Fairfax County	NVCC Annadale Campus Dam	S	Earth	1/1/1968	Recreation, Stormwater Management	28.9	24	10/19/2017 (Active)	Satisfactory	2 Homes, 1 School, 4 Roadways
Fairfax County	Occoquan Lower Storage Dam	H	Gravity	1/1/1950	Water Supply, Hydro-electric	20	170	9/15/2015 (Expired 9/15/2021)	Satisfactory	0

Community	Name of Dam	Classification	Dam Type	Year Built	Primary Purpose	Top Height (Feet)	Top Capacity (Acre Feet)	Emergency Action Plan Status (Last Approval Date)	Most Recent Condition Assessment	Summary Impacts
Fairfax County	Plute McLean SWM Pond Dam	H	Earth	NA	NA	17	74	4/22/2022 (Active)	Satisfactory	12 Homes, 1 Roadway
Fairfax County	Pohick Creek Dam #1	H	Earth	1/1/1985	Stormwater Management, Recreation	60	4815	4/22/2022 (Active)	Satisfactory	8 Homes, 1 Roadway
Fairfax County	Pohick Creek Dam #2	H	Earth	1/1/1978	Stormwater Management, Recreation	39.1	560	6/26/2012 (Expired 6/26/2018)	Satisfactory	12
Fairfax County	Pohick Creek Dam #3	H	Earth	1/1/1975	Stormwater Management, Recreation	38	960	8/9/2017 (Active)	Satisfactory	73 Homes, 1 Railroad, 11 Roadways
Fairfax County	Pohick Creek Dam #4	H	Earth	1/1/1977	Stormwater Management, Recreation	42	2558	2/11/2022 (Active)	Satisfactory	128 Homes, 3 Railroads, 1 Roadway
Fairfax County	Pohick Creek Dam #7	H	Earth	1/1/1970	Stormwater Management	47	554	1/15/2019 (Active)	Satisfactory	0
Fairfax County	Pohick Creek Dam #8	H	Earth	1/1/1973	Stormwater Management	45.4	1740	8/12/2021 (Active)	Satisfactory	61 homes, 7 Railroads, 1 Roadway
Fairfax County	Reston Northern Sector Pond 1 Dam	H	Earth	NA	Stormwater Management	20.8	70.33	7/31/2020 (Active)	Satisfactory	1 Home, 1 Roadway
Fairfax County	Reston Town Center Western BMP Dam	H	Earth	NA	Stormwater Management	20.7	56.6	4/14/2014 (Expired 4/14/2020)	Satisfactory	6 Homes, 36 Businesses, 2 Roadways
Fairfax County	South Twin Lake Dam	S	Earth	1/1/1967	Recreation	14	118	1/9/2019 (Active)	Satisfactory	1 Golf Course, 3 Roadways
Fairfax County	Upper Occoquan Dam	H	Gravity	1/1/1955	Water Supply, Hydro-electric	65	25472	9/15/2015 (Expired 9/15/2021)	Satisfactory	0

Community	Name of Dam	Classification	Dam Type	Year Built	Primary Purpose	Top Height (Feet)	Top Capacity (Acre Feet)	Emergency Action Plan Status (Last Approval Date)	Most Recent Condition Assessment	Summary Impacts
Fairfax County	Upper Occoquan Sewage Authority Dam	H	Earth	1/1/1976	Other	41	1130	11/1/2019 (Active)	Fair	3 Roadways
Fairfax County	West Ox Road BMP Dam	H	Earth	NA	Stormwater Management	25.5	142.3	7/12/2022 (Active)	Satisfactory	5 Homes, 1 Roadway
Loudoun County	Arcola Center	S	Earth	1/1/2010	Stormwater Management	NA	NA	NA	NA	NA
Loudoun County	Ashburn Village Lake #1	H	Earth	1/1/1989	Recreation, Stormwater Management	32	221	NA	NA	NA
Loudoun County	Ashburn Village Lake #2	H	Earth	1/1/1990	Recreation, Stormwater Management	28.9	794	5/27/2008 (Expired 5/27/2014)	Fair	2 Roadways
Loudoun County	Beaverdam Creek	H	Earth	1/1/1972	Water Supply	55	6764	6/18/2018 (Active)	Satisfactory	3 roadways, 2 dams downstream
Loudoun County	Brambleton Land Bay 3 Pond 6 Dam	H	Earth	3/1/2005	Stormwater Management	14.2	79.2	5/9/2004 (Expired 2010)	Satisfactory	1 Roadway
Loudoun County	Creighton Hills Dam	S	Earth	6/1/2000	Recreation, Stormwater Management	57.9	89.54	11/30/2021 (Active)	Satisfactory	1 Roadway
Loudoun County	Daley Dam	S	Earth	1/1/1974	Recreation	29	465	6/17/2007 (Expired 6/17/2013)	Satisfactory	30 Homes, 2 Roadways
Loudoun County	Dulles Airport Dam	S	Earth	1/1/1962	Water Supply	11.4	259	7/11/2002 (Expired 7/1/2008)	Fair	1 Roadway
Loudoun County	Dulles Corner Lake	S	Earth, Concrete	1/1/1990	Other	20.4	116	10/14/2017 (Active)	Satisfactory	0

Community	Name of Dam	Classification	Dam Type	Year Built	Primary Purpose	Top Height (Feet)	Top Capacity (Acre Feet)	Emergency Action Plan Status (Last Approval Date)	Most Recent Condition Assessment	Summary Impacts
Loudoun County	Goose Creek Dam	H	Gravity	1/1/1960	Water Supply	39	4373	6/18/2018 (Active)	Satisfactory	2 Roadways
Loudoun County	Gore Dam	H	Earth	1/1/1950	Recreation	40	162	2/25/2021 (Active)	Satisfactory	1 Roadway, 1 Dam Downstream
Loudoun County	Haynes Dam	S	Earth	1/1/1980	Recreation	41	312	9/3/2015 (Expired 9/3/2021)	Fair	6 Homes, 1 Business, 1 Roadway
Loudoun County	Hope Parkway Dam	H	Earth	NA	Recreation	30.3	128.6	8/28/2020 (Active)	Satisfactory	0
Loudoun County	Horsepen Dam	H	Earth	1/1/1961	Water Supply	50	15200	9/15/2021 (Active)	Satisfactory	0
Loudoun County	J.T. Hirst Dam	S	Earth	1/1/1962	Water Supply	34	155	7/16/2021 (Active)	Fair	4 Roadways
Loudoun County	Kalnasy Dam	H	Earth	1/1/1964	Recreation, Irrigation	26.1	116.1	8/20/2014 (Expired 8/20/2020)	Fair	17 Homes, 2 Roadways
Loudoun County	Morefield Station East SWM Pond Dam	H	Earth	2/1/2018	Stormwater Management	14.25	136.3	4/24/2018 (Active)	Satisfactory	44 Homes, 2 Roadwaysw
Loudoun County	Morefield Station West SWM Pond Dam	H	Concrete	1/1/2015	Stormwater Management	14.4	95.6	4/14/2021 (Active)	Satisfactory	15 Homes, 1 Roadway
Loudoun County	Oliver Dam	S	Earth	1/1/1965	Recreation	43.85	337	12/22/2014 (Expired 12/22/2022)	NA	0
Loudoun County	Precision Dynamics Lake Dam	S	Earth	1/1/1967	Irrigation, Recreation	36	391	5/10/2010 (Expired 5/10/2016)	Satisfactory	45 homes, 6 Roadways

Community	Name of Dam	Classification	Dam Type	Year Built	Primary Purpose	Top Height (Feet)	Top Capacity (Acre Feet)	Emergency Action Plan Status (Last Approval Date)	Most Recent Condition Assessment	Summary Impacts
Loudoun County	Red Cedar Lake Two Dam	S	Earth	1/1/1900	Irrigation, Recreation	28	174	7/22/2015 (Expired 7/22/2021)	Fair	13 Homes, 1 Business, 1 Roadway
Loudoun County	Richmond Square Dam	H	Earth	1/1/1900	Stormwater Management	12	112.3	4/1/2020 (Active)	Fair	0
Loudoun County	Sleeter Lake Dam	H	Earth	1/1/1966	Irrigation, Recreation	55	3159	5/27/2010 (Expired 5/27/2016)	Satisfactory	14 Homes, 1 Utility, 6 Roadways
Loudoun County	The Lakes at Red Rock Dam	H	Earth	NA	Recreation	18	126	3/2/2015 (3/02/2021)	Satisfactory	1 Roadway
Prince William County	ARC Redevelopment SWM Pond Dam	H	Earth	1/1/2030	Stormwater Management	21.5	170	3/10/2021 (Active)	NA	27 Homes, 2 Utilities, 3 Roadways
Prince William County	Breckinridge Dam	H	Gravity	1/1/1940	Water Supply, Recreation	58	2670	NA	NA	NA
Prince William County	Camp 5 Dam	H	Gravity	1/1/1937	Recreation	24	92	NA	NA	NA
Prince William County	F.P Griffith Water Plant Lorton Quarry Dam	S	Other	NA	Other	20	253	NA	NA	NA
Prince William County	Innovation at Prince William Pond 3 Dam	H	Earth	NA	Stormwater Management	16	109	2/10/2016 (Expired)	Satisfactory	3 Homes, 1 Roadway
Prince William County	Lake Jackson Dam	S	Gravity	1/1/1928	Recreation	28	1228	NA	Satisfactory	0
Prince William County	Lake Monclair Dam	H	Earth	1/1/1964	Recreation	74	5938	4/19/2019 (Active)	Satisfactory	354 Homes, 3 Critical Infrastructure, 4 Roadways

Community	Name of Dam	Classification	Dam Type	Year Built	Primary Purpose	Top Height (Feet)	Top Capacity (Acre Feet)	Emergency Action Plan Status (Last Approval Date)	Most Recent Condition Assessment	Summary Impacts
Prince William County	Locust Shade Park Dam	H	NA	NA	NA	24	70	3/31/2016 (Expired 1/31/2022)	Satisfactory	4 Roadways
Prince William County	Market Center Pond 1 Dam	S	Earth	NA	Stormwater Management	37.5	175	11/26/2016 (Active)	Satisfactory	1 Business, 3 Roadways
Prince William County	New Bristow Village Regional SWM Facility Dam	H	Earth	1/1/2005	Stormwater Management	16	118	2/5/2021 (Active)	NA	10 Homes, 1 Railroad, 1 Roadway
Prince William County	North Fork Wetlands Bank Dam	H	Earth	1/1/1999	Other	24.35	536	6/28/2017 (Active)	Satisfactory	30 Homes, 13 Businesses, 4 Roadways
Prince William County	NVCC Woodbridge Campus	S	Earth	1/1/1975	Recreation, Stormwater Management	48.4	84.64	10/13/2016 (Expired 10/13/2022)	Satisfactory	0
Prince William County	Occoquan Lower Storage Dam	H	Gravity	1/1/1950	Water Supply, Hydro-electric	20	170	9/15/2015 (Expired 9/15/2021)	Satisfactory	0
Prince William County	Omisol Dam	H	Earth	1/1/1940	Recreation	21.1	156.4	7/9/2008 (Expired 7/9/2014)	Fair	1 Roadway
Prince William County	Possum Point Ash Dam #D	H	Earth	1/1/1989	Debris Control	140	6400	11/19/2021 (Active)	Satisfactory	1 Roadway
Prince William County	Potomac Club Regional Pond Dam	S	Earth	1/1/2000	Stormwater Management	34.12	98.6	6/22/2020 (Active)	Satisfactory	16 Homes, 2 Businesses, 1 Roadway
Prince William County	Prince William Parkway	H	Earth	1/1/1991	Stormwater Management	47.5	316	10/19/2020 (Active)	Satisfactory	14 Homes, 2 Roadways

Community	Name of Dam	Classification	Dam Type	Year Built	Primary Purpose	Top Height (Feet)	Top Capacity (Acre Feet)	Emergency Action Plan Status (Last Approval Date)	Most Recent Condition Assessment	Summary Impacts
	Regional SWM									
Prince William County	Rocky Branch Regional SWM Dam	H	Earth	NA	Stormwater Management	21.5	375.9	8/2/2018 (Active)	Satisfactory	42 Homes, 2 Roadways
Prince William County	Silver Lake Dam	H	Earth	1/1/1961	Recreation	27	526	7/18/2017 (Active)	Satisfactory	155 Homes, 4 Roadways
Prince William County	Southern Shores Drive Dam	S	Earth	NA	Stormwater Management	34	43.69	NA	NA	NA
Prince William County	T. Nelson Elliot Dam	H	Gravity	1/1/1968	Water Supply	76	33000	10/6/2021 (Active)	Satisfactory	3869 homes, 90 Businesses, 2 Schools, 2 Critical Infrastructure, 2 Railroads, 2 Utilities, 2 Parks, 2 Golf Courses, 7 Roadways, 1 Dam Downstream
Prince William County	Upper Occoquan Dam	H	Gravity	1/1/1955	Water Supply, Hydro-electric	65	25472	9/15/2015 (Expired 9/15/2021)	Satisfactory	0

5.1.1.4. Probability of Future Occurrence

From the first documented incident in 1848 through 2017, dam failures have occurred in the United States at an average of nearly 10 each year, mostly linked to small dams that result in limited flooding and downstream impact.[50] Since 1980 when dam safety became a national priority, the average number of dam failures has increased to 24 per year. Nevertheless, in 96% of dam failure events, the resulting flooding does not result in deaths or significant property damage.[51]

Predicting the probability of flooding from dam failure requires a detailed, site-specific engineering analysis for each dam. This is because failure may result from hydrologic and hydraulic design limitations, or from geotechnical or operational factors.

Dam failure is considered unlikely in the NOVA region, given the number of safety measures in place and rigorous programs of inspection and dam oversight. DCR requires specific operation and maintenance procedures for dams that present the greatest risk or require structural repair. It also requires routine inspections of dams and regularly updated emergency action plans (EAPs) for each of the major and commonwealth-regulated dams in the NOVA region. As such, future damage from dam failure and associated dollar losses are expected to be negligible, though the danger remains real and will continue to receive critical attention through DCR's Dam Safety and Floodplain Management Program.

Dam failure remains an unlikely occurrence for all major and non-regulated dams in the NOVA region.

5.1.2. Risk Assessment

Because of the lack of specific data on the probability of dam failure and inundation zones, the potential risk to critical facilities and existing buildings and infrastructure was not estimated for this revision of the Plan. Virginia's new Impounding Structure Regulations require dam break inundation zone mapping, and additional information is available from the DCR Dam Safety Program. However, a few observations about the impact of dam failure are discussed.

5.1.2.1. People

Persons living in a dam inundation area may be affected by dam failure if there is little to no advance warning to allow them to evacuate in a timely fashion. Because many dams are used for recreational purposes and are located adjacent to parks and other open spaces where visitors may gather, dam failure may affect those who do not live nearby but who enjoy visiting the recreational amenities.

5.1.2.2. Economy

The failure of dams may result in catastrophic localized damage. Vulnerability to dam failure is contingent on dam operations planning and the nature of downstream development. Depending on the elevation and storage volume of the impoundment, the amount of water released could impact businesses located in the inundation area. Nearby commercial establishments, including those of persons who manage a home-based business, may be affected.

[50] Stanford University. (2018 September). *National Performance of Dams Program, Dept. of Civil & Environmental Engineering (NPDP-01 V1)*.
http://npdp.stanford.edu/sites/default/files/reports/npdp_dam_failure_summary_compilation_v1_2018.pdf
[51] Ibid.

5.1.2.3. Built Environment, Community Lifelines, and Assets

Many types of structures in the built environment may be affected by dam failure. These include roads, bridges, culverts, homes, farms, parks, and greenspace. The built environment may also include communities and their assets, such as utility systems and infrastructure. Any or all of these may be damaged when a dam fails.

5.1.2.4. Natural Environment

The natural environment includes open spaces and other resources that may also include the built environment, such as parks that encompass trees or waterways. The natural environment could be affected by dam failure if trees are damaged or there is soil erosion from heavy water flow. Agricultural lands, while developed, may include shrubbery, water sources, crops, and livestock. Agricultural lands could suffer from soil erosion, drowned crops, or fields that cannot be planted or harvested.

5.1.3. Vulnerability Analysis

5.1.3.1. Historical

Because of the lack of specific data related to previous dam failure events in the planning area, it is difficult to identify the exact exposure of the population, property, economy, or environment related to this hazard. Enhanced coordination between emergency managers, dam owners and operators, USACE, and DCR will increase the availability of critical data and information necessary for appropriate mitigation actions.

5.1.3.2. Scenario

When data on the probability of dam failure and inundation zones do not exist or are unavailable, the vulnerability of critical facilities, existing buildings, and infrastructure could not be estimated for this revision of the Plan. Virginia's new Impounding Structure Regulations[52] require dam break inundation zone mapping and additional information to be available from the DCR Dam Safety Program.

5.1.3.3. Hazard Analysis Summary

The hazard ranking process included consideration of probability and consequences in determining an overall risk score and ranking. Information presented in this section and the hazard risk ranking process present the quantitative and qualitative summaries for dam failure. The Hazard Identification and Risk Assessment methodology is described in **Section 4, Base Plan**.

Table 32: Hazard Risk Rankings for Dam Failure, by Jurisdiction

Jurisdiction	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Arlington County	0	0	0	**N/A**
City of Alexandria	1.0	4.4	5.5	**Medium**
City of Fairfax	1.0	4.5	5.5	**Medium**
City of Falls Church	1.0	4.5	5.5	**Medium**
City of Manassas	1.0	4.1	5.1	**Medium**

[52] https://www.dcr.virginia.gov/laws-and-regulations/document/damsafetyregulations.pdf

Jurisdiction	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
City of Manassas Park	1.0	3.1	4.1	**Low**
Fairfax County	1.0	4.5	5.5	**Medium**
Town of Clifton	1.0	4.5	5.5	**High**
Town of Herndon	1.0	4.5	5.5	**High**
Town of Vienna	1.0	4.5	5.5	**High**
Loudoun County	1.0	4.4	5.5	**Medium**
Town of Leesburg	1.0	4.4	5.5	**Medium**
Town of Lovettsville	1.0	4.4	5.5	**Medium**
Town of Middleburg	1.0	4.4	5.5	**Medium**
Town of Purcellville	1.0	4.4	5.5	**Medium**
Town of Round Hill	1.0	4.4	5.5	**Medium**
Prince William County	1.3	5.2	6.5	**High**
Town of Dumfries	1.0	4.1	5.1	**Medium**
Town of Haymarket	1.0	4.1	5.1	**Medium**
Town of Occoquan	4.0	7.9	11.9	**High**

5.1.3.4. Future Population and Development Trends

Because the potential consequence of dam failure is flooding, the flood zones identified in the current Flood Insurance Rate Maps (FIRMs) serve as guidance for appropriate development near dams. In addition, federal, and state regulations restrict significant development in these areas. Current land-use codes incorporate standards that address and mitigate dam failure.

The potential for impacts of future growth and development on dam failure will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed and whether there are opportunities for mitigation related to development that could reduce hazard impacts in the future.

5.1.3.5. Opportunities for Mitigation

In recent years, the Federal Emergency Management Agency (FEMA) has recognized the need to address the high level of vulnerability of dams in recognition of the overall deterioration of the nation's infrastructure. Concern about the safety of dams and potentially affected communities led to the development of the National Dam Safety Program/High Hazard Potential Dam Grant Program (NDS/HHPD), which that may be used for eligible mitigation projects. The Planning Committee or individual jurisdictions may wish to consider this potential funding source for improving the security of dams deemed to be at high or significant risk. The callout box below describes this program in detail.

Coronavirus (COVID-19) relief funds were distributed by the United States Congress to federal, state, and local government agencies, nonprofit organizations, and individuals in 2020 and 2021. The main funding programs were the Coronavirus Aid, Relief, and Economic Security (CARES) Act (2020), the Coronavirus Response and Consolidated Appropriations Act (2021), and the American Rescue Plan Act (ARPA) (2021).[53] These funds have a broad range of allowable expenses, including supporting public health, replacing lost public sector revenue, and investing in water, sewer, broadband, and cybersecurity

[53] USA Spending. (2021, September 20). *The Federal Response to COVID-19*. https://www.usaspending.gov/disaster/covid-19?publicLaw=all

infrastructure. Within these overall categories, recipients have broad flexibility to decide how best to use this funding to meet the needs of their communities.[54] As of December 2021, $350 billion was allocated to states, counties, cities, tribal governments, territories, and non-entitlement units of local government.[55]

Virginia Department of Conservation and Recreation (DCR) funds and controls the Dam Safety and Floodplain Management Grants. The fund was established to provide grants to public and private dam owners whose dams are under state regulations and to help local governments improve methods for flood prevention and protection. Another recent influx in federal funds that can be used for mitigation actions comes from the Infrastructure Investment and Jobs Act, which was passed by Congress on November 6, 2021. This investment in infrastructure includes legislation that addresses repairing and rebuilding roads and bridges with a focus on climate change, mitigation, and resilience, and making the nation's infrastructure resilient against the impacts of climate change, cyberattacks, and extreme weather events. The ways in which this legislation will be administered was still being determined at the time this Plan was written.

National Dam Safety Program/High Hazard Potential Dam Grant Program (NDS/HHPD)[56]

The Virginia Department of Conservation and Recreation (DCR) serves as the commonwealth's dam safety agency, working in partnership with federal agencies and other stakeholders under the National Dam Safety Program to encourage and promote the establishment and maintenance of effective federal and state dam safety programs to reduce the risk to life, property, and the environment.

For the purposes of the HHPD program, all dam risk includes incremental risk, non-breach risk, and residual risk associated with each eligible high hazard potential dam, as well as the reason(s) a state has determined the dam is an eligible high hazard potential dam. To be eligible for an HHPD grant, the high hazard dam must have an emergency action plan approved by DCR, and it must fail to meet minimum dam safety standards of the commonwealth and pose an unacceptable risk to the public.

High hazard potential is a classification standard for any dam whose failure or incorrect operation would cause loss of human life and significant property destruction. There are 58 dams ranked as high hazard in the NOVA planning area.

Funding from the HHPD program provides technical, planning, design, and construction assistance for eligible rehabilitation activities that reduce dam risk and increase community preparedness.

Objectives of the program include:

1. Provide financial assistance for repair, removal, or rehabilitation of eligible high hazard potential dams
2. Protect the federal investment by requiring operation and maintenance of the project for 50 years following completion of rehabilitation

[54] United States Department of the Treasury. (n.d.). *Coronavirus State and Local Fiscal Recovery Funds*. https://home.treasury.gov/policy-issues/coronavirus/assistance-for-state-local-and-tribal-governments/state-and-local-fiscal-recovery-funds
[55] USA Spending. (2021, September 20). *The Federal Response to COVID-19*. https://www.usaspending.gov/disaster/covid-19?publicLaw=all
[56] Federal Emergency Management Agency. (2021, October 20). *Rehabilitation of High Hazard Potential Dam (HHPD) Grant Program*. https://www.fema.gov/emergency-managers/risk-management/dam-safety/rehabilitation-high-hazard-potential-dams

3. Encourage state, local, and territorial governments to consider all dam risks in state and local mitigation planning
4. Promote community preparedness by requiring recipients to develop and implement floodplain management plans that address potential measures, practices, and policies to reduce loss of life, injuries, damage to property and facilities, public expenditures, and other adverse effects of flooding in the area impacted by the project; plans for flood fighting and evacuation; and public education and awareness of flood risks
5. Reduce the potential consequences to life and property of high hazard potential dam incidents
6. Incentivize states to incorporate risk-informed analysis and decision-making into their dam safety practice
7. Reduce the overall number of high hazard potential dams that pose an unacceptable risk to the public
8. Promote a program of emergency action plan implementation, compliance, and exercise for high hazard potential dams
9. Reduce costs associated with dam rehabilitation through the deployment of innovative solutions and technologies

Eligible activities include the repair, removal, or rehabilitation of eligible high hazard potential dams. For the purposes of the HHPD program, rehabilitation means the repair, replacement, reconstruction, or removal of a dam that is carried out to meet applicable state dam safety and security standards.

The HHPD grant **period of performance** is 36 months from the date of the award.

Specific criteria for the HHPD grant program are in FEMA Policy 104-008-7.

5.1.3.6. Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluating, and updating of this Plan should consider the following factors related to dam failure, as well as other information from updates of Virginia's COV-SHMP:

- Have dam failure events occurred in the planning area since the adoption of 2022 HMP?
- Did dam failure events take place in areas adjacent to the planning area that impacted the planning area by virtue of their being located upstream of the planning area?
- Has any new scientific research or methodology changed the ability to predict dam failure events or assess risk and vulnerability?
- Have there been significant changes in the population, built environment, natural environment, or economy that could affect the risk or vulnerability to dam failure?
- Is there new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to dam failure?
- Has any new funding source for dam failure research or the repair, removal, or rehabilitation of dams become available?

5.2. Drought

2022 HMP Update

The drought hazard was reexamined, and a new analysis was performed that included but was not limited to the following:

- Reformatting the hazard section to improve flow and clarity.
- Refreshing the hazard profile with updated data, maps, and imagery, where available.
- Updating the assessment of risk and vulnerability by jurisdiction based on new data.
- Ranking the hazard by jurisdiction using the methodology described in Section 4.

Though drought and extreme heat are often interrelated hazards, they can and do occur independently of each other. The 2012 plan update consolidated the analysis of each into one section; however, the 2017 plan update separated them into different sections, a practice which is continued in this 2022 update.

Table 33: Drought Profile

<table>
<tr><th colspan="5">Drought</th><th>Overall Vulnerability</th></tr>
<tr><th colspan="5">Definition, Key Terms, and Overview</th><td rowspan="4">Medium</td></tr>
<tr><td colspan="5">A prolonged period with no rain, particularly during the planting and growing seasons in agricultural areas. Drought can also result from limited winter precipitation followed by moderately long periods without rain during the spring and summer months.</td></tr>
<tr><th>Frequency</th><th>Probability</th><th colspan="3">Potential Magnitude</th></tr>
<tr><td rowspan="2">Low</td><td rowspan="2">Occasional</td><th>Injuries/Deaths</th><th>Infrastructure</th><th>Environment</th></tr>
<tr><td>Low</td><td>Moderate</td><td>High</td></tr>
</table>

5.2.1. Hazard Profile

Drought is a period without substantial rainfall that persists from one year to the next. It is a normal part of virtually all climatic regions, including areas with high and low average rainfall. Drought is one of the most complex of all natural hazards because it is difficult to determine precisely when it begins and ends. In addition, droughts can result from other hazards, such as extreme heat. The impact of drought on wildlife and area farming is enormous, often killing crops, grazing land, edible plants, and, in severe cases, even trees. A secondary hazard of drought is wildfire, because dying vegetation serves as a prime ignition source. Therefore, a heat wave combined with a drought is a very dangerous condition.

Drought is a normal, recurrent feature of climate, although at times it is considered a random event. Its characteristics vary significantly from one region to another. Drought is a temporary condition; it differs from aridity, which is a permanent climate feature in regions with low rainfall.

Drought can have a widespread impact on the environment and the economy, depending upon its severity. Unlike other natural disasters, it typically does not directly result in loss of life or damage to property. However, drought can have indirect impacts on livelihoods and well-being that can lead, over the long term, to loss of life.

Drought, as a persistent moisture deficiency, can lead to adverse impacts on vegetation, people, and animals. High temperatures, high winds, and low humidity can worsen drought conditions and leave areas more susceptible to wildfire. Human demands and actions can also hasten drought-related impacts. Drought may be classified as meteorological, hydrologic, agricultural, or socioeconomic.

Table 34: Definitions of Drought Types[57]

Term	Definition
Meteorological Drought	The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales. This type of drought usually takes at least three months to develop and can last for years.
Hydrological Drought	The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels. The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate from a precipitation shortfall, hydrologists are more concerned with how this deficiency plays out through the hydrologic system. Hydrological droughts are usually out of phase with, or follow the occurrence of, meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, stream flow, and groundwater and reservoir levels.
Agricultural Drought	Agricultural drought links various characteristics of meteorological or hydrological drought to agricultural impacts, focusing on precipitation shortfalls, differences between actual and potential evapotranspiration (evaporation combined with transpiration), soil water deficits, and reduced groundwater or reservoir levels. Crop water demand depends on prevailing weather conditions, biological characteristics of the specific crops, their stage of growth, and the physical and biological properties of the soil.
Socioeconomic Drought	The effect of demands for water that exceed the supply because of a weather-related supply shortfall, occurring when physical water shortage begins to affect the population, individually and collectively. Most socioeconomic definitions of drought associate it with supply, demand, and economic good.

There is a link between the various types of droughts. Meteorological droughts are typically defined by the level of dryness when compared to an average, or normal, amount of precipitation over a given period. Hydrological drought is directly related to the effect of precipitation shortfalls on surface and groundwater supplies. Agricultural droughts relate common characteristics of drought to their specific agricultural-related impacts, emphasizing factors like soil water deficits, water reservoir levels, and differing water needs based on stages of crop development. Human factors, particularly changes in land use, can alter the hydrologic characteristics of a basin. Socioeconomic drought results from water shortages that limit the ability to supply water-dependent products in the marketplace, including food supplies.

[57] National Drought Mitigation Center. (n.d.). *Types of Drought*. https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx

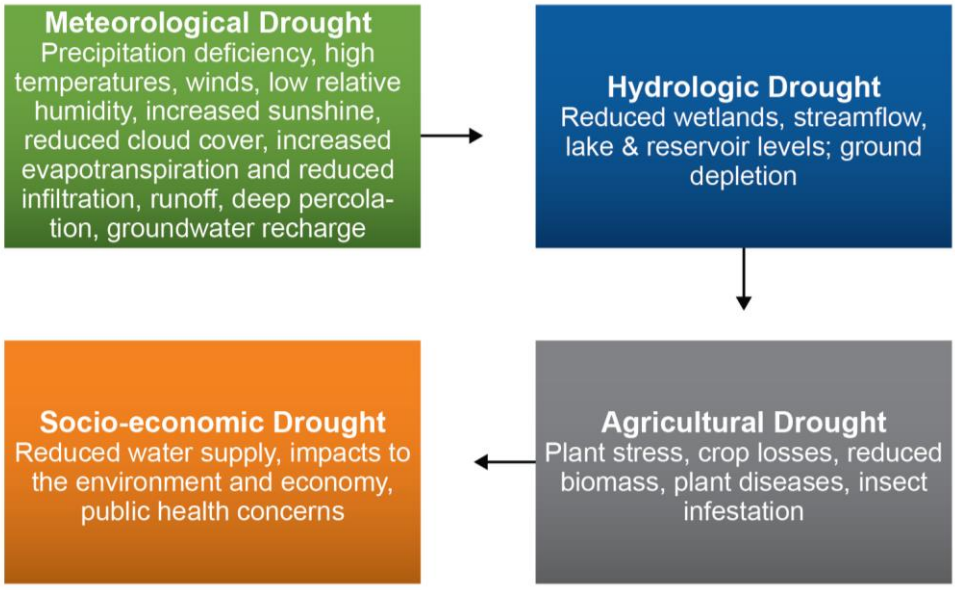


Figure 19: Interrelationship and Related Impacts of the Hydrological Cycle[58]

Drought should be considered relative to some long-term average conditions of balance between precipitation and evapotranspiration in a particular area, a condition often perceived as "normal." It is also related to the timing (i.e., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e., rainfall intensity, number of rainfall events, antecedent moisture conditions, etc.) of the rains. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with drought in many regions of the world and can significantly affect its severity.

Table 35: Hazard Profile Summary

Drought **Assessment: Medium Risk Hazard**	**Location**	Jurisdiction-wide	**Potential Cascading Effects**
	Extent	Moderate to significant	• Water supply shortage • Decrease in agricultural production • Livestock loss • Loss of natural resources • Food supply shortage • Increased fire hazard • Economic loss
	Duration	Several weeks to several years	
	Probability	Occasional	
	Seasonal Pattern	No distinct seasonal pattern but may be exacerbated by excessive heat in the summer	
	Speed of Onset	Slow	
	Warning Time	Days to weeks	
	Repetitive Loss	N/A	

[58] National Drought Mitigation Center, University of Nebraska–Lincoln, Types of Drought. Retrieved at: https://www.drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx

5.2.1.1. Location

All jurisdictions in the Northern Virginia region are susceptible to drought conditions, although these are typically not as severe as those in other parts of the Commonwealth or in other regions of the country. According to historical Palmer Drought Severity Index (PDSI) records,[59] for the years 1895 to 2010, the Northern Virginia region was in severe to extreme drought conditions for only 5 to 10% of the time, compared to areas in the western portion of the United States that experienced severe to extreme drought conditions for more than 20% of the time.

According to the United States Department of Commerce, Bureau of Economic Analysis,[60] less than 1% of the Northern Virginia region's civilian workforce is involved in the farm or agriculture sector. According to the United States Department of Agriculture's 2017 Census of Agriculture, Loudoun County is the agricultural leader in the Northern Virginia region with more than 1,259 active farms on 142,452 acres of farmland, with an average farm size of approximately 100 acres. Cropland accounts for 49% of the land on farms, with pastureland for cattle accounting for 27%.

The number of farms and acres of farmland have declined by 10% from the previous statistical update in 2012. As continued development impacts previously undeveloped agricultural lands, agricultural production in the region is becoming potentially less vulnerable to drought.

5.2.1.2. Extent

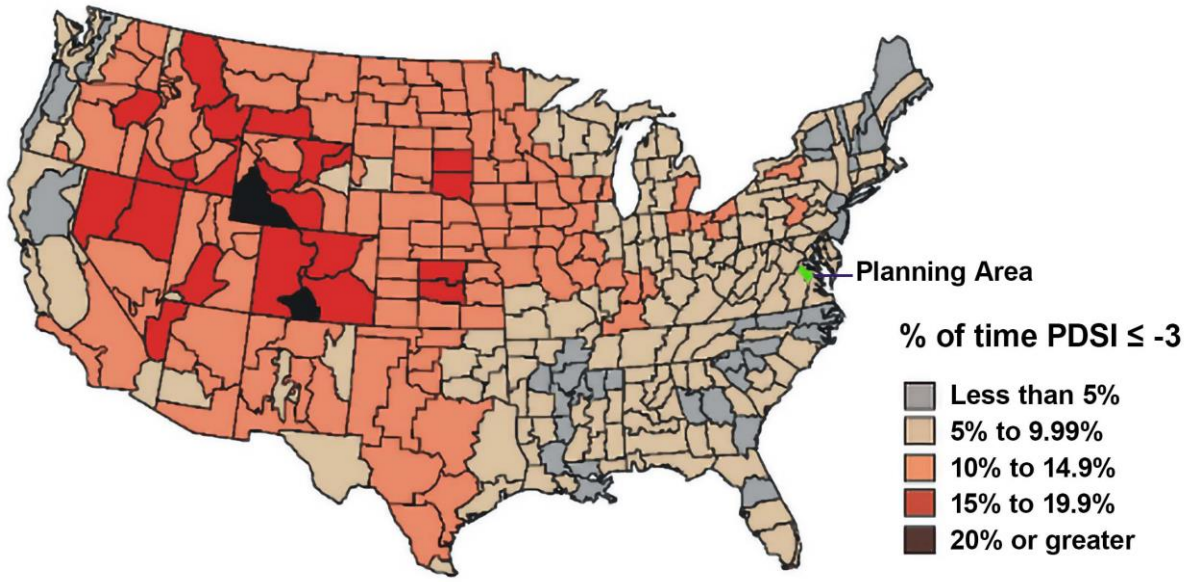
Scientists and meteorologists use several tools to indicate the occurrence and severity of drought. The PDSI uses mathematical equations that incorporate precipitation and temperature data to estimate evaporation, runoff, and soil moisture recharge; it measures the extent or magnitude of drought by evaluating the duration and intensity of long-term drought-inducing circulation patterns. Long-term drought is cumulative, with the intensity of drought during a month dependent upon that month's weather patterns plus the cumulative patterns of previous months. The hydrological impacts of drought take longer to develop. The fixed mathematical formulas can be applied retroactively to historical data, and the National Center for Environmental Information (NCEI) maintains a database of monthly PDSI dating to 1895. The PDSI drought classifications are based on observed drought conditions.

Table 36: Palmer Drought Severity Index (PDSI) Classifications[61]

Drought Index	Drought Condition Classifications						
	Extreme	Severe	Moderate	Normal	Moderately Moist	Very Moist	Extremely Moist
Z Index	-2.75 and below	-2.00 to -2.74	-1.25 to -1.99	-1.24 to +.99	+1.00 to +2.49	+2.50 to +3.49	N/A
Meteorological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.99	+3.00 to +3.99	+4.00 and above
Hydrological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.99	+3.00 to +3.99	+4.00 and above

[59] Dai PDSI data provided by the NOAA/OAR/ESRL PSL, Boulder, Colorado, USA, from their Web site at: https://psl.noaa.gov/data/gridded/data.pdsi.html
[60] United States Department of Agriculture. (2017). *2017 Census of Agriculture, County Profile for Loudoun County, Virginia.* http://www.nass.usda.gov/AgCensus
[61] National Drought Mitigation Center. (n.d.). *Measuring Drought*. https://drought.unl.edu/ranchplan/DroughtBasics/WeatherandDrought/MeasuringDrought.aspx

The planning area is highlighted in green on the PDSI summary map for the United States from 1895 to 1995. As can be seen, the Eastern United States has not experienced as many significant long-term droughts as the Central and Western regions of the country. The PDSI can also be used to develop maps showing the percentage of time an area is considered to be in extreme or severe drought conditions.



SOURCE: McKee et al. (1993); NOAA (1990); High Plains Regional Climate Center (1996)
Albers Equal Area Projection; Map prepared at the National Drought Mitigation Center

Figure 20: Historic Palmer Drought Severity Index (1895-1995), Percent of Time in Severe and Extreme Drought[62]

In addition to the PDSI, the United States Drought Monitor produces maps based on a drought classification system that summarizes conditions and impacts in a format that is easy for the general public to understand. Drought intensity is classified from D0 (abnormally dry) to D4 (exceptional drought. The classifications identify the level of intensity using the associated descriptor and define possible impacts at the various stages of drought. In addition, the classifications integrate other drought monitoring tools within each drought category.

[62] National Drought Mitigation Center. (2021). *Historic Palmer Drought Severity Index*. https://www.drought.unl.edu/monitoring/HistoricPDSI.aspx

Table 37: United States Drought Monitor Intensity Scale[63]

Category	Description	Possible Impacts	Ranges				
			Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: • Short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: • Some lingering water deficits. • Pastures and crops not fully recovered.	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	21-30
D1	Moderate Drought	• Some damage to crops, pastures. • Streams, reservoirs, and wells low; some water shortages developing or imminent. • Voluntary water-use restrictions requested.	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	• Crop or pasture losses likely. • Water shortages common. • Water restrictions imposed.	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	• Major crop/pasture losses. • Widespread water shortages or restrictions.	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses. • Shortages of water in reservoirs, streams, and wells, creating water emergencies.	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

[63] National Drought Mitigation Center. (2021). *United States Drought Monitor, Drought Classification*. https://droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx

When geographic areas are classified as D0, they are considered “drought watch” areas because they are in one of the following conditions: drying out and possibly heading for drought; recovering from drought but not yet back to normal; or suffering long-term impacts of drought such as low reservoir levels. The short-term drought indicator focuses on one- to three-month precipitation predictions; the long-term indicator focuses on six- to sixty-month predictions.

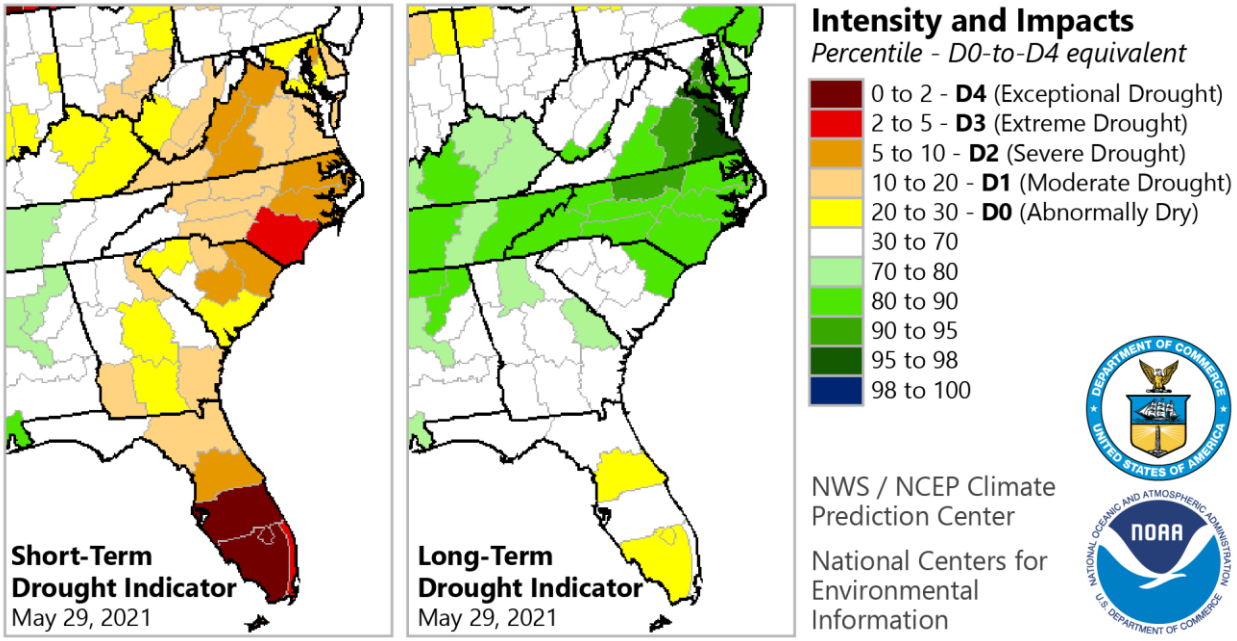


Figure 21: Examples of Short-Term and Long-Term Drought Prediction Maps, May 29, 2021[64]

5.2.1.3. Previous Occurrences

Because of the widespread geographic nature of the hazard, droughts typically affect large land areas, such as the entire Northern Virginia region. Descriptions of previous occurrences of drought in Northern Virginia have been consolidated to cover the entire planning area.

Table 38: Previous Drought Events, All Northern Virginia Jurisdictions, 1950–June 2021[65]

Jurisdiction	Drought Events 1950 to 2021
Arlington County	9
City of Alexandria	9
City of Fairfax	10
City of Falls Church	10
City of Manassas	12
City of Manassas Park	12
Fairfax County	10

[64] National Drought Mitigation Center. (2021). *United States Drought Monitor*. https://droughtmonitor.unl.edu/
[65] National Oceanic and Atmospheric Administration (2021). *National Center for Environmental Information Storm Events Database,* 1950-June 30, 2021 [Data set]. https://www.ncdc.noaa.gov/stormevents/

Jurisdiction	Drought Events 1950 to 2021
Town of Clifton	10
Town of Herndon	10
Town of Vienna	10
Loudoun County	12
Town of Leesburg	12
Town of Lovettsville	12
Town of Middleburg	12
Town of Purcellville	12
Town of Round Hill	12
Prince William County	12
Town of Dumfries	12
Town of Haymarket	12
Town of Occoquan	12

Based on NCEI data records, significant drought years in Northern Virginia occurred in 1987, 1998, 1999 and 2007. There have been no additional drought events reported since the 2017 Plan.

Table 39: Previous Drought Event Periods in Northern Virginia, 1997–2007[66]

Jurisdictions Affected (By NWS Zone)	Begin Date	End Date	Drought Period
Prince William County	7/1/1997	7/31/1997	4 weeks
Prince William County, City of Manassas	8/1/1998	8/31/1998	4 weeks
Prince William County	11/1/1998	11/30/1998	4 weeks
Arlington, Fairfax, and Prince William Counties	12/1/1998	12/31/1998	4 weeks
Arlington, Fairfax, and Prince William Counties	5/1/1999	5/31/1999	4 weeks
Arlington, Fairfax, and Prince William Counties	6/1/1999	6/30/1999	4 weeks
Arlington, Fairfax, and Prince William Counties, Cities of Alexandria and Falls Church	7/1/1999	7/31/1999	4 weeks
Arlington, Fairfax, and Prince William Counties	8/1/1999	8/31/1999	4 weeks
Arlington, Fairfax, and Prince William Counties	9/1/1999	9/17/1999	3 weeks
Arlington, Fairfax, and Prince William Counties	7/24/2007	7/31/2007	4 weeks
Arlington, Fairfax, and Prince William Counties	8/1/2007	8/21/2007	3 weeks

[66] Ibid.

Jurisdictions Affected (By NWS Zone)	Begin Date	End Date	Drought Period
Fairfax and Prince William Counties	10/1/2007	10/30/2007	4 weeks

Because droughts do not exhibit distinct beginning and end dates, it can be difficult to determine the period of a drought; multiple instances may be recorded for the same long-term drought. More detailed information on historical drought events can be obtained through the NCEI Storm Events Database.

Although 31 drought events since 1950 are documented in separate zones in the NCEI database, the events are spread over multiple jurisdictions, often with similar beginning and ending dates. Therefore, National Weather Service (NWS) zones listed within the same time period have been grouped as one incident. Each event is depicted as affecting multiple jurisdictions and possibly additional communities adjacent to the planning area. Because of the widespread nature of drought, towns located within each county are included in the county-level data.

Table 40: Drought Impacts for Northern Virginia Jurisdictions, 1950–June 2021[67]

Number of County and/or Zone Areas Affected	5
Number of Days with a Drought Event	12
Number of Days with a Drought Event and Death	0
Number of Days with a Drought Event and Death or Injury	0
Number of Days with a Drought Event and Property Damage	0
Number of Days with a Drought Event and Crop Damage	0
Number of Drought Event Types Reported	1

[67] National Oceanic and Atmospheric Administration (2021). *National Center for Environmental Information Storm Events Database,* 1950-June 30, 2021 [Data set]. https://www.ncdc.noaa.gov/stormevents/

Significant Previous Occurrences

Table 41: Summary of Previous Significant Drought Events[68]

Date(s)	Impacts
July 1997	• Dry weather reduced crop yields, including corn, hay, alfalfa, and soybeans. • Counties reported crop damage in the millions. • Temporary water restriction in some counties.
August 1998	• Only 0.45 inches of rain fell at Dulles International Airport, significantly less than the normal rainfall of 3.94 inches. • Reduced crop yields by estimated 20%–40% across the region, affecting corn, hay, and soybeans. • Winter feed reserves used to sustain livestock. • Increasingly dry timber and brush; five fires broke out in National Forests. • Reservoirs continued to dry out; water emergency declared in one county.
November–December 1998	• Fifth and sixth months with drought conditions across the region. • During November, only 0.91 inches of rain fell at Reagan National Airport in Arlington County, 2.19 inches below normal. • The five-month rain total at the airport was 5.78 inches, 11.38 inches below normal. • Total of 11.15 inches of rain from July through November. • Fairfax County had only 57% of its normal rainfall from July to November; Loudoun County had only 6.22 inches of rain. • Water supply reservoirs at record lows, with only backup reserve water, forcing mandatory water restrictions. • Second worst agricultural drought in 100 years; 89% of topsoil moisture was rated short or very short, and 76% of pastureland was rated poor or very poor. Hardest hit were barley, corn, hay, soybeans, tobacco, and wheat. • First time the Farm Service Agency made direct payments for grazing losses. • Loudoun County reported one-third of winter hay already fed to livestock by end of November, necessitating use of feed reserves. • Unprecedented number of forest and brush fires—65 reported statewide during November.

[68] Ibid.

Date(s)	Impacts
May–July 1999	• Climatological drought continuing since summer of 1998. • May was seventh month of below-normal precipitation and eighth driest month on record. • During May, only 2.22 inches of rain fell at Dulles International Airport, 1.80 inches below normal. • Fairfax and Loudoun counties each registered 2.0 inches of rain during June. • Potomac River water levels fell to average daily flow of 18% of the long-term average. • With low water tables, some voluntary water restrictions were issued. • Impacts on agriculture, with crop losses and trees prematurely shedding leaves in orchards. • Irrigation sources drying up, forcing reduction of herd sizes. • Dry forest conditions led to sizable brush fires. • Second warmest July on record, with average temperature of 82.9 degrees; record highs of over 90 degrees for 22 days in June. • PDSI indicated Extreme Drought. • Between August 1998 and July 1999, precipitation was 10–16 inches below average. Measurable rain fell on only eight days during July. • Low water tables forced additional voluntary and mandatory water restrictions. • Increasing number of wildlife entering populated areas searching for food and water.
August–September 1999	• Wells and springs remained short of water. • High temperatures were at or above 90 degrees through 19 August, then cooled into the 70s and 80s for the remainder of the month. • From September 1998 through August 1999, precipitation was 8–14 inches below average. • The KBDI measure of fire danger listed Northern Virginia at 650 prior to 26 August and 500 by month's end, indicating a slight decline in severity due to some rainfall. • The lack of rainfall continued to affect water levels along the Potomac River. The flow of water past Washington, D.C., was below average for the twelfth consecutive month. During August, the average daily flow of the river was only 11% of average. • Water was released from reservoirs to boost water levels, and some waterways ran dry. Beaverdam Reservoir in Loudoun County was 13 feet below capacity. • Many communities continued voluntary and mandatory water restrictions. • Loudoun and several other counties were declared federal drought disaster areas. Several crops never reached maturity, and agricultural losses in multiple counties reached in the millions. Hay production in Prince William County was cut by 65%. Loudoun County lost 50% of its corn crops. • Forests and rural vegetation were dangerously dry. A record fire season was reported for January through August, with 1,444 fires burning 9,373 acres. Some counties instituted mandatory burn bans during the month. • Loudoun County estimated $15 to $20 million in agricultural losses.

Date(s)	Impacts
August–October 2007	• Severe agricultural drought conditions were experienced in multiple Mid-Atlantic areas, including the Washington, D.C. metro area. • Some locations averaged rainfall totals 6 inches below normal, leading to some water restrictions. • In early October, rainfall deficits totaled nearly 10 inches. • All counties and independent cities in the Commonwealth were designated primary disaster areas except for Arlington County and the independent cities of Alexandria and Falls Church, which were designated contiguous disaster areas. • Many counties and cities posted both voluntary and mandatory water restrictions throughout the month. Just before rainfall towards the end of the month, the National Drought Monitor listed much of Northern Virginia and the Northern Piedmont under extreme drought conditions.

5.2.1.4. Probability of Future Occurrence

Based on past events, the probability that Northern Virginia region will experience recurring drought conditions is occasional.

The United States Drought Monitor is one tool that can be utilized by plan participants to monitor the development of short- and long-term drought conditions. This resource presents drought estimations for a given point in time and can be used for planning, mitigation, and preparation.

5.2.2. Risk Assessment

Impacts from drought in the planning area are primarily related to cascading effects on water supply and agriculture and the resulting increase in wildfires. Lack of rainfall during drought conditions affects water levels along the Potomac River, the main water source for the upper Northern Virginia region. Many of the major reservoirs serving the Northern Virginia region, including the Occoquan in Fairfax County and the Beaverdam in Loudoun County, have experienced dangerously low levels in the past due to ongoing periods of drought. During these periods, many locations are forced to impose water restrictions, which could lead to economic impacts for the region. The most vulnerable residents are those in the more rural areas, many of whom draw their water supply from wells.

Short-term droughts can impact agricultural productivity, while longer-term droughts are more likely to impact not only agriculture but also water supply. Jurisdictions that have invested in water supply and distribution infrastructure are generally less vulnerable to drought. Short- and long-term drought may lead to an increase in the incidence of wildfires, which might in turn lead to increased potential for landslides or mudflows once rain does fall.

5.2.2.1. Population and Property

There is low risk of human injury and/or death due to drought in Northern Virginia; however, water shortages may impact vulnerable populations who are unable to plan for shortages or access alternate water sources. Extreme long-term drought may also impact food supplies.

5.2.2.2. Built Environment, Community Lifelines, and Assets

Vulnerability associated with drought has not been quantified in terms of geographic extent for this revision; as a result, specific vulnerabilities of the built environment, Community Lifelines, and assets have not been calculated. Most drought-related damages do not impact buildings or infrastructure.

Since 1950, the region has been severely impacted by numerous instances of a long-term drought with agricultural damages totaling approximately $25 million, most of which are attributable to agricultural losses in Loudoun and Prince William counties. Prior to this period, very little historical data exists on drought events.

5.2.2.3. Natural Environment and Economy

Crop damages resulting from drought are difficult to predict, as agricultural productivity often varies with growing conditions from year to year. Past events have demonstrated, however, that drought can lead to crop failure, loss of trees and native species, and impacts on watersheds and waterways. These impacts have economic consequences, including agricultural losses related to crops and livestock, disruption to business operations, and loss of revenues from recreation and tourism.

5.2.2.4. Hazard Risk Ranking Summary

The hazard ranking process considered probability and consequences in determining an overall risk score and ranking. Information in this section and the hazard risk ranking process present the quantitative and qualitative summary for drought. The Hazard Identification and Risk Assessment methodology is described in **Section 4, Base Plan**.

Table 42: Hazard Risk Rankings for Drought, by Jurisdiction

Jurisdiction	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Arlington County	1.7	3.2	4.8	**Medium**
City of Alexandria	2.3	3.3.	5.6	**Medium**
City of Fairfax	2.0	3.2	5.2	**Medium**
City of Falls Church	2.0	3.2	5.2	**Medium**
City of Manassas	2.3	3.2	5.5	**Medium**
City of Manassas Park	2.3	3.2	5.5	**Medium**
Fairfax County	2.0	3.2	5.2	**Medium**
Town of Clifton	2.0	3.2	5.2	**Medium**
Town of Herndon	2.0	3.2	5.2	**Medium**
Town of Vienna	2.0	3.2	5.2	**Medium**
Loudoun County	2.0	3.2	5.2	**Medium**
Town of Leesburg	2.0	3.2	5.2	**Medium**
Town of Lovettsville	2.0	3.2	5.2	**Medium**
Town of Middleburg	2.0	3.2	5.2	**Medium**
Town of Purcellville	2.0	3.2	5.2	**Medium**
Town of Round Hill	2.0	3.2	5.2	**Medium**
Prince William County	2.3	3.4	5.7	**Medium**
Town of Dumfries	2.3	3.2	5.5	**Medium**
Town of Haymarket	2.3	3.2	5.5	**Medium**
Town of Occoquan	2.0	2.0	4.0	**Medium**

5.2.3. Vulnerability Analysis

There is no single standardized methodology for estimating vulnerability to the hazard of drought; however, annualized crop losses of $463,000 can be calculated based on NCEI data for previous events. Future updates to this Plan should consider methods for quantifying annual drought losses in sectors outside of agriculture. This might include defining losses related to maintaining water supply, hydropower, tourism, and recreation and would require data sources outside of NCEI storm events data, including detailed local reports of occurrences and associated damages. Because drought does not pose a direct threat to life and property, its impact is primarily measured by its potential and actual economic effects on the agricultural sector as well as municipal and industrial water supplies. This economic effect can also be expected to affect related sectors, such as wholesale and retail trade.

Table 43: Annualized Property and Crop Loss Due to Drought, 1950-2021[69]

Jurisdiction	Annual Total Property and Crop Damage (151 Total Drought Events)
Arlington County	$22,315
City of Alexandria	$22,315
City of Fairfax	$0
City of Falls Church	$22,315
City of Manassas	$28,160
City of Manassas Park	$0
Fairfax County	$22,315
Town of Clifton	Included in Fairfax County estimate
Town of Herndon	Included in Fairfax County estimate
Town of Vienna	Included in Fairfax County estimate
Loudoun County	$317,304
Town of Leesburg	Included in Loudoun County estimate
Town of Lovettsville	Included in Loudoun County estimate
Town of Middleburg	Included in Loudoun County estimate
Town of Purcellville	Included in Loudoun County estimate
Town of Round Hill	Included in Loudoun County estimate
Prince William County	$28,160
Town of Dumfries	Included in Prince William County estimate
Town of Haymarket	Included in Prince William County estimate
Town of Occoquan	Included in Prince William County estimate
Total Annualized Property and Crop Loss Due to Drought	**$462,886**

[69] National Oceanic and Atmospheric Administration (2021). *National Center for Environmental Information Storm Events Database,* 1950-June 30, 2021 [Data set]. https://www.ncdc.noaa.gov/stormevents/

5.2.3.1. Future Population and Development Trends

Future development and the resulting population increase have the potential to elevate drought vulnerability in the future; the degree of vulnerability depends on climate change variables and how well jurisdictions manage growth relevant to the water supply needs of the population and the agricultural and industrial sectors. The impacts and consequences of the 1998-99 drought can serve as a guide for future planning and regulatory actions based on appropriate development in the region's jurisdictions.

5.2.3.2. Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluating, and updating of this Plan should consider the following factors related to drought, as well as other information from the Virginia COV-SHMP:

- Have drought events occurred within the planning area since adoption of 2022 HMP?
- Did drought events take place in areas adjacent to the planning area that impacted the planning area by virtue of proximity?
- Has new scientific research or methodology changed the ability to predict drought events or assess risk and vulnerability?
- Has there been significant change in the population, built environment, natural environment, or economy that could affect the level of risk or vulnerability to drought, including land use for agricultural purposes and water infrastructure?
- Is there new evidence related to the impacts of drought that could affect the level of risk or vulnerability to drought?

5.3. Earthquake

2022 HMP Update

The earthquake hazard was reviewed, and a new analysis was performed that included but was not limited to the following:

- Reformatting the hazard section to improve flow and clarity.
- Refreshing the hazard profile
- Updating number of previous occurrences and associated losses by jurisdiction
- Updating data sources and imagery, where available.
- Updating risk assessment and vulnerability analysis, by jurisdiction.
- Reviewing and re-evaluating hazard ranking using methodology described in Section 4, Base Plan

Table 44: Earthquake Profile

<table>
<tr><th colspan="5">Earthquake</th><th rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="5">Definition, Key Terms, and Overview</th></tr>
<tr><td colspan="5">An earthquake is the motion or trembling of the ground produced by sudden displacement of rock in the earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or 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 or thousands, and disrupt the social and economic functioning of the affected area. Earthquakes are naturally occurring and are caused by earth movement.
Fault: A fracture or zone of fractures between two blocks of rock that allows blocks to move relative to each other. Rapidly occurring movement results in an earthquake incident.[70]
Magnitude: Earthquake intensity measured on logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude.
Seismic: Of or relating to earthquakes or other vibrations of the earth and its crust.
Tectonic plates: The earth’s outermost layer is broken into large rocky plates that lie on top of a partially molten layer of rock. These tectonic plates move relative to each other at different rates, from two to 15 centimeters (or one to six inches) per year. This movement is responsible for many phenomena, including earthquakes, volcanoes, and the development of mountain ranges.[71]</td><td rowspan="4">Medium</td></tr>
<tr><th>Frequency</th><th>Probability</th><th colspan="3">Potential Magnitude</th></tr>
<tr><td rowspan="2">Low</td><td rowspan="2">Occasional</td><th>Injuries/Deaths</th><th>Infrastructure</th><th>Environment</th></tr>
<tr><td>Low</td><td>Moderate</td><td>Moderate</td></tr>
</table>

[70] United States Geological Survey. (n.d.). *What is the relationship between faults and earthquakes? What happens to a fault when an earthquake occurs?* https://www.usgs.gov/faqs/what-relationship-between-faults-and-earthquakes-what-happens-a-fault-when-earthquake-occurs?qt-news_science_products=0#qt-news_science_products
[71] National Geographic Society. (n.d.). *Plate Tectonics*, https://www.nationalgeographic.org/encyclopedia/plate-tectonics

5.3.1. Hazard Profile

Earthquakes are primarily caused by the release of stresses accumulated as a result 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 borders generally follow the outlines of the continents, with the North American plate following the continental border with the Pacific Ocean in the west and the mid-Atlantic trench in the east. Earthquakes occurring in the mid-Atlantic trench usually pose little danger to humans. Although the greatest earthquake threat to North America lies along the Pacific Coast, there is some threat to the eastern United States from the Caribbean Plate.

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

Ground shaking can lead to the collapse of buildings and bridges and disrupt gas lines, electricity, and phone service. Death, injuries, and extensive infrastructure and property damage are possible with this hazard. Some secondary threats caused by earthquakes may include fire, hazardous material release, landslides, flash flooding, and dam failure.

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

Table 45: Hazard Profile Summary

Earthquake **Assessment: Medium Risk Hazard**	**Location**	Jurisdiction-wide	**Potential Cascading Effects** • Property damage to homes and businesses • Infrastructure damage and disruption of services • Water supply shortage. • Increased fire hazard from gas line ruptures • Economic harm from business loss or temporary closures • Death and injury • Damage to the environment and habitats
	Extent	Minimal to moderate	
	Duration	Minutes	
	Probability	Occasional	
	Seasonal Pattern	No seasonal pattern	
	Speed of Onset	Slow	
	Warning Time	Minor ground shaking may precede a stronger event	
	Repetitive Loss	N/A	

5.3.1.1. Location

The potential for earthquakes exists across all of Virginia; however, based on scientific and historical data, the Northern Virginia region is in an area that has a slightly lower risk of earthquakes than other areas of the Commonwealth, such as the southwest portion.

Virginia has three main seismic zones that relate to most earthquakes, none of which are in the Northern Virginia planning area. These zones are believed to be the sources of most magnitude 6 or greater earthquakes during the past 1.6 million years around Virginia, though there has never been an earthquake event of that magnitude recorded in Virginia in modern times.

Because of the geophysical nature of the hazard, the entire planning area is susceptible to impacts from a major earthquake.

5.3.1.2. Extent

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. Each unit increase in magnitude on the Richter Scale corresponds to a ten-fold increase in wave amplitude, or a thirty-two-fold increase in energy.

Intensity is 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 ranging from I, which corresponds to instrumental or imperceptible events, to XII, which represents catastrophic effects. Both the Richter and MMI scales are used by the National Weather Service (NWS) as measures of impact.

Table 46: Modified Mercalli Intensity (MMI) and Peak Ground Acceleration (PGA)[72]

MMI	PGA (%)	Perceived Shaking	Potential Damage
I	<0.17	Not Felt	None
II	0.17 - 1.4	Weak	None
III	0.17 - 1.4	Weak	None
IV	1.4 -3.9	Light	None
V	3.9 -9.2	Moderate	Very Light
VI	9.2 -18	Strong	Light
VII	18 -34	Very Strong	Moderate
VIII	34 - 65	Severe	Moderate to Heavy
IX	65 - 124	Violent	Heavy
X	> 124	Extreme	Very Heavy
XI	> 124	Extreme	Very Heavy
XII	> 124	Extreme	Very Heavy

[72] Wu, Y., Teng, T., Shin, T., & Hsiao, N.C. (2003). Relationship between Peak Ground Acceleration, Peak Ground Velocity, and Intensity in Taiwan. *Bulletin of the Seismological Society of America*. 93. 386-396. 10.1785/0120020097

Category	Effects	Richter Scale (approximate)
I. Instrumental	Not felt	1-2
II. Just perceptible	Felt by only a few people, especially on upper floors of tall buildings	3
III. Slight	Felt by people lying down, seated on a hard surface, or in the upper stories of tall buildings	3.5
IV. Perceptible	Felt indoors by many, by few outside; dishes and windows rattle	4
V. Rather Strong	Generally felt by everyone; sleeping people may be awakened	4.5
VI. Strong	Trees sway, chandeliers swing, bells ring, some damage from falling objects	5
VII. Very Strong	General alarm; walls and plaster crack	5.5
VIII. Destructive	Felt in moving vehicles; chimneys collapse; poorly constructed buildings seriously damaged	6
IX. Ruinous	Some houses collapse; pipes break	6.5
X. Disastrous	Obvious ground cracks; railroad tracks bent; some landslides on steep hillsides	7
XI. Very disastrous	Few buildings survive; bridges damaged or destroyed; all services interrupted (electrical, water, sewage, railroad); severe landslides	7.5
XII. Catastrophic	Total destruction; objects thrown into the air; river courses and topography altered	8

Figure 22: Comparison of the Modified Mercalli Intensity Scale and the Richter Magnitude Scale[73]

Most earthquake events in the planning area register at a magnitude lower than 3.0 and are not felt by people.

5.3.1.3. Previous Occurrences

The first recorded earthquake in Virginia occurred in 1774. Since 1900, there have been more than 541 earthquakes documented in the Commonwealth,[74] 18 at a magnitude of 4.5 or higher on the Richter Scale. The largest event before 2011 occurred in Giles County in 1897, with a magnitude of 5.8; however, the most recent major earthquake, on August 23, 2011, with an epicenter 11 kilometers south-southwest of Mineral, Virginia, was also measured at a magnitude of 5.8.

Most epicenter locations are clustered northwest of Richmond or in the southwestern region of the Commonwealth. Epicenters of seven earthquakes are noted to have occurred in or within proximity of the planning area:

- March 23, 1974: 2.5 magnitude, exact location not identified
- September 29, 1997: 2.5 magnitude, 3.7 miles south-southwest of the City of Manassas, Virginia
- May 6, 2008: 2.0 magnitude, Ravensworth, Virginia
- July 16, 2010: 3.6 magnitude, 3.1 miles north-northwest of Barnesville, Maryland

[73] Global Weather & Climate Center. (2020, March 25). *Geoscience Topics: Salt Lake Quake!* https://www.globalweatherclimatecenter.com/geoscience-topics/salt-lake-quake
[74] United States Geological Survey. (2019, June 26). *Information by Region-Virginia*. https://www.usgs.gov/programs/earthquake-hazards/science/information-region-virginia#overview

- August 23, 2011: 5.8 magnitude, near Mineral, Virginia
- June 13, 2013: 2.0 magnitude, 4.3 miles west-northwest of Calverton, Virginia
- January 17, 2016: 3.0 magnitude, 1.9 miles northeast of Ranson, West Virginia
- August 17, 2018: 1.3 magnitude, 1.2 miles east-northeast of Belmont, Virginia

There has been no documented epicenter within the planning area and none of the earthquakes documented with epicenters near the planning area have been major earthquakes. The August 17, 2018, event is the only one of note to occur since the previous plan.

Most earthquakes have resulted in very little property damage, if any, and there are no historical records of earthquake-related damages in the Northern Virginia region. Northern Virginia has not been included in any federal disaster declarations for earthquake, and only one earthquake event has been recorded by the NWS.

The United States Geological Survey (USGS) has also documented 62 significant earthquake events as having occurred within 300 miles of the Northern Virginia region, including some centered outside of Virginia. There are no reported casualties or significant property damages for the Northern Virginia region as a result of these events.

It is assumed that these events were experienced across the planning region, though it is possible that there were no specific reports of damages in localized geographic areas. The historic occurrences discussed here were initially included in the 2013 and 2018 Commonwealth of Virginia State Hazard Mitigation Plans and are retained here to maintain current awareness of the hazard history.

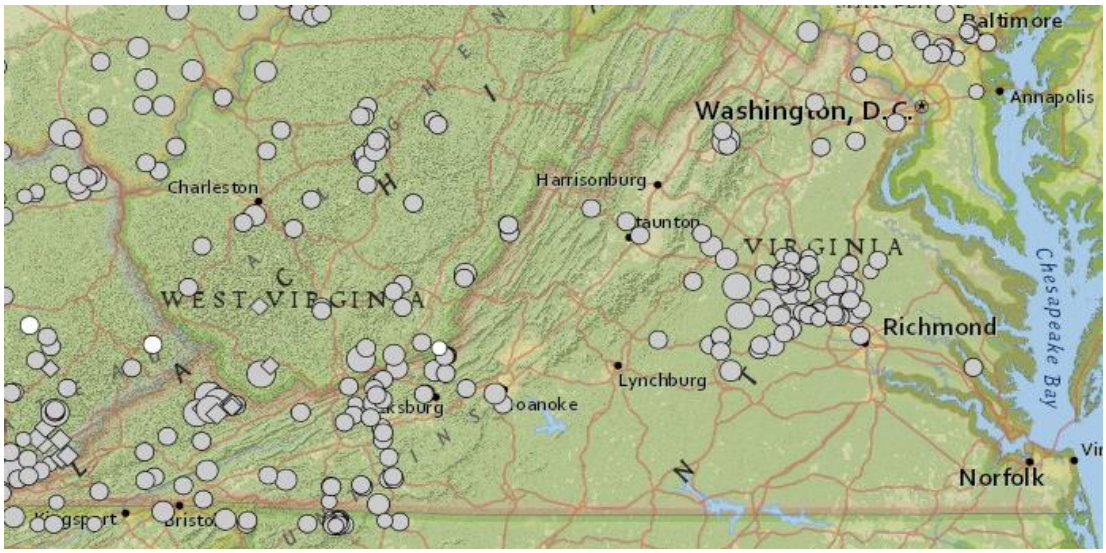


Figure 23: Epicenter Locations of Documented Earthquakes in Virginia, 1774–2016[75]

[75] United States Geological Survey. (2021). *Earthquake Hazards.* https://www.usgs.gov/programs/earthquake-hazards/earthquakes

Significant Earthquake Events

May 6, 2008

A minor earthquake of 2.0 magnitude occurred near Annandale, a census-designated place in Fairfax County. Felt reports were primarily received from people in Fairfax County, Washington, D.C., and Montgomery County, Maryland.

August 23, 2011

The most significant major earthquake causing any impact the planning area in recent years is the 5.8 magnitude event on August 23, 2011, which caused significant damage and was felt over thousands of square miles. The event was followed by major aftershocks for two days. The earthquake struck the Piedmont region of Virginia with an epicenter near the Town of Mineral in Louisa County, approximately 61 miles from the southern boundary of the planning area. The earthquake was felt in approximately 12 states and into Canada. No fatalities from the event were recorded, though some injuries were reported. Damage was widespread and estimated at hundreds of millions of dollars, much of which was uninsured. The earthquake caused the automatic shutdown of the North Anna Nuclear Power Station in Louisa County. It was one of the highest magnitude earthquakes to occur east of the Rocky Mountains and resulted in a multi-county federal disaster declaration, DR-4042-VA. No jurisdictions within the planning area were included in this declaration.

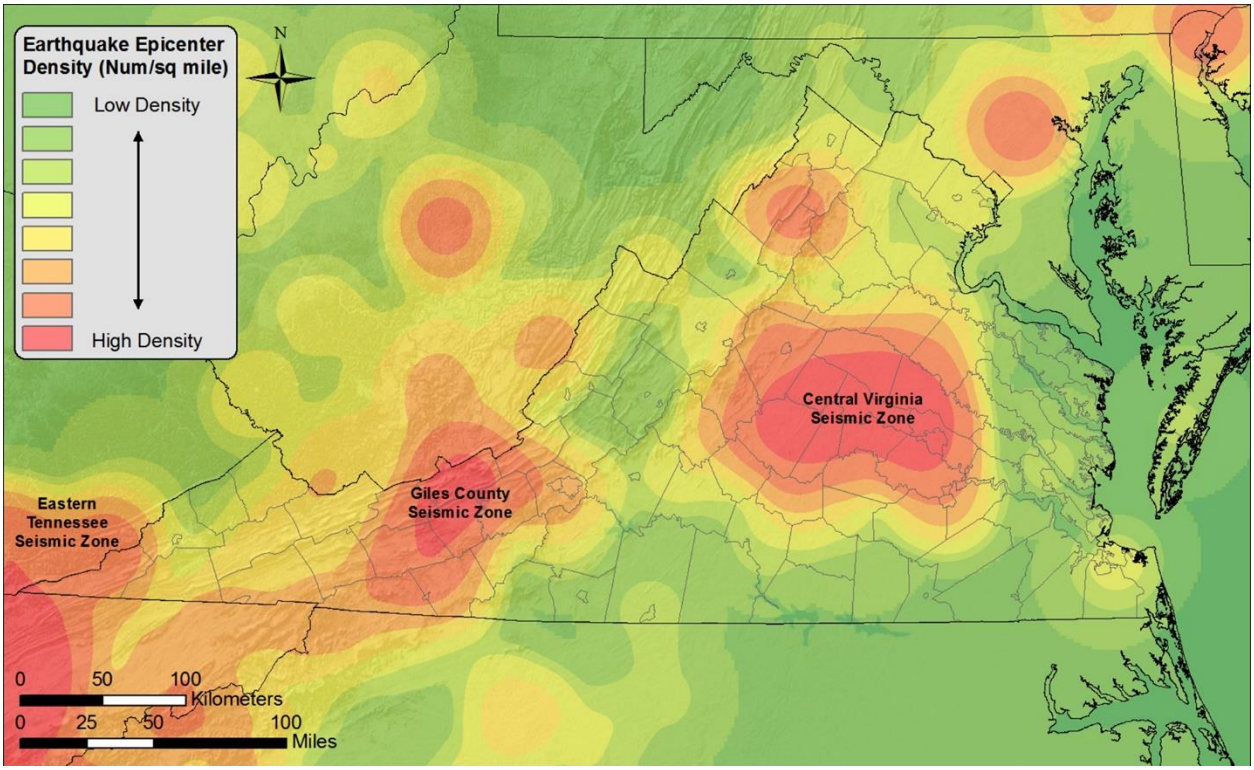


Figure 24: 2011 Virginia Earthquake Epicenter Density[76]

During the event, a pipe ruptured in the Pentagon in Arlington County, resulting in the flooding of at least two corridors. Damage was also reported at an Arlington County theater and several additional structures in Arlington County. The City of Manassas reported slight damage to city hall and the fire and rescue headquarters. In Prince William County, the earthquake caused damage to a dam and slight damage to several county facilities.

[76] UVAToday. (2015, July 1). *An Earthquake History: Finding Faults in Virginia*. https://news.virginia.edu/content/earthquake-history-finding-faults-virginia

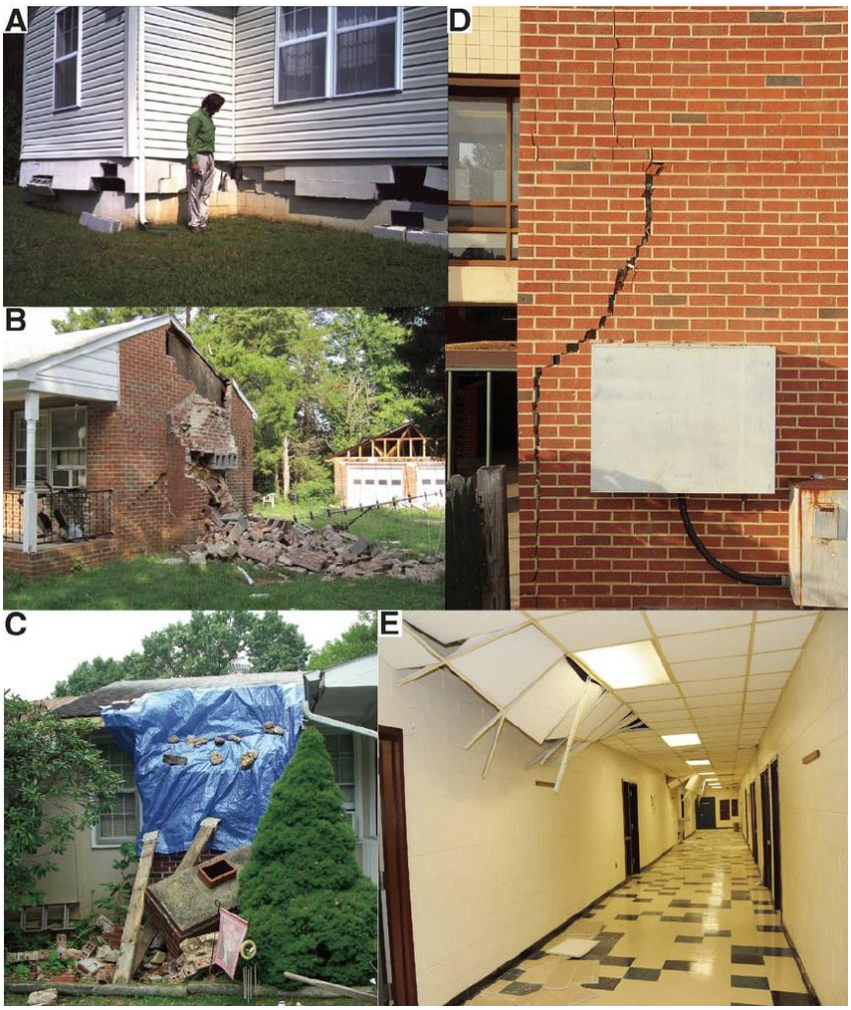


Figure 25: Examples of Structure Damage in Louisa County, Virginia After the 2011 Earthquake[77]

A familiar image from the August 2011 earthquake is damage to the Washington National Cathedral in Washington, D.C. The ground movement caused displacement of segments of the structure's stone spires. The Washington Monument was also damaged and closed for three years for repairs.

[77] Horton, J., Chapman, M. & Green, R. (2015). The 2011 Mineral, Virginia, earthquake, and its significance for seismic hazards in eastern North America—Overview and synthesis. 10.1130/2015.2509(01)

Figure 26: Earthquake Damage to Washington National Cathedral in Washington, D.C. After the 2011 Earthquake[78]

Table 47: August 23, 2011, Louisa County, Virginia Earthquake Report[79]

Date	August 23, 2011
Time	17:51
Location	Virginia (Louisa County), Maryland, Washington, D.C.
Latitude	37.936
Longitude	-77.933
Magnitude	5.8
Modified Mercalli Intensity (MMI)	7
Deaths	0
Injuries	0
Missing Persons	0
Damage	$200 Million
Damage Description Level	4

[78] United States Geological Survey. (2019, August 5). *M5.8 August 23, 2011, Mineral, Virginia*. https://www.usgs.gov/programs/earthquake-hazards/science/m58-august-23-2011-mineral-virginia#overview
[79] National Oceanic and Atmospheric Administration National Centers for Environmental Information. (2021, August 30). *Significant Earthquake Information*. https://www.ngdc.noaa.gov/hazel/view/hazards/earthquake/event-more-info/9861

Total Houses Destroyed	0
Total Houses Damaged	600
Total Houses Damaged Description Level	3

Incident Description:

- Moderately heavy damage (MMI VIII) occurred in rural Louisa County, southwest of Mineral. Widespread light to moderate damage occurred from central Virginia to southern Maryland including the District of Columbia area. Minor damage reported in parts of Delaware, southeastern Pennsylvania, and southern New Jersey. Very strongly felt (MMI VII) in the Virginia communities of Boston, Bumpass, Kents Store, Louisa, Mineral, Rhoadsville, and Sumerduck. Felt strongly in much of central Virginia and southern Maryland. Felt throughout the eastern United States from central Georgia to central Maine and west to Detroit, Michigan and Chicago, Illinois. Felt in many parts of southeastern Canada from Montreal to Windsor.

Tectonic Summary:

- This event occurred as reverse faulting on a north or northeast-striking plane within a previously recognized seismic zone, the Central Virginia Seismic Zone. The Central Virginia Seismic Zone has produced small and moderate earthquakes since at least the 18th century. The previous largest historical shock from the Central Virginia Seismic Zone occurred in 1875; effective seismographs had not yet been invented, but the felt area of the shock suggests that it had a magnitude of about 4.8. The 1875 earthquake shook bricks from chimneys, broke plaster and windows, and overturned furniture at several locations. A magnitude 4.5 earthquake on December 9, 2003, also produced minor damage.
- Although less frequent than in the western United States, earthquakes in the central and eastern United States are typically felt over a much broader region (see Figure 27). East of the Rockies, an earthquake can be felt over an area as much as ten times larger than a similar magnitude earthquake on the west coast. A magnitude 4.0 earthquake in the eastern United States can typically be felt as far as 62 miles from its source, and it infrequently causes damage near its source. A magnitude 5.5 earthquake in the eastern United States usually can be felt as far as 311 miles from its source and may cause damage as far away as 25 miles
- Estimated total economic losses from the 2011 earthquake were from $200 to $300 million, including major damage to the National Cathedral, Armed Forces Retirement Home, Washington Monument, and 600 houses. The shaking was felt by approximately one-third of the United States population and caused minor damage as far away as Charleston, South Carolina, 373 miles from the epicenter. The shaking caused the first ever shutdown of a United States commercial nuclear power plant at the North Anna nuclear power facility located about 14 miles northeast of the epicenter.
- Louisa County residential property damage was estimated at $18.3 million, and the total estimate of private property damage in the epicentral region was $21.4 million. [...] Damage to businesses, churches, and nonprofits in Louisa County was estimated at $1.5 million as of September 2011, and damage to public structures was estimated at $66.2 million, including $63.8 million to replace two schools.

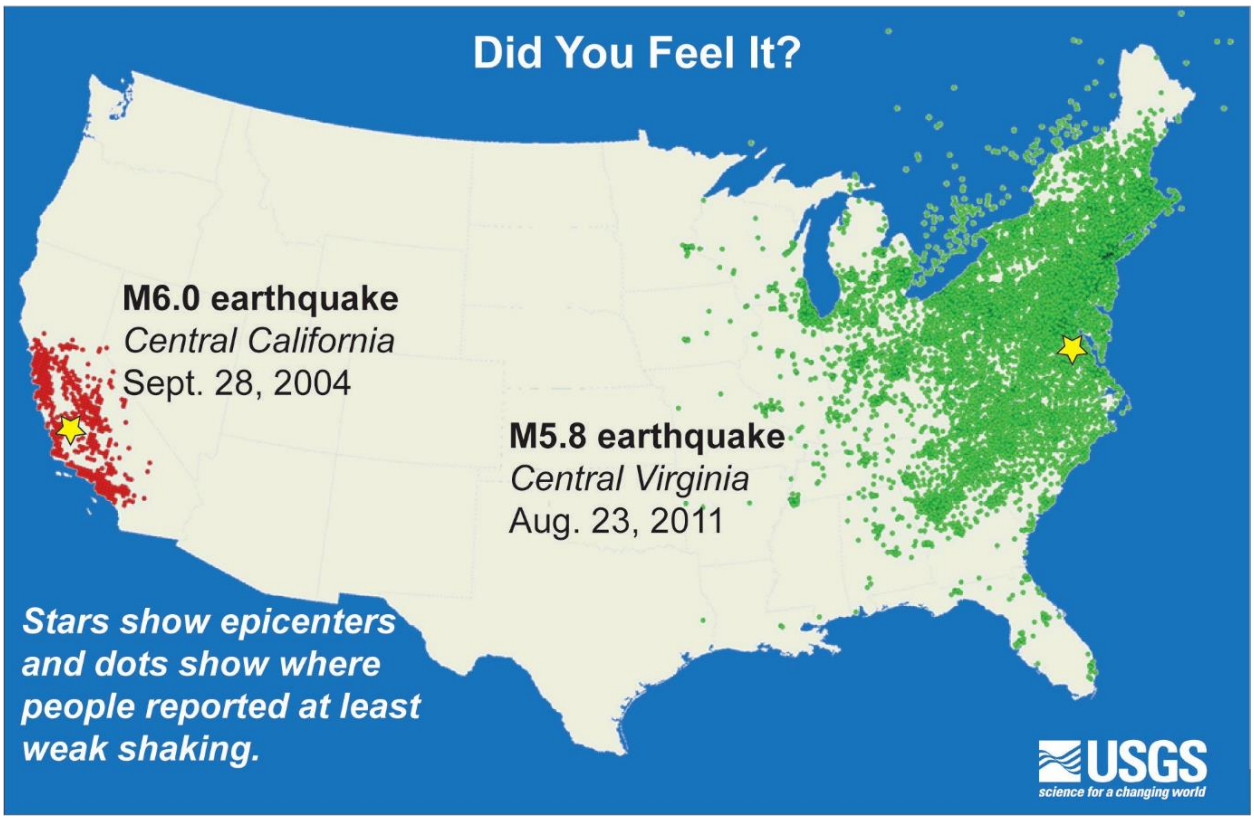


Figure 27: Comparison of Site Reports for West Coast and East Coast Earthquakes[80]

Due to the terrain, earthquakes east of the Rocky Mountains have a far wider geographic range in which people report feeling the shaking. A report released by the USGS on August 4, 2021, about this event included significant observations by Thomas Pratt, a USGS research geophysicist and expert on eastern earthquakes:

> *One of the fascinating things we discovered was heightened ground shaking in Washington, D.C., resulting in damage to buildings in the city at distances that would not ordinarily be expected.*
>
> *USGS scientists found that the strength of ground shaking from the Mineral earthquake was substantially greater to the northeast than in other directions. This direction is nearly parallel to the orientation of the Appalachian Mountains and the eastern edge of the continent, which shows the influence of large-scale features like mountain ranges on ground shaking.*
>
> *Subsequent research identified that the underlying sediment is what led to amplified shaking. We were familiar with that phenomenon on the West Coast of the United States and internationally, but the Mineral earthquake showed the significance of this effect in the eastern U.S. The areas on sediment received significantly stronger shaking than nearby locations on firmer rock.*

[80] United States Geological Survey reported in the Advancing Earth and Space Science Blogosphere. (2012, August 23). *The Rare 5.8 Virginia Earthquake: One Year Later*. https://blogs.agu.org/geospace/2012/08/23/the-rare-5-8-virginia-earthquake-one-year-later/

Knowing the amplification caused by these sediments and the direction of shaking will help emergency managers identify communities that may be more vulnerable to shaking. This knowledge will help the USGS refine its seismic hazard maps, which estimate the strength of ground shaking that can be expected during earthquakes in each area of the country.

These insights can also be used by emergency managers when planning for and responding to disasters; state and local governments as they refine building codes; and architects and engineers as they design and renovate buildings to mitigate the effects of future earthquakes. In addition, the science helps inform planning for major infrastructure investments such as dams and reservoirs.[81]

5.3.1.4. Probability of Future Occurrences

Given Northern Virginia's proximity to the Central Virginia Seismic Zone, it is expected that the planning area will experience earthquakes in the future occasionally. Based on past historic data that documented 541 events between 1900 and 2021, there is a recurrence interval of 0.235% in any given year.

Probabilistic ground motion maps are typically used to assess the magnitude and frequency of seismic events. These maps measure the probability of exceeding a certain ground motion, expressed as percent peak ground acceleration (%PGA), over a specified period of years. The severity of earthquakes is site-specific and is influenced by soil type and proximity to the earthquake epicenter, among other factors. The 2,500-year return period, or 0.04%-annual chance of occurrence, is much more varied than the 100-year return period.

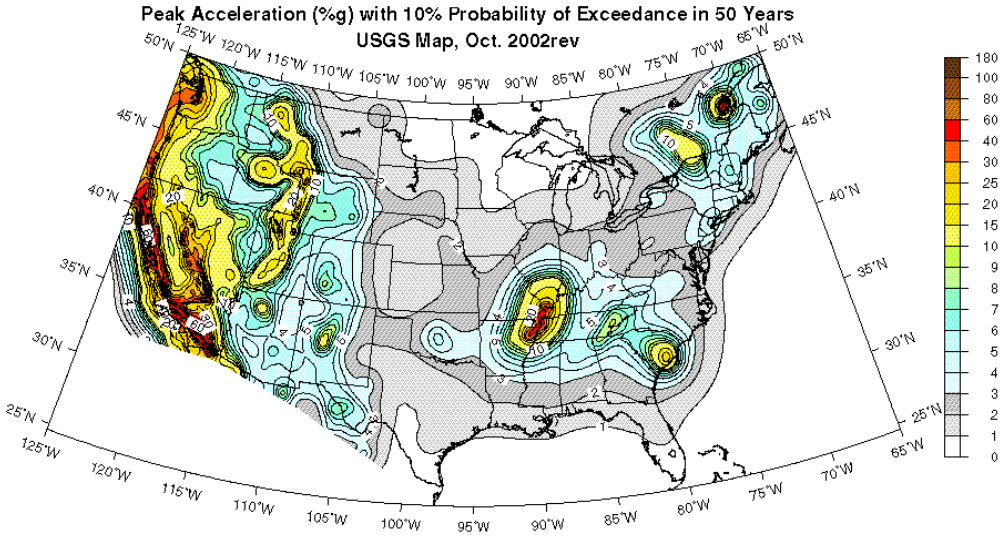


Figure 28: Peak Acceleration with 10% Probability of Exceedance in 50 Years[82]

[81] United States Geological Survey. (2021, August 4).*10-Year Anniversary of US's Most Widely Felt Earthquake*. https://www.usgs.gov/news/10-year-anniversary-us-s-most-widely-felt-earthquake?qt-news_science_products=7#qt-news_science_products.

[82] Matheu, E., Yule, D. & Kala, R. (2005). Determination of Standard Response Spectra and Effective Peak Ground Accelerations for Seismic Design and Evaluation

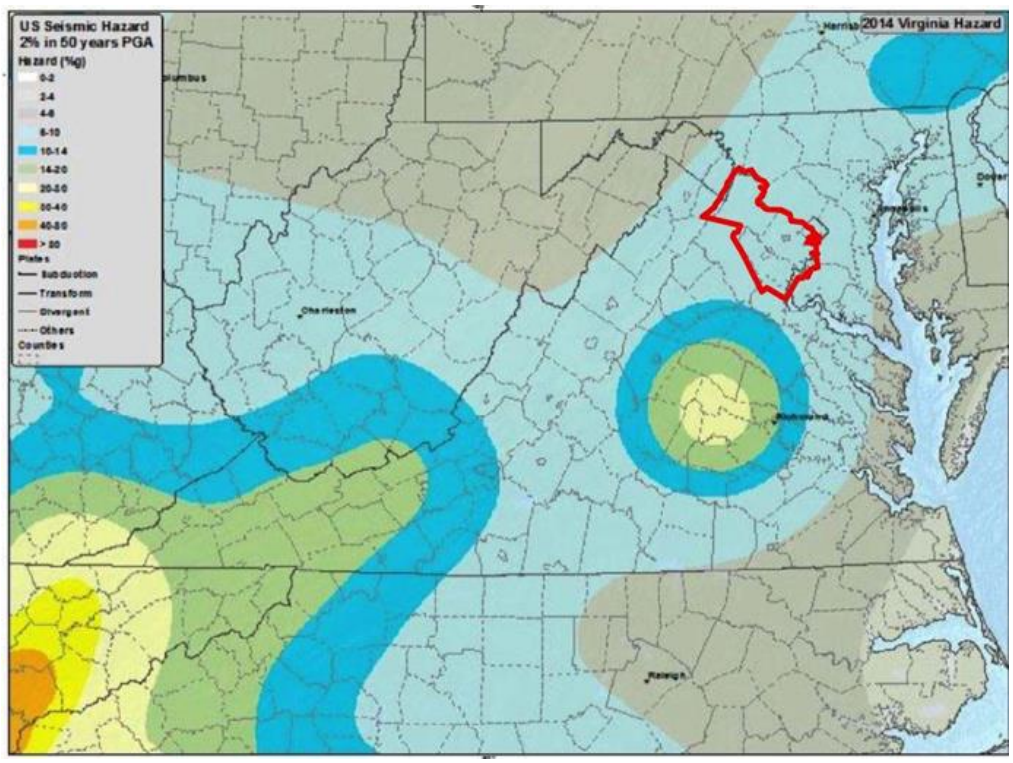


Figure 29: Peak Acceleration with 2% Probability of Exceedance in 50 Years[83]

5.3.2. Risk Assessment

Like other states on the eastern seaboard, the Commonwealth of Virginia is designated by the USGS as a moderate risk state for earthquake occurrence. Earthquake events can and occasionally do occur, though they are much less intense than those that occur along the west coast of the United States. The greatest seismic risk in Virginia is in the Eastern Tennessee Seismic Zone, located in the southwestern portions of the Commonwealth and far from the Northern Virginia region.

Earthquakes are low-probability, high-consequence events. While they may occur only once in the lifetime of an asset, they may have devastating impacts. A moderate earthquake can seriously damage unreinforced buildings, building contents, and non-structural systems and seriously disrupt building operations. Moderate and even very large earthquakes may occur, however infrequently, in areas of normally low seismic activity. Consequently, local construction is seldom designed to standards required to mitigate potential earthquake impacts. As such, buildings and infrastructure in the Northern Virginia region are particularly vulnerable to higher magnitude earthquakes.

5.3.2.1. Population

Although people residing or working in sub-standard structures may be more at risk than others in an earthquake, the random nature of the location and timing of these events makes it difficult to identify specific vulnerable populations. In general, preparedness messages highlighting appropriate life-safety measures in an earthquake are the most effective method of saving lives.

[83] United States Geological Survey. (2019, December 23). *2014 United States (Lower 48) Seismic Hazard Long-Term Model*. https://www.usgs.gov/programs/earthquake-hazards/science/2014-united-states-lower-48-seismic-hazard-long-term-model#multimedia

5.3.2.2. Built Environment and Community Lifelines

Earthquake impacts are mostly felt in the built environment, putting homes, businesses, and Community Lifeline infrastructure at the greatest risk. As the earth shakes, structures not built to withstand specific earth movement can “fracture” and, in extreme events, collapse. As the 5.8 earthquake in August 2011 demonstrated, even masonry structures such as the National Cathedral and Washington Monument were vulnerable to shifting motions. Enhanced building codes can require construction methods and materials to help withstand major earthquakes; however, in areas with a lower probability of this level of event it is considered to be too costly to require building to these standards.

5.3.2.3. Natural Environment

Although major earthquakes can shift the ground and cause changes in topography, it is unlikely that this would occur in Northern Virginia, based on historical information. Minor earthquakes could lead to minor fissures that disrupt the flow of rivers, creeks, or streams; however, this type of occurrence would be extremely rare.

5.3.2.4. Economy

The risk to the Northern Virginia economy from a major earthquake could be high if structures of major employers and government agencies are damaged. This could result in short- or long-term business and office closures, loss of wages, and loss of employment.

5.3.2.5. Hazard Risk Ranking Summary

The hazard ranking process considered probability and consequences in determining an overall risk score and ranking. Information presented within this section and the hazard risk ranking process present the quantitative and qualitative summary for earthquakes. The Hazard Identification and Risk Assessment methodology is described in **Section 4, Base Plan**.

Table 48: Hazard Risk Rankings for Earthquake, by Jurisdiction

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Arlington County	1.3	2.8	4.1	**Low**
City of Alexandria	1.7	3.2	4.9	**High-Medium**
City of Fairfax	1.7	3.2	4.9	**Medium**
City of Falls Church	1.7	3.2	4.9	**Medium**
City of Manassas	2.3	3.2	5.5	**Medium**
City of Manassas Park	2.3	3.2	5.5	**Medium**
Fairfax County	1.7	3.2	4.9	**Medium**
Town of Clifton	1.7	3.2	4.9	**Medium**
Town of Herndon	1.7	3.2	4.9	**Medium**
Town of Vienna	1.7	3.2	4.9	**Medium**
Loudoun County	1.7	3.2	4.9	**Medium**
Town of Leesburg	1.7	3.2	4.9	**Medium**
Town of Lovettsville	1.7	3.2	4.9	**Medium**

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Town of Middleburg	1.7	3.2	4.9	**Medium**
Town of Purcellville	1.7	3.2	4.9	**Medium**
Town of Round Hill	1.7	3.2	4.9	**Medium**
Prince William County	2.3	3.7	6.1	**Medium**
Town of Dumfries	2.3	3.2	5.5	**Medium**
Town of Haymarket	2.3	3.2	5.5	**Medium**
Town of Occoquan	2.0	4.7	6.7	**Medium**

5.3.3. Vulnerability Analysis

Although the recurrence interval for significant earthquake events in the Northern Virginia region is low, the potential impact of a major seismic event along the Eastern Tennessee or Central Virginia seismic zone could be moderately destructive. The Federal Emergency Management Agency's Hazus Program was used to determine potential impacts on the planning area from an earthquake.

5.3.3.1. Hazus Analysis

The FEMA Hazus Program was utilized to model a 2,500-year return event earthquake scenario for the planning area based on an event in Goochland County, Virginia, approximately 95 miles from the southern boundary of the planning area. This model evaluated the vulnerability related to damage to buildings and infrastructure according to ground shaking data from the USGS ShakeMap website.

Due to the region's overall low seismic risk, most infrastructure and buildings have not been designed to withstand major ground shaking events. Although these incidents may be few and far between, when they do occur, they may generate substantial losses. Hazus was used to update damage and loss estimates for the probabilistic ground motions associated with each of three return periods (scenarios for 100, 500, and 2,500 years). Building damage estimates were used as the basis for computing direct economic losses. Losses include building repair costs, contents and business inventory losses, costs of relocation, capital- and wage-related costs, and rental losses.

All Hazus reports, GIS-maps, and other information generated by the models are included in **Appendix B**.

Hazus-Generated Earthquake Model Reports in Appendix B

- Earthquake 100-year Global Summary Report
- Earthquake 500-year Global Summary Report
- Earthquake 1,000-year Global Summary Report
- Earthquake 2,500-year Global Summary Report
- Earthquake 2,500-year Advanced Engineering Building Model (ABEM) Report
- Earthquake 2,500-year Building Stock Exposure by General Occupancy
- Earthquake 2,500-year Direct Economic Losses for Buildings
- Earthquake 2,500-year Direct Economic Losses for Transportation
- Earthquake 2,500-year Direct Economic Losses for Utilities
- Earthquake 2,500-year Quick Assessment Report: 2:00 a.m.
- Earthquake 2,500-year Quick Assessment Report: 2:00 p.m.
- Earthquake 2,500-year Quick Assessment Report: 5:00 p.m.

- Earthquake 2,500-year Transportation System Dollar Exposure
- Earthquake 2,500-year Utility System Dollar Exposure

Hazus may be used to evaluate a variety of hazards and associated risks to support hazard mitigation. The current scenarios utilized a Level 1 analysis for the earthquake module, meaning the scenarios are based on hazard and inventory data included with the program and do not include additional, locally collected data. This is an acceptable level of information for mitigation planning. A future version of this Plan could be enhanced with Level 2 or 3 analyses, which would include local data and detailed engineering data, respectively.

The estimates of social and economic impacts contained in this report were produced using Hazus loss-estimation methodology software based on current scientific and engineering information. There are uncertainties inherent in any loss-estimation technique. As such, there may be differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. Results may be improved by adding community-based information about local assets to enhance the program inventory, dataset inventory, geotechnical information, and observed ground motion data.

Building stock data includes structural and nonstructural damage to buildings, contents, inventory, and business interruption costs. Utility infrastructure includes damages to facilities and pipelines. Transportation infrastructure accounts for road segments, bridges, tunnels, and facilities.

Data from the Hazus region-wide 2,500-year probabilistic scenario shows the Northern Virginia planning area can expect over $4.1 billion in damage to buildings, transportation, and utility systems from such an event. The scenario modeled a 6.5 magnitude earthquake centered near the same location as the actual 2011 Louisa County earthquake at a depth of approximately 33 feet; this is the same scenario used in the 2017 Plan. This scenario was maintained for assessment continuity.

Table 49: Estimated Direct Economic Losses from Probabilistic 2,500-Year Earthquake Return Interval[84]

Jurisdiction*	Building Losses	Transportation Infrastructure	Utility Infrastructure	Total
Arlington County	$359,916,000	$15,331,000	$5,748,000	$347,551,000
City of Alexandria	$284,828,000	$6,294,000	$5,377,000	$281,238,000
City of Fairfax	$67,670,000	$127,000	$88,000	$63,745,000
City of Falls Church	$28,828,000	$1,000	$35,000	$274,243,000
City of Manassas	$76,980,000	$353,000	$4,332,000	$80,787,000
City of Manassas Park	$20,833,000	$139,000	$28,000	$20,592,000
Fairfax County	$1,929,731,000	$27,003,000	$25,228,000	$1,828,219,000
Loudoun County	$441,720,000	$4,977,000	$30,872,000	$440,526,000
Prince William County	$724,815,000	$10,717,000	$36,923,000	$699,632,000
Totals	**$3,935,168,000**	**$64,941,000**	**$108,632,000**	**$3,935,167,000**

*Town information is included in county totals.

[84] Hazus, Earthquake 2500-year Direct Economic Losses for Buildings, Transportation and Utilities, August 17, 2021

Table 50: Estimated Dollar Exposure of Transportation and Utility Assets from Probabilistic 2,500-Year Return Interval Earthquake[85]

Jurisdiction*	Transportation Exposure	Utilities Exposure	Total
Arlington County	$1,908,225,000	$802,793,000	$3,092,013,000
City of Alexandria	$1,583,341,000	$685,247,000	$2,565,087,000
City of Fairfax	$189,675,000	$9,317,000	$266,877,000
City of Falls Church	$39,809,000	$3,935,000	$72,454,000
City of Manassas	$227,906,000	$319,296,000	$628,867,000
City of Manassas Park	$16,590,000	$319,296,000	$356,886,000
Fairfax County	$8,293,279,000	$2,325,526,000	$12,600,767,000
Loudoun County	$2,411,988,000	$5,018,429,000	$7,907,986,000
Prince William County	$288,081,000	$2,145,060,000	$3,205,596,000
Totals	**$14,958,894,000**	**$11,628,899,000**	**$30,696,533,000**

*Town information is included in county totals.

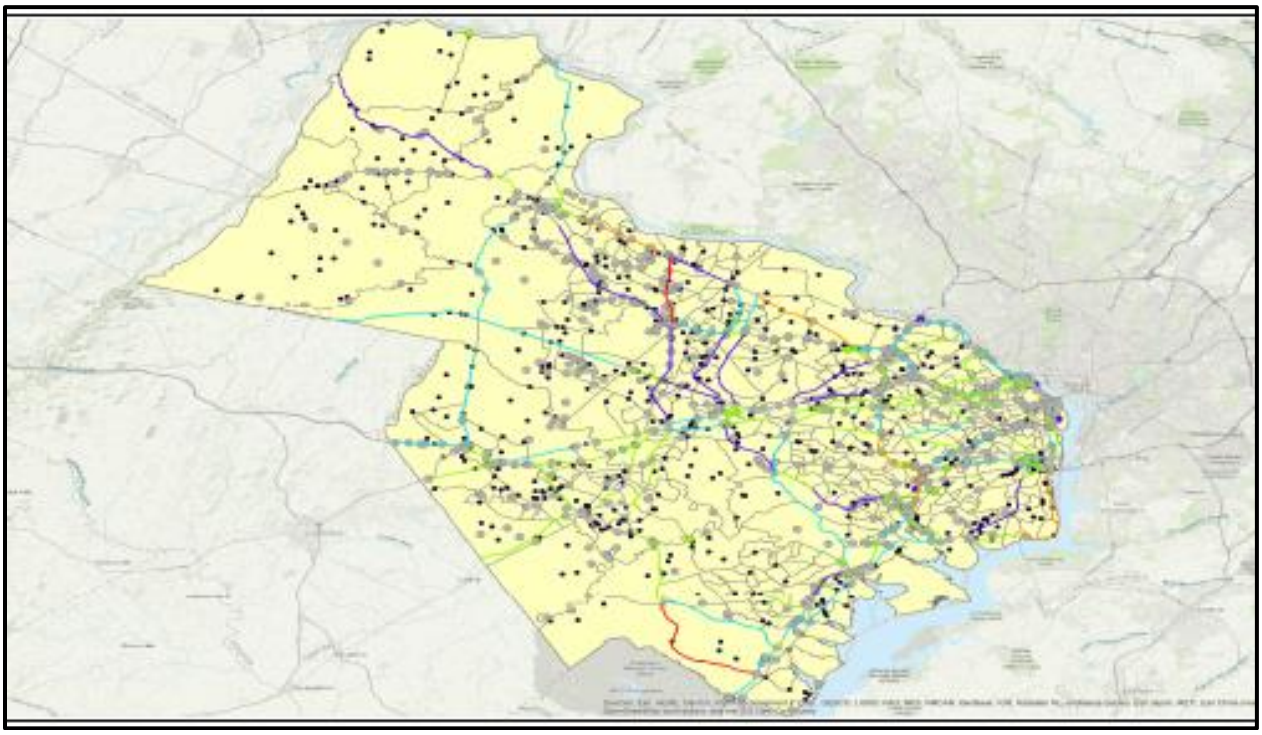


Figure 30: Potential Transportation Lifeline Damage Locations[86]

[85] Hazus Earthquake 2500-year Transportation System Dollar Exposure and Utility System Dollar Exposure, August 3, 2021.
[86] Federal Emergency Management Agency (2021, August 3). *Hazus Earthquake 2,500-year Global Risk Report, Earthquake Scenario: NOVA 2,500 Year 6.5 Magnitude*

5.3.3.2. Community Lifelines and Critical Facility Risk

There are 11 hospitals, not including Ft. Belvoir in the region, with a total bed capacity of 2,890 beds. Based on the 2,500-year scenario, 24% would be unavailable, while 76% would be undamaged on the day of the earthquake. These beds would be available for use by both patients already hospitalized and for those injured during the earthquake. After one week, 89% of the beds would be back in service. Thirty days after the event, 98% of beds would be operational.

The Hazus scenario estimates that most essential facilities would maintain functionality of greater than 50% on the day of the earthquake.

Table 51: Damages to Essential Facilities from Probabilistic Earthquake Scenario, 2,500-Year Return Interval[87]

Type of Facility	Total	Number of Facilities		
		At Least Moderate Damage (> 50%)	Complete Damage (> 50%)	With Functionality (> 50% on day 1)
Hospitals	19	0	0	19
Schools	846	0	0	846
Emergency Operations Centers	14	0	0	14
Police Stations	46	0	0	46
Fire Stations	110	0	0	110

5.3.3.3. Sheltering Needs

The Hazus earthquake model estimates 2,436 households to be displaced in this scenario. Of a total planning area population of 2,230,623 people, 1,283 people would seek temporary shelter.

5.3.3.4. Debris Generation

For the 2,500-year scenario, Hazus estimates the region would need to pick up a total of 1.21 million tons of brick, wood, concrete, and steel debris after the event. Of that amount, 84% would be brick and wood debris, with the remainder composed of reinforced concrete and steel. Assuming that debris is hauled from disaster sites in trucks with an estimated capacity of 25 tons each, debris cleanup will require 48,520 truckloads to remove the debris generated.

5.3.3.5. Existing Buildings and Infrastructure Risk

There are an estimated 663,000 buildings in the region with an aggregate total building replacement value, excluding contents, of $341.5 billion. Most buildings in the region are used for residential housing. Wood frame construction makes up 70% of the building inventory.[88]

Based on the Hazus scenario, roughly 22,807 buildings would experience moderate damage. Approximately 554 buildings would be damaged beyond repair.

[87] Ibid.
[88] Federal Emergency Management Agency (2021, August 3). *Hazus Earthquake 2,500-year Global Risk Report, Earthquake Scenario: NOVA 2,500 Year 6.5 Magnitude*

Table 52: Expected Building Damage by Occupancy, 2,500-Year Earthquake Scenario, None to Moderate, with Totals[89]

Occupancy Type	None		Slight		Moderate	
	Count	%	Count	%	Count	%
Agriculture	1,311.38	0.23	218.96	0.34	99.32	0.44
Commercial	26,687.93	4.67	4,501.83	6.97	2,523	11.06
Education	1,458.55	0.26	236.71	0.37	134.07	0.59
Government	918.41	0.16	154.48	0.24	93.31	0.41
Industrial	6,280.76	1.1	1,072.40	1.66	663.08	2.91
Other Residential	21,475.78	3.76	2,923.84	4.53	1,481.63	6.50
Religious	2,921.86	0.51	395.14	0.61	202.87	0.89
Single Family	510,550.99	89.32	55,059.17	85.28	17,609.54	77.21
Subtotals	**571,604.00**	**-**	**64,562.53**	**-**	**22,807.00**	**-**

Table 53: Expected Building Damage by Occupancy, 2,500-Year Earthquake Scenario, Extensive to Complete, with Totals[90]

Occupancy Type	Extensive		Complete		Totals
	Count	%	Count	%	Count
Agriculture	18.76	0.45	1.58	0.29	1,650
Commercial	463.93	11.16	50.89	9.19	34,229
Education	21.74	0.52	2.94	0.53	1,854
Government	14.98	0.36	1.82	0.33	1,182
Industrial	116.29	2.8	12.47	2.25	8,144
Other Residential	200.54	4.82	18.21	3.29	26,100
Religious	40.99	0.99	5.14	0.93	3,564
Single Family	3,280.70	78.90	460.6	83.19	586,961
Subtotals	**4,158.00**	**-**	**554**	**-**	**-**

[89] Federal Emergency Management Agency (2021, August 3). *Hazus Earthquake 2,500-year Global Risk Report, Earthquake Scenario: NOVA 2,500 Year 6.5 Magnitude*
[90] Ibid.

Table 54: Building Loss for 2,500-Year Earthquake Scenario, Type of Loss by Jurisdiction[91]

Jurisdiction	Structural	Non-structural	Contents	Inventory	Relocation	Income	Wage	Rental	Total
Arlington County	$62,754,000	$169,182,000	$44,190,000	$356,000	$35,324,000	$12,406,000	$20,934,000	$3,823,000	**$359,916,000**
City of Alexandria	$47,783,000	$130,317,000	$36,433,000	$338,000	$30,639,000	$10,563,000	$13,006,000	$15,750,000	**$284,828,000**
City of Fairfax	$11,447,000	$27,132,000	$8,353,000	$164,000	$6,946,000	$4,360,000	$5,345,000	$3,922,000	**$67,670,000**
City of Falls Church	$5,086,000	$12,268,000	$3,504,000	$52,000	$2,983,000	$1,457,000	$1,779,000	$1,547,000	**$28,674,000**
City of Manassas	$13.203,000	$33,433,000	$10,680,000	$254,000	$8,353,000	$3,018,000	$4,330,000	$3,709,000	**$76,990,000**
City of Manassas Park	$3,859,000	$9,735,000	$2,813,000	$78,000	$2,206,000	$566,000	$674,000	$902,000	**$20,833,000**
Fairfax County *Town of Clifton* *Town of Herndon* *Town of Vienna*	$464,386,000	$911,319,000	$244,752,000	$2,696,000	$190,822,000	$58,883,000	$67,801,000	$89,073.000	**$1,929,731,000**
Loudoun County *Town of Leesburg* *Town of Lovettsville* *Town of Middleburg* *Town of Purcellville* *Town of Round Hill*	$88,082,000	$210,687,000	$53,764,000	$814,000	$46,074,000	$10,578,000	$12,637,000	$19,084,000	**$441,720,000**
Prince William County *Town of Dumfries* *Town of Haymarket* *Town of Occoquan* *Town of Quantico*	$135,663,000	$354,828,000	$100,005,000	$1,164,000	$69,771,000	$16,023.000	$18,932,000	$28,427,000	**$724,815,000**
Totals	**$732,263,000**	**$1,858,900,000**	**$504,494,000**	**$5,916,000**	**$393,119,000**	**$117,853,000**	**$139,274,000**	**$183,349,000**	**$3,935,168,000**

[91] Federal Emergency Management Agency (2021, August 3). *Hazus Earthquake 2,500-year Global Risk Report, Earthquake Scenario: NOVA 2,500 Year 6.5 Magnitude*

The National Oceanic and Atmospheric Administration National Centers for Environmental Information does not monitor earthquake hazard events, so information from this source is not available to calculate annualized loss estimates.

In addition, a qualitative assessment was performed by planning participants. Given the widespread nature of the hazard it was determined that all counties, cities, and towns have the same qualitative risk associated with the hazard.

The geographic extent ranking category used the PGA values for the 2,500-return period. This return period represents a 0.04% annual chance of occurrence in any given year. The Northern Virginia planning region was ranked as being of "moderate" risk of the earthquake hazard. Parameters that did not have recorded events in the NCDC database were given the lowest default score.

5.3.3.6. Potential Impacts of Climate Change

Scientific and governmental organizations continue to research climate change to learn how it can potentially affect the frequency and intensity of natural hazards. To date, USGS has identified only one correlation between the weather and earthquake induction:

> *Large changes in atmospheric pressure caused by major storms like hurricanes have been shown to occasionally trigger what are known as "slow earthquakes," which release energy over comparatively long periods of time and do not result in ground shaking like traditional earthquakes do. While such large low-pressure changes could potentially be a contributor to triggering a damaging earthquake, the numbers are small and are not statistically significant.*[92]

5.3.3.7. Opportunities for Mitigation

Data Collection and Incorporation

In its 2018 Hazard Mitigation Plan, the Commonwealth of Virginia included an action item to develop a more complete database of critical facilities, an enhanced Commonwealth facility database, and an energy-gathering pipeline facility database. The Virginia Department of Emergency Management (VDEM) also discussed the possibility of standardizing the definition of a critical facility for local plan revisions and advising communities on essential assets to be collected for this project, providing a template for future local plans to follow. Such data would enable Hazus users to incorporate more local data into the risk modeling process and more accurately pinpoint structures likely to be affected with an extent identified by a given return period. At present, Hazus runs are conducted using a fixed database that may not include all buildings and critical facilities, especially for fast-growing areas such as Northern Virginia.

Updating Building Codes

Emergency managers and seismologists agree there is no more important factor in reducing a community's risk from an earthquake than the adoption and enforcement of up-to-date building codes. Evaluating older buildings and retrofitting structural and nonstructural components are also critical steps. To survive and remain resilient, communities could also strengthen core infrastructure and critical facilities so that they can withstand an earthquake or other disaster and continue to provide essential services.

[92] Buis, A. (2019, October 29). *Can Climate Affect Earthquakes, Or Are the Connections Shaky?* National Aeronautics and Space Agency Global Climate Change. https://climate.nasa.gov/news/2926/can-climate-affect-earthquakes-or-are-the-connections-shaky/

Professionals in the disaster response and recovery field have been known to say, “earthquakes don't kill people, buildings do.”[93] They are referring to the fact that while it is not possible to control seismic occurrences, communities have the ability to adopt and enforce the latest building codes maintained by the International Code Council (ICC), whose codes include the following:

- **International Building Code (IBC), which** applies to almost all types of new buildings.
- **International Residential Code (IRC), which a**pplies to new one- and two-family dwellings and townhouses of not more than three stories in height.
- **International Existing Building Code (IEBC), which a**pplies to the alteration, repair, addition, or change in occupancy of existing structures.

The ICC publishes new editions of the International Codes every three years, and many states and localities have adopted them since the first editions were issued in 2000.

Some provisions within the IBC, IRC, and IEBC are intended to ensure that structures can resist seismic forces during earthquakes. These seismic provisions represent the best available guidance on how structures should be designed and constructed to limit seismic risk. Changes or additions to seismic provisions come from an array of sources, including new research results and documentation of performance in past earthquakes.

Stronger building codes may also lessen the impact of other hazards, such as severe storms, tornadoes, and floods.

National Earthquake Hazards Reduction Program

The National Earthquake Hazards Reduction Program (NEHRP) spearheads federal efforts to reduce the fatalities, injuries, and property losses caused by earthquakes. It was established by Congress in 1977 and directs four federal agencies to coordinate their complementary activities to implement and maintain the program: FEMA, the National Institute of Standards and Technology (NIST); the National Science Foundation (NSF); and the USGS. NEHRP also partners with state and local governments, universities, research centers, professional societies, trade associations, and businesses to mitigate earthquake risks.[94]

NEHRP funding is available to support the seismic mitigation planning components of the local hazard mitigation process. Funding may also be used to promote education and community awareness about seismic hazards, including education about earthquake insurance for high-risk areas.

5.3.3.8. Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluating, and updating of this Plan should consider the following factors related to earthquakes, as well as other information from the Virginia COV-SHMP:

- Since the adoption of the 2022 NOVA HMP, has the region experienced an earthquake or small tremors? Were these centered in the planning region or close enough to be felt within the planning area?
- Has any new scientific research or methodology changed the ability to predict earthquake events or assess risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment, or economy that could affect the risk or vulnerability to earthquakes?

[93] Federal Emergency Management Agency. (2021, July 1). *Seismic Codes*. https://www.fema.gov/emergency-managers/risk-management/earthquake/seismic-building-codes
[94] National Earthquake Hazards Reduction Program. (2021, January 21). *Background and History*. https://www.nehrp.gov/index.htm

- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to earthquakes?
- Has the Virginia Tech Seismological Laboratory, the Commonwealth's center of earthquake science, released new findings or updates about earthquakes within Virginia boundaries or in adjacent states?

5.4. Extreme Temperatures

2022 HMP Update

The extreme temperature hazard was reexamined, and a new analysis was performed that included but was not limited to the following:

- Reformatting the hazard section to improve flow and clarity
- Refreshing the hazard profile with updated data, maps, and imagery where available
- Updating the assessment of risk and vulnerability by jurisdiction based on new data
- Ranking the hazard by jurisdiction using the methodology described in detail in Section 4

Extreme heat and drought are often interrelated hazards; however, they can and do occur independently of each other. The 2010 Plan update consolidated their analysis into one section; however, the 2016 Plan update treated them as separate hazards, an approach that is continued in this 2022 update. Extreme Cold and Winter Weather are also often interrelated hazards but can occur independently and are addressed as separate hazards in this update.

Table 55: Extreme Temperatures Profile

<table>
<tr><th colspan="5">Extreme Temperatures</th><th>Overall Vulnerability</th></tr>
<tr><th colspan="5">Definition, Key Terms, and Overview</th><td rowspan="5">Medium</td></tr>
<tr><td colspan="5">Extreme heat: Temperatures that hover 10 degrees Fahrenheit (°F) or more above the average high temperature for the region and last for several weeks.

Extreme cold: The definition of extreme cold varies in different parts of the country; however, temperatures at or below 0°F for an extended period are usually defined as extreme cold in the Northern Virginia region. Extreme cold events are usually part of winter storms but can occur at any time of the year.</td></tr>
<tr><th>Frequency</th><th>Probability</th><th colspan="3">Potential Magnitude</th></tr>
<tr><td rowspan="2">Low</td><td rowspan="2">Likely</td><th>Injuries/Deaths</th><th>Infrastructure</th><th>Environment</th></tr>
<tr><td>Low</td><td>Low</td><td>Low</td></tr>
</table>

5.4.1. Hazard Profile

Temperature extremes can result from heat waves, unseasonably cold weather, and winter storms. Other natural hazards such as floods and severe storms occur more frequently in the Northern Virginia region and serve to overshadow extreme temperature when considering hazard mitigation planning; however, the effects of extreme temperatures, especially on the population, can be devastating.

5.4.1.1. Extreme Heat

Atmospheric variables can affect the impacts of extreme heat. Humid conditions exacerbate human discomfort with high temperatures and can increase the adverse effects of prolonged exposure to extreme heat. Heat-related illnesses like heat exhaustion or heat stroke happen when the body is not able to cool itself. While the body normally cools itself by sweating, during extreme heat, this might be insufficient. In these cases, a person's body temperature rises faster than it can cool itself, which can cause damage to the brain and other vital organs.

Additionally, extended periods of hot weather in combination with lack of rainfall and dry conditions can lead to drought and resulting impacts to crops and livestock, and indirectly, to the economy.

Heat is one of the leading weather-related killers in the United States, despite the ability to prevent or reduce the risk of heat exhaustion and heat stroke through outreach and intervention.[95]

The relationship between heat and humidity is best explained through the Heat Index chart, developed by the National Weather Service (NWS) as a means of portraying how the combined threat of heat and humidity impacts people. Humid conditions can make it seem hotter than it actually is.[96]

5.4.1.2. Extreme Cold

What is considered an excessively cold temperature varies according to the normal climate for the region. Whenever temperatures drop decidedly below normal and wind speed increases, heat leaves the human body more rapidly, increasing the possibility of negative effects of these extreme cold temperatures.

Wind chill can multiply the impacts of extremely cold temperatures, especially to people. Wind chill describes the rate of heat loss on the human body resulting from the combined effect of low temperature and wind. As winds increase, heat is carried away from the body at a faster rate, driving down the skin temperature and eventually the internal body temperature.

Every winter, extremely cold arctic air joining together with brisk winds leads to dangerously cold wind-chill values. People exposed to extreme cold are susceptible to frostbite in a matter of minutes. Areas most prone to frostbite are uncovered skin and the extremities, such as hands and feet. Hypothermia is another threat during extreme cold, occurring when the body loses heat faster than it can generate heat. Cold weather can also affect crops, especially in late spring or early fall, when cold air outbreaks can damage or kill produce, as well as residential plants and flowers. A freeze occurs when the temperature drops below 32°F. Freezes and their effects are significant during the growing season, as plant species have different tolerances to cold temperatures.

Table 56: Hazard Profile Summary

Extreme Temperature **Assessment: Medium Risk Hazard**	**Location**	Jurisdiction-wide	**Potential Cascading Effects**
	Extent	Low to moderate	• Public health impacts, especially to medically vulnerable populations • Crop loss • Economic loss
	Duration	Hours to days	
	Probability	Likely	

[95] United States Environmental Protection Agency. (March 2016). *Excessive Heat Events Guidebook*. https://www.epa.gov/heatislands/excessive-heat-events-guidebook
[96] National Weather Service. (n.d.) *What is the Heat Index?* https://www.weather.gov/ama/heatindex

	Seasonal Pattern	Related to seasonal weather patterns Extreme heat may coincide with drought periods and extreme cold may be exacerbated by wind.	
	Speed of Onset	Moderate to fast	
	Warning Time	Hours to days	
	Repetitive Loss	N/A	

5.4.1.3. Location

Extreme temperature is not a hazard with a defined geographic boundary. All jurisdictions within the Northern Virginia planning area are susceptible to the effects of extreme heat and extreme cold. Higher elevations away from coastal areas tend to be a few degrees cooler, on average, than lower elevations.

5.4.1.4. Extent

One of the highest temperatures on record in the planning area was 105°F, recorded on August 17, 1997, at Ronald Reagan Washington National Airport in Arlington County. On average, the warmest temperatures in the region occur in July and the coldest occur in January.

Extreme Heat

The NWS issues a range of watches and warnings associated with extreme heat:[97]

- **Excessive Heat Outlook–Be Aware!** The potential exists for an excessive heat event in the next three to seven days. An outlook is used to provide information to those who need considerable lead time to prepare for the event, such as public utilities, emergency management, and public health officials.
- **Excessive Heat Watch–Be Prepared!** Conditions are favorable for an excessive heat event in the next 24 to 72 hours. A watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain. It is intended to provide enough lead time so those who need to set preparation plans in motion can do so, such as established local excessive heat event plans.
- **Excessive Heat Warning–Take Action!** Issued within 12 hours of the onset of extremely dangerous heat conditions. The warning is used when the maximum heat index temperature is expected to be 105°F or higher for at least two days and nighttime air temperatures will not drop below 75°F; however, the criteria vary across the country, especially for areas not used to extreme heat conditions that could lead to serious illness or death.
- **Heat Advisory–Take Action!** Issued within 12 hours of the onset of extremely dangerous heat conditions when the maximum heat index temperature is expected to be 100°F or higher for at least two days and nighttime air temperatures will not drop below 75°F; however, the criteria vary across the country, especially for areas that are not used to dangerous heat conditions that could lead to serious illness or death.

[97] National Weather Service. (n.d.). Heat Watch vs. Warning. https://www.weather.gov/safety/heat-ww

Extreme heat can be measured with the Heat Index (HI) chart, developed by the NWS. The HI is sometimes referred to as the "apparent temperature." The HI, given in degrees Fahrenheit, is a measure of how hot it truly feels when relative humidity (RH) is added to the actual air temperature.

To find the HI, the NWS calculates the apparent temperature. For example, if the air temperature is 96°F and the RH is 65%, the HI—or how hot it actually feels—is 121°F. Since HI values were devised for shady, light wind conditions, exposure to full sunshine can increase HI values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous. This corresponds to a level of HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

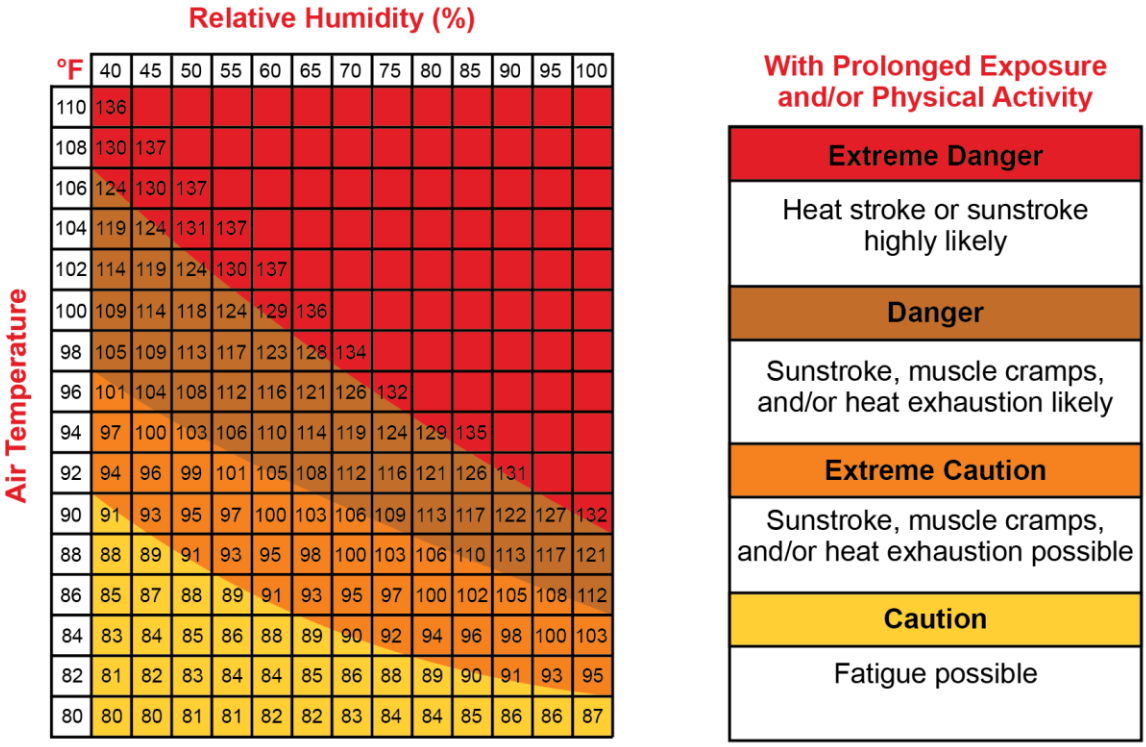


Figure 31: Heat Index and Relative Humidity, Effects on People[98]

Extreme Cold

Extremes of cold temperature have reached below 0°F F. Combined with wind chill, the temperature has reached as low as -10°F in higher elevations of the planning area.

The NWS issues a range of watches and warnings associated with extreme cold, including notices about wind chill, freezes, and frost:[99]

- **Wind Chill Warning–Take Action!** Issued when dangerously cold wind chill values are expected or occurring. Those in an area with a wind chill warning should avoid going outside during the coldest parts of the day. If those in the area do have to go outside, they should dress in layers, cover exposed skin, and make sure at least one other person knows their whereabouts.

[98] National Weather Service. (n.d.). *National Weather Service New York, NY Excessive Heat Page*. https://www.weather.gov/okx/excessiveheat
[99] National Weather Service. (n.d.). Wind Chill Warning vs. Watch. https://www.weather.gov/safety/cold-wind-chill-warning

- **Wind Chill Watch–Be Prepared!** Issued when dangerously cold wind chill values are possible. As with a wind chill warning, those in the area should adjust their plans to avoid being outside during the coldest parts of the day. Those travelling in the watch area should make sure their cars have at least a half a tank of gas and an updated winter survival kit.
- **Wind Chill Advisory–Be Aware!** Issued when seasonably cold wind chill values, but not extremely cold values, are expected or occurring. Those in an area under this type of advisory should dress appropriately and cover exposed skin when venturing outdoors.

- **Hard Freeze Warning–Take Action!** Issued when temperatures are expected to drop below 28°F for an extended period, killing most types of commercial crops and residential plants.
- **Freeze Warning–Take Action!** Issued when temperatures are expected to go below 32°F for a long period of time. This temperature threshold kills some types of commercial crops and residential plants.
- **Freeze Watch–Be Prepared!** Issued when there is a potential for significant, widespread freezing temperatures within the next 24-36 hours. A freeze watch is issued in the autumn until the end of the growing season and in the spring at the start of the growing season.
- **Frost Advisory– Be Aware!** Issued when areas of frost are expected or occurring, posing a threat to sensitive vegetation.

Extreme cold can be measured using the Wind Chill Temperature (WCT) index chart, developed by the NWS. The WCT calculates the dangers from winter winds and freezing temperatures. The index does the following:

- Calculates wind speed at an average height of 5 feet, the typical height of an adult human face, based on readings from the national standard height of 33 feet, which is the typical height of an anemometer.
- Is based on a human face model.
- Incorporates heat transfer theory based on heat loss from the body to its surroundings during cold and breezy or windy days.
- Lowers the calm wind threshold to 3 miles per hour (MPH).
- Uses a consistent standard for skin tissue resistance.
- Assumes no impact from the sun, i.e., clear night sky.

Based on the WCT, at a temperature of 0°F, even a light wind of 5 MPH can create a wind chill of -11°F and cause frostbite within 30 minutes.

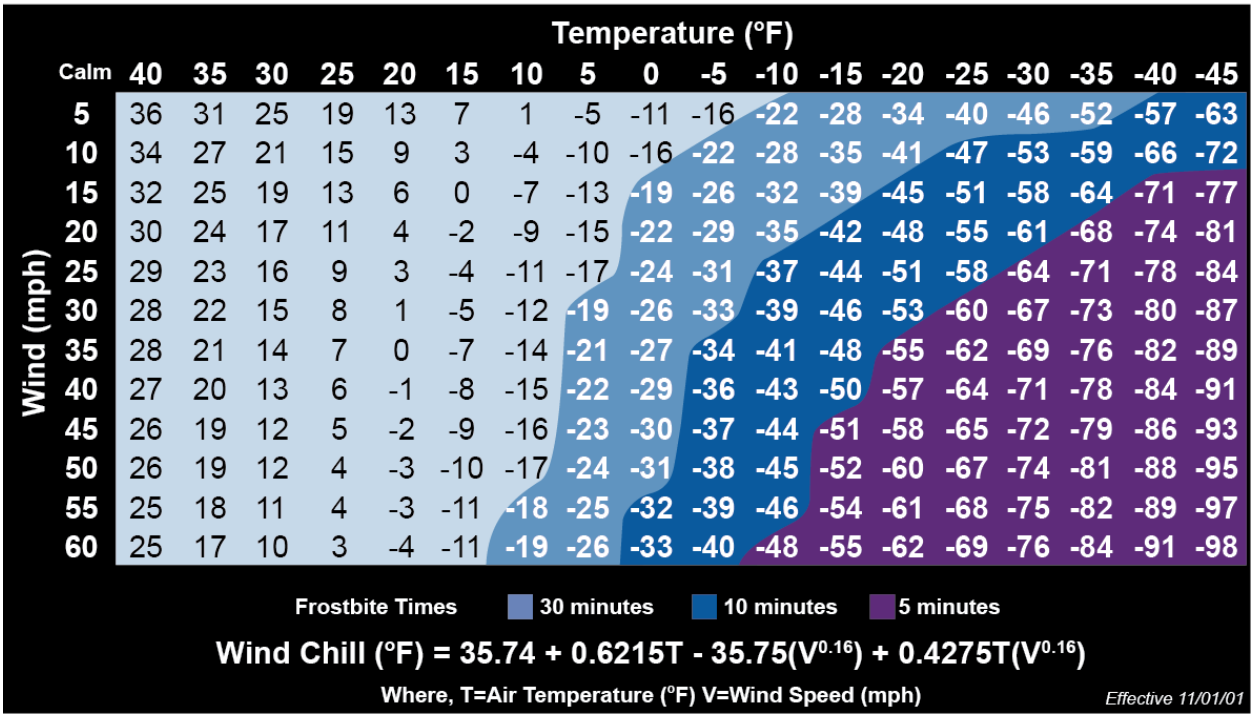


Figure 32: Wind Chill Chart[100]

5.4.1.5. Previous Occurrences

The NOAA, National Centers for Environmental Information (NCEI) Storm Events Database tracks reports of "excessive heat," "cold/wind chill," and "extreme cold/wind chill." Where possible, NCEI tracks reports of these events separately by impacted jurisdiction, although it is not always possible to identify damages below a county or city level. In most cases, therefore, damages that were reported for counties and cities include damages that occurred within towns. Damage reports for towns are included in county reports.

Based on the records from January 1950 through June 2021, a total of 33 excessive heat events were reported for the planning area, affecting six county zones with a reported total of 13 days of excessive heat events. There was one heat-related death in the City of Alexandria and no injuries reported. No property or crop damages were associated with these events.

[100] National Weather Service. (n.d.). *Wind Chill Chart*. https://www.weather.gov/safety/cold-wind-chill-chart

Table 57: Excessive Heat Events and Impacts, 1950-2021[101]

Date	Impacts
May 18, 1996	• Four-day heat wave • 100 cases of schoolchildren with heat exhaustion during an air show in Manassas Regional Airport in the City of Manassas • Three cases of heat exhaustion in the City of Alexandria • Many schools were closed • Forced power "brownout" to cut energy consumption
July 13, 1997	• Seven days of temperatures in the middle or upper 90°F • Intense media coverage may have saved lives, as there were no direct heat-related deaths in Virginia
August 16, 1997 Record Highs: Summer Months	• Record high temperatures over 100°F with heat index values from 105 to 110°F for two days • No heat-related deaths
January 6, 1998 Record Highs: Winter Months	• An unencumbered flow of tropical air from the Caribbean impacted the state for 2.5 days • New record highs, with temperatures remaining above 60°F • Mean temperatures between 15°F and 20°F above normal

During the same period, a total of 39 cold or extreme cold events were reported, affecting all county zones, including the independent cities, with a total of 13 days of cold or extreme cold. There was one hypothermia-related death in the City of Fairfax and one injury reported. Minimal crop and no property damage were associated with these events.

Table 58: Excessive Cold/Wind Chill Events and Impacts, 1950-2021[102]

Date(s)	Impacts
March 11–13, 1998	• The second arctic air mass of the winter of 1997/1998 caused an estimated $25,000 damage to fruit crops in northern Virginia due to accelerated bud growth brought on by the previously mild and moist conditions earlier in the winter. These conditions may have also decreased the resistance of fruit trees to the hard freeze. • The coldest morning, March 13, produced several record low temperatures, including at Washington Dulles International Airport, which had a low of 16°F, breaking a previous record of 18 set in 1984.
January 22, 2000	• The morning of January 22, temperatures dropped into the single digits above and below zero. Lows included 7°F at Dulles International Airport located in Fairfax and Loudoun counties. Reagan National Airport in Arlington County dropped only to 14°F because its metropolitan location tends maintain higher temperatures.

[101] National Oceanic and Atmospheric Administration (2021). *National Center for Environmental Information Storm Events Database,* 1950-June 30, 2021 [Data set]. https://www.ncdc.noaa.gov/stormevents/
[102] Ibid.

Date(s)	Impacts
January 5, 2018	• Arctic air and gusty winds caused wind chills to drop between -5°F and -15°F.
January 21, 2019	• The combination of cold temperatures and strong winds produced wind chills as low as -10°F.

5.4.1.6. Probability of Future Events

Based on historical data from the NCEI Storm Events Database, the return interval for extreme heat events is 0.46% in any given year. Using the same formula, the return interval for extreme cold events is 0.55% in any given year, indicating that extreme cold is slightly more likely to occur than extreme heat. Overall, extreme temperatures are likely to occur in the Northern Virginia region.

5.4.2. Risk Assessment

The greatest danger from extreme temperatures is to people, as prolonged exposure can impact both healthy individuals and those with pre-existing medical conditions.

Health-related illnesses include heat stroke, heat exhaustion, heat cramps, sunburn, and heat rash. Although all these illnesses can cause problems, the two most deadly are heat stroke and heat exhaustion.

Older adults, the very young, and people with mental illness and chronic diseases are at highest risk from extreme heat. High heat indexes can exacerbate pre-existing health and medical conditions, and some medications may make the body more susceptible to impacts from extreme heat.

However, even young, healthy people can be affected if they participate in strenuous physical activities during hot weather. Summertime activity, whether on the playing field or the construction site, must be balanced with actions that help the body cool itself to prevent heat-related illness such as heat exhaustion and heat stroke.

Extreme heat conditions can increase the incidence of mortality and morbidity in affected populations. People can suffer heat-related illnesses when the body is unable to compensate for the extreme heat and properly cool itself. Very high body temperatures can cause damage to the brain and other vital organs.

Extreme cold can cause frostbite or hypothermia and quickly become life threatening. People who have poor blood circulation, drink alcohol or use illicit drugs, remain outdoors for long periods of time, or are not properly dressed for extreme cold temperatures may have a greater chance of developing frostbite or hypothermia.

Body temperatures that are too low affect the brain, making it difficult to think clearly or move well. This makes hypothermia particularly dangerous to those with the condition, as they may not understand what is happening or know what to do about it.

Additionally, when extreme cold occurs simultaneously with precipitation events such as a snow or ice storms, accidents that can cause injury or death may occur, such as slip and fall accidents, overexertion accidents related to shoveling snow or clearing ice, and motor vehicle accidents.

5.4.2.1. Who Is Most at Risk?

Heat and cold stress are environmental hazards. Because of their unique physiology, children are more susceptible to temperature extremes and their health effects. Children are less able to regulate their body

temperature compared with adults. As a result, children are more likely to develop significant health effects when they are exposed to environmental temperature extremes.

5.4.2.2. Built Environment, Community Lifelines, and Assets

Since 1950, the region has experienced multiple events of extreme temperature; however, no property damage related to this hazard has been documented. Based on the lack of previous impacts, risk and vulnerability associated with this hazard have not been quantified for this Plan update.

5.4.2.3. Natural Environment and Economy

Since 1950, the region has experienced multiple events of extreme temperature; however, only minimal impacts to the economy and the natural environment, including an estimated $25,000 damage to fruit trees, have been documented. Based on the lack of previous impacts, risk and vulnerability associated with this hazard have not been quantified for this Plan update.

5.4.2.4. Hazard Risk Ranking Summary

The hazard ranking process considered probability and consequences in determining an overall risk score and ranking. Information presented within this section and the hazard risk ranking process present the quantitative and qualitative summary for extreme temperatures. The hazard identification and risk assessment methodology are described in **Section 4, Base Plan**.

Table 59: Hazard Risk Rankings for Extreme Temperature, by Jurisdiction

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Arlington County	2.3	2.9	5.2	**Medium**
City of Alexandria	2.7	2.5	5.2	**Medium**
City of Fairfax	2.7	2.5	5.2	**Medium**
City of Falls Church	2.7	2.5	5.2	**Medium**
City of Manassas	3.0	2.5	5.5	**Medium**
City of Manassas Park	3.0	2.5	5.5	**Medium**
Fairfax County	2.7	2.5	5.2	**Medium**
Town of Clifton	2.7	2.5	5.2	**Medium**
Town of Herndon	2.7	2.5	5.2	**Medium**
Town of Vienna	2.7	2.5	5.2	**Medium**
Loudoun County	2.3	2.7	5.0	**Medium**
Town of Leesburg	2.3	2.7	5.0	**Medium**
Town of Lovettsville	2.3	2.7	5.0	**Medium**
Town of Middleburg	2.3	2.7	5.0	**Medium**
Town of Purcellville	2.3	2.7	5.0	**Medium**
Town of Round Hill	2.3	2.7	5.0	**Medium**
Prince William County	3.0	2.5	5.5	**Medium**
Town of Dumfries	3.0	2.5	5.5	**Medium**
Town of Haymarket	3.0	2.5	5.5	**Medium**

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Town of Occoquan	4.0	2.4	6.4	**Medium**

Based on previous occurrences and minimal impacts, this hazard is ranked as a low risk and provides justification for a minimal hazard profile. Consequently, **a vulnerability assessment will not be conducted**.

5.4.2.5. Future Population and Development Trends

Future development and the resulting population increase has a minimal potential to elevate vulnerabilities to extreme temperature; however, depending on climate change variables, an increase in vulnerability related to public health and safety is possible.

5.4.2.6. Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluating, and updating of this Plan should consider the following factors related to extreme temperature, as well as other information from the next Virginia COV-SHMP:

- Have extreme temperature events occurred within the planning area since adoption of the 2022 HMP?
- Did extreme temperature events take place in areas adjacent to the planning area that impacted the planning area by virtue of being in proximity?
- Has new scientific research or methodology, potentially related to climate change, improved the ability to predict extreme temperature events or assess risk and vulnerability?
- Has there been significant change in the population, built environment, natural environment, or economy that could affect the risk or vulnerability to extreme temperature, including land use for agricultural purposes?

5.5. Flood/Flash Flood (Including Erosion)

2022 HMP Update

The Flood/Flash Flood hazard was reexamined, and a new analysis was performed, which included, but was not limited to the following:

- Reformatted the hazard section to improve clarity and flow
- Refreshed the hazard profile with updated data, maps, and imagery, where available
- Updated the assessment of risk and vulnerability by jurisdiction based on new data
- Reviewed and re-evaluated of the hazard ranking by jurisdiction using the methodology described in detail in Section 4, Base Plan

Table 60: Flood/Flash Flood Profile

<table>
<tr><th colspan="5">Flood/Flash Flood</th><th>Overall Vulnerability</th></tr>
<tr><td colspan="5">Definition, Key Terms, and Overview</td><td rowspan="4">High</td></tr>
<tr><td colspan="5">Flood: an overflow of water onto normally dry land; the inundation of a normally dry area caused by rising water in an existing waterway (e.g., a river, stream, or drainage ditch); ponding of water at or near the point where the rain fell. Flooding may last days or weeks and is a longer-term event than flash flooding.

Flash Flood: A flood caused by heavy or excessive rainfall in a short period of time, generally less than six hours. Events are usually characterized by raging torrents after heavy rains that run through riverbeds, urban streets, or mountain canyons sweeping up everything before them. They can occur within minutes or hours of excessive rainfall, or even in cases of zero rainfall, such as after a levee or dam has failed, or after a sudden release of water by a debris or ice jam.</td></tr>
<tr><th>Frequency</th><th>Probability</th><th colspan="3">Potential Magnitude</th></tr>
<tr><td rowspan="2">Moderate</td><td rowspan="2">Occasional</td><th>Injuries/Deaths</th><th>Infrastructure</th><th>Environment</th></tr>
<tr><td>Minimal</td><td>High</td><td>Moderate</td></tr>
</table>

5.5.1. Hazard Profile

Flooding is the most common and costly natural hazard in the United States; a hazard that impacted 99 percent of the counties in the United States in 1996, causing thousands of fatalities.[103] Nearly 90% of presidential disaster declarations result from natural events where flooding was a major contributor. As of November 2021, the National Weather Service Report, *Preliminary U.S. Flood Fatality Statistics*, shows that there have been 144 fatalities to date in 2021, with one occurring in Virginia.[104]

[103] Federal Emergency Management Agency (FEMA), Historical Flood Risk and Costs. Retrieved at: https://www.fema.gov/data-visualization/historical-flood-risk-and-costs
[104] National Weather Service, Preliminary US Fatality Statistics, https://www.weather.gov/arx/usflood. Accessed on: November 12, 2021.

Within the region of Northern Virginia, there have been more than 976 flood or flood-related events since 1950 that included five deaths, 27 people injured, and more than $59 million in property damage. Floods also caused more than $300,000 in crop damage.[105]

Regardless of the circumstances leading to a flood or flash flood event, occurrences resulting from excessive precipitation may be classified into one of two types:

- **General floods:** precipitation over a given river basin for a long period of time. A flood event may last for several days. The primary types of flooding include riverine, coastal, and urban. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, nor'easters, and other large coastal storms. Urban flooding occurs where man-made development has obstructed the natural flow of water and decreased the ability of natural groundcover to absorb and retain surface water runoff.
- **Flash flood:** the product of heavy, localized precipitation in a short period of time across a given location. Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. Flash flood events may also occur from a dam or levee failure within minutes or hours after heavy amounts of rainfall affect the region, or from a sudden release of water held by an ice jam. Although flash flooding occurs often along mountain streams, it also occurs frequently in urbanized areas where much of the ground is covered by impervious surfaces. Flash flood waters move at very high speeds– "walls" of water can reach heights up to 10 to 20 feet. Flash flood waters and the accompanying debris can uproot trees, roll boulders, and damage or destroy buildings, bridges, and roads.

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
- The degree of vegetative clearing

5.5.1.1. Erosion

Erosion is the gradual breakdown and movement of land due to both physical and chemical processes of water, wind, and general meteorological conditions. Natural (geologic) erosion has occurred since the Earth's formation and continues at a slow and uniform rate each year.

The two general causes of soil erosion—wind and water—can both cause significant soil loss. Winds blowing across sparsely vegetated or disturbed land can pick up soil particles and transport them to other locations. Water flowing over land also transports soil particles to other locations. Wind erosion generally impacts wider and lesser-defined areas than water erosion, but water erosion can transport larger particles than wind. Major storms, such as hurricanes, may cause significant erosion by combining the impacts of high winds and high velocity water flow over large flood areas, including storm surges that significantly impact the shoreline.

Wind erosion is not a significant hazard in the planning area and will not be further addressed in this section.

The main causes of water erosion are stream or overland flow and wave action. **Stream or overland flow erosion** results from mechanical or chemical removal, and transportation of soil particles to a new location. Mechanical erosion is caused by hydrodynamic forces pushing particles down-gradient,

[105] NOAA, National Centers for Environmental Information, Storm Events Database, January 1, 1950–June 30, 2021.

hydraulic drag forces pulling particles down-gradient, and/or hydraulic uplift. Susceptibility of an area to stream or overland flow erosion is a function of soil characteristics, vegetative cover, water quality, topography, and climate. Soils weathered from calcareous carbonate rock (i.e., limestone and dolomite), are more susceptible to chemical erosion by dissolution than other soils. Vegetative cover can be very helpful in controlling erosion by shielding the soil surface from direct water contact and reinforcing the soil, with the foliage serving as an energy dissipater and the root mat reinforcing the near surface soils.

Wave action occurs within waterways that are navigable or wide enough in area to allow wind-driven waves to impact a shoreline. Within the Northern Virginia region, the Potomac River is the primary body of water that could enable wave action to cause erosion.

Water quality impacts both chemical and mechanical erosion; water with a relatively high concentration of carbon dioxide, oxygen, and organic acids accelerates dissolving minerals from calcareous carbonate soils. Sand and gravel that are transported during periods of high velocity flow increase mechanical erosion through abrasion of the flow bed.

Topography of the area, including size, shape, and slope, is a key variable in determining water flow velocity, which in turn is a key variable in the magnitude of the hydraulic forces producing erosion. The greater the slope length and gradient, the more potential an area has for erosion. Climate can also affect the amount of runoff, especially the frequency, intensity, and duration of rainfall and storms. When rainstorms are frequent, intense, or are long in duration, erosion risks are high. Seasonal changes in temperature and rainfall amounts define the period of highest erosion risk for the year.

During the mid to late 1960s, the importance of erosion control garnered increased public interest in the United States. Implementation of erosion control measures consistent with sound agricultural and construction operations was needed to minimize the adverse effects associated with increasing settling of soil particles due to water or wind. The increase in governmental regulatory programs and public concern has resulted in a wide range of erosion control products, techniques, and analytical methodologies in the United States. The preferred method of erosion control in recent years has been the restoration of vegetation. These measures are addressed in the Northern Virginia region through local sedimentation and erosion control programs.

Table 61: Hazard Profile Summary

Flood/Flash Flood **Assessment: High Risk Hazard**	**Location**	Jurisdiction-wide	**Potential Cascading Effects** • Traffic/roadway damage/closures • Resident/visitor/responder safety • Loss of deliverable services • Major redirect of response operations/equipment • Loss of revenue • Property and infrastructure damage
	Extent	Moderate to significant	
	Duration	Several hours to weeks or days	
	Probability	Occasional	
	Seasonal Pattern	More likely in late spring with snow melt, or summer with excessive rainfall events	
	Speed of Onset	Slow to Rapid	
	Warning Time	Minutes to hours	
	Repetitive Loss	Moderate	

5.5.1.2. Location

There are numerous rivers and streams flowing through the Northern Virginia region. When heavy or prolonged rainfall events occur, these rivers and streams are, to some degree, susceptible to flooding. The most notable of these bodies of water is the Potomac River, which, in the past, has been the source of significant storm surge and tidal flooding–particularly in waterfront communities such as Arlington and Alexandria.

The entire Northern Virginia region falls within the Potomac River Basin, which serves as the border between Maryland and Virginia and flows in a southeasterly direction into the Chesapeake Bay. The topography of the upper region of the basin is characterized by gently sloping hills and valleys.

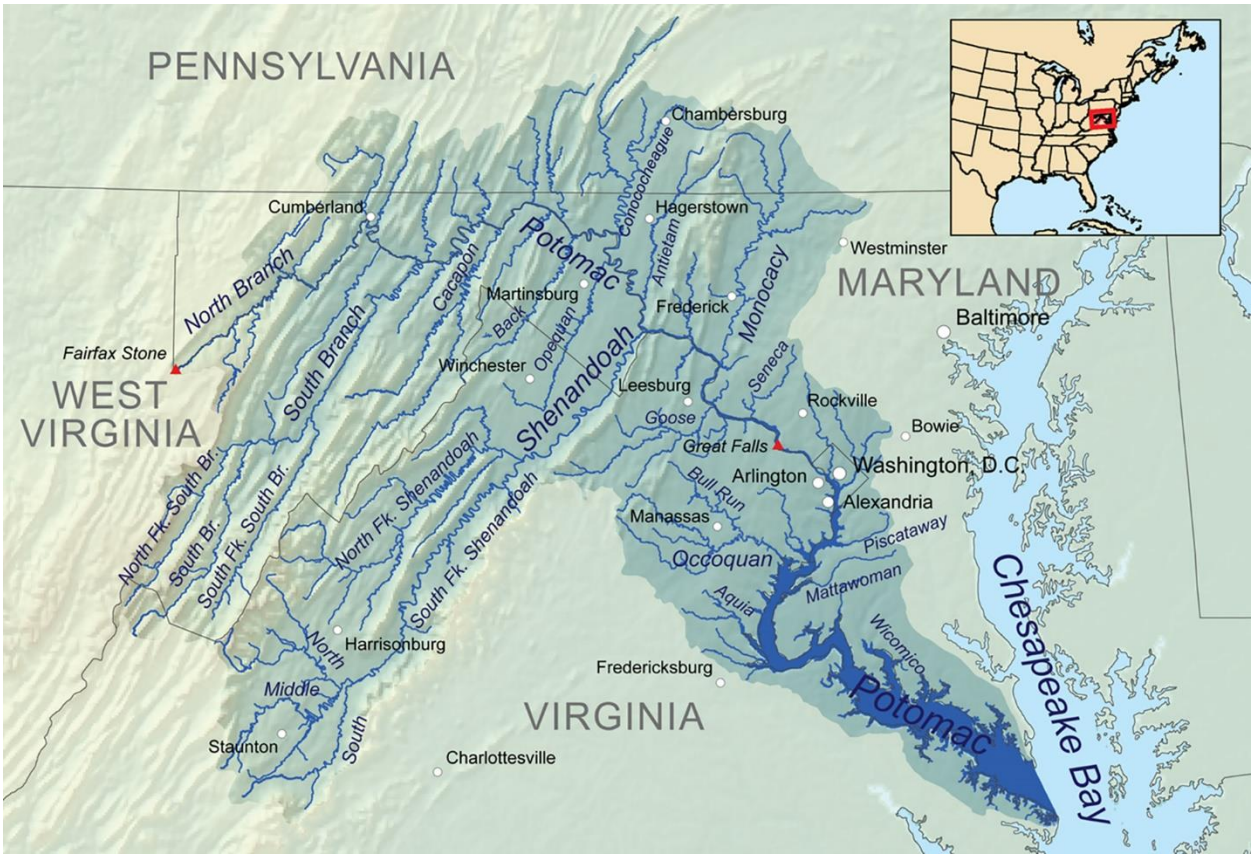


Figure 33. The Potomac River Watershed[106]

In Great Falls, Maryland, the Potomac River begins a more rapid descent to sea level by dropping 76 feet in less than one mile through a deep gorge. Eastward of Great Falls, the Potomac flows between Washington, DC; Arlington; and Alexandria. Here, the river broadens and is flanked by low marshes in many places along the eastern side of Prince William County, where tides further influence the river. The Potomac then flows through the coastal plain and eventually expands to more than 11 miles wide as it reaches the Chesapeake Bay.

While some of the most dramatic flooding events in Northern Virginia are associated with the tidal flooding of the Potomac River during hurricanes or tropical storms, other more frequent inland flood hazards exist throughout the region. Too much rainfall or snowmelt in too little time causes serious flooding problems along even the smallest of tributaries or storm drainage systems. The low-lying areas most prone to this type of flooding are known as floodplains or Special Flood Hazard Areas (SFHAs).

[106] American Rivers. Retrieved at: https://www.americanrivers.org/

These locations, which are more commonly referred to as the “100-year floodplain” (areas with a 1%-annual-chance of flooding), are routinely surveyed and mapped by FEMA as part of a Flood Insurance Study (FIS) sponsored by the National Flood Insurance Program (NFIP). These studies and associated maps are then provided to local communities in order to regulate the development of land within these hazard areas. Jurisdiction-specific flood maps that show the FEMA floodplain relative to regional boundaries and assets are included in the jurisdiction annexes.

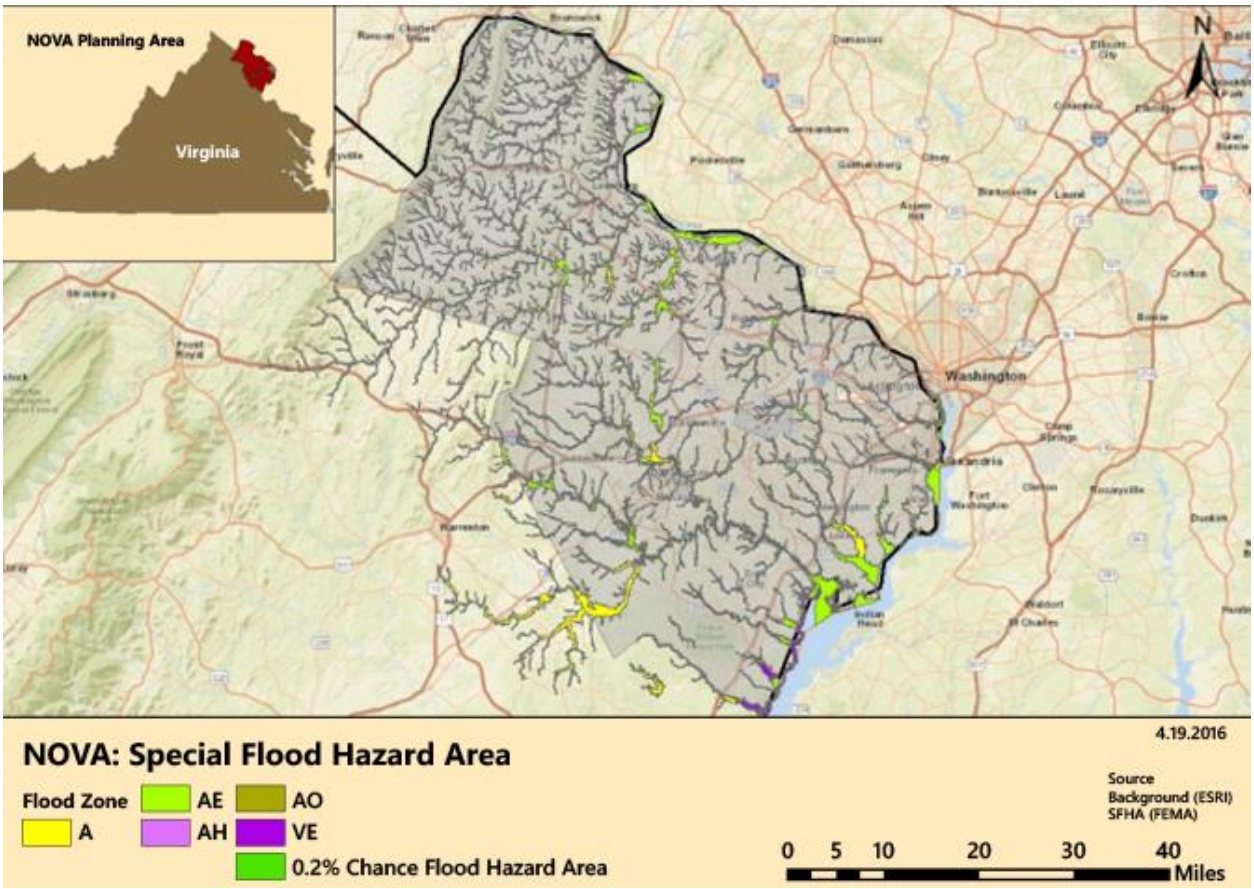


Figure 34: FEMA Special Flood Hazard Area (SFHA) Map of the Northern Virginia Region[107]

Flash flooding can occur quickly outside of identified flood-hazard areas and is frequently related to stormwater systems blocked with debris, or excessive rainfall events that exceed the capacity of these systems. Back-up from these systems can close and damage infrastructure such as roads and culverts, as well as personal property. Sloped streets and other areas that act as drainage channels during heavy rainfall are highly susceptible to flash flooding. In these locations, stormwater run-off may exceed the design capacity of the drainage systems, leading to increased water depth and velocity. Overland flow erodes ravines, accelerates head-cutting, and steepens side slopes. Steep hillsides that have been cut to accommodate roads are especially susceptible to these conditions and may lead to extensive erosion.

While local erosion hazard areas are not identified, the areas of greatest concern are typically those areas consisting of steep slopes and fast-running stream channels, as well as large construction sites involved in the excavation and disturbance of their natural state. Erosion events are often extremely localized in nature and often go unreported unless they damage infrastructure, or the resulting topography presents a new hazard.

[107] National Flood Hazard Layer data. Retrieved at: https://www.fema.gov/flood-maps/national-flood-hazard-layer

Arlington, Fairfax, Loudoun, and Prince William Counties, City of Alexandria, Towns of Occoquan, Dumfries, Quantico, and Leesburg all have tidal shorelines along the Potomac River and its associated embayment's and tributaries. The accretion and erosion of these shorelines are influenced by wind-induced waves, littoral currents, tidal currents, sea-level rise, boat wake, and storm water runoff. Other contributing factors include the physical characteristics of the shoreline (e.g., topography and soil), as well as human activities (e.g., land use, dredging, and shoreline stabilization).

The Northern Virginia Regional Council (NVRC) study, "Tidal Shoreline Erosion in Northern Virginia" (September 1992), discussed the erosion situation for various segments of the shoreline in the Northern Virginia region, as well as locations of "priority" erosion concern. The report served as a valuable resource document for the Commonwealth and local officials to assist in planning for shoreline and erosion control throughout Northern Virginia. In addition, the report augments a computer data file also created by NVRC that contains the names, mailing addresses, and tax parcel numbers of tidal Potomac shoreline property owners. This data is distributed to the Shoreline Erosion Advisory Service and Northern Virginia local governments. Combined with the set of approximately 360 low altitude aerial photographs, these work products serve as a historical record of current planning efforts and future research. Specific areas of Northern Virginia noted in the study for shoreline stabilization efforts include:

- Twenty (20) percent of the Northern Virginia shoreline has been artificially stabilized with 32 miles of hard structures.
- Arlington County has 13.3 miles of tidal shoreline, with 4.9 miles of hardened shoreline (37 percent). This information has not been updated since the 2006 Plan creation and remains the best available data for the 2021 update to this Plan.
- The City of Alexandria has the shortest shoreline length (8.8 miles), with the largest percent stabilized (58 percent, or 5.1 miles).
- Fairfax has the most tidal shoreline in Northern Virginia (87 miles), and the most artificial stabilization (13.3 miles), but the smallest percent of stabilized shoreline (15 percent).
- Prince William County has approximately 48 miles of shoreline with 8.7 miles of artificial shoreline stabilization structures.

Local areas susceptible to flood and flash flood are further identified in the jurisdiction annexes.

5.5.1.3. Extent

The strength or magnitude of flooding varies depending on multiple meteorological, environmental, and geological features such as latitude, altitude, topography, and atmospheric conditions. In addition, there is seasonal variation in severe weather events that influences a storm's characteristics, warning time, speed of onset, and duration. Flash Flooding is most common in NOVA and may not always have warning. Flash flooding can be caused by 3 inches of rain from a thunderstorm passing through, and duration can last from minutes to hours, or even to multiple days in extreme events.

The term "stage" refers to the height of a river, or any other body of water, above a locally defined elevation. As with most rivers in the United States, the Potomac River has gauging stations where measurements of the river's stage and discharge are continually taken. These are plotted on a hydrograph, which shows the stage or discharge of the river as measured at the gauging station versus time. The Middle Atlantic River Forecast Center maintains and monitors the status of all rivers within the planning area. The Center currently indicates eight gauges on waterways that impact Northern Virginia, including seven on the Potomac River and one on Goose Creek in Loudoun County.

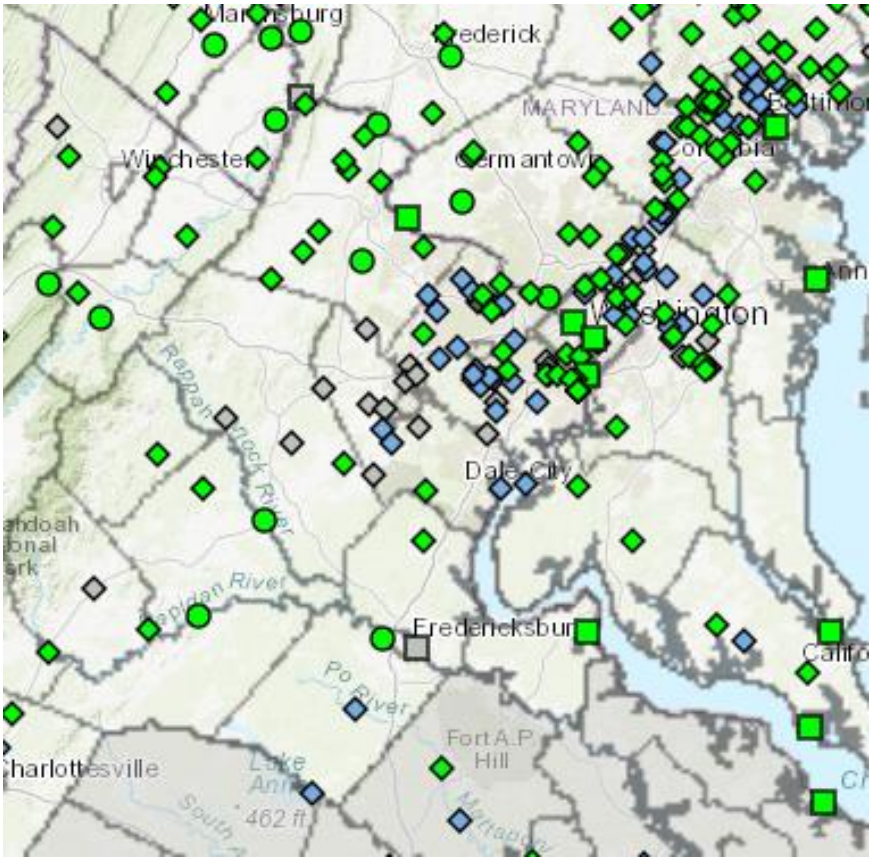


Figure 35: River Gauges in Northern Virginia[108]

The Forecast Center maintains multiple flood-planning resources, including hydrographic models at specific gauge sites, and interactive inundation maps which illustrate potential water depth values for specific locations. The hydrographic models provide multiple-day forecasts of river depth compared to flood stage. As an example, the Potomac River at Alexandria hydrograph for the period from January 5 to January 13, 2021 indicates a fluctuating river stage that briefly denotes a level over the flood action stage of 2.6 feet, with a slight increase to minor flood stage of 3.3 feet between January 5 and 6. The river stage then quickly receded below the action stage level for the succeeding days.

[108] National Weather Service Advanced Hydrologic Prediction Services
https://water.weather.gov/ahps2/index.php?wfo=lwx

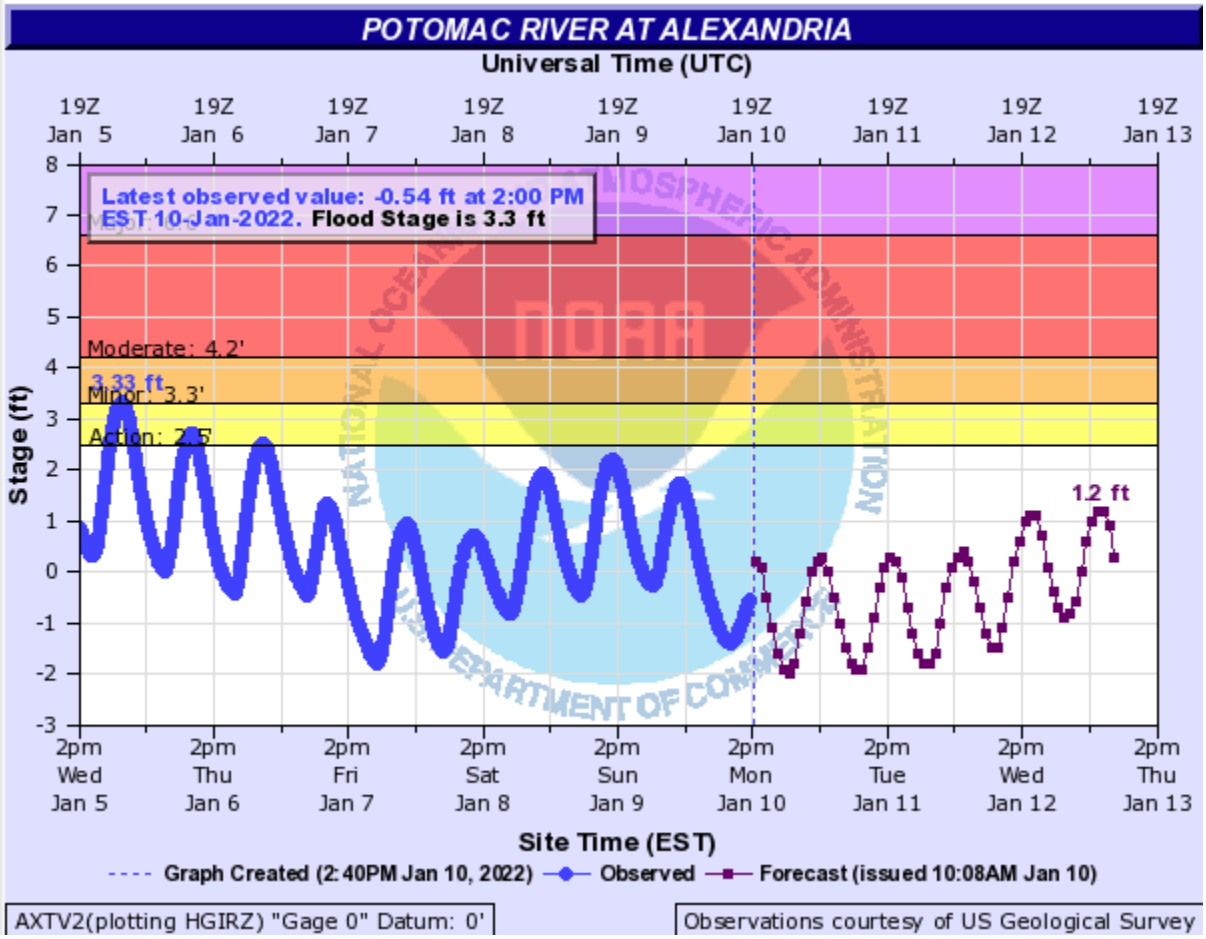


Figure 36: Hydrograph of Potomac River Gauge at Alexandria, January 2021[109]

The Forecast Center's inundation maps provide information related to potential water depth at specific locations. The example provided in Figure 37 illustrates a potential depth of 0 to 1.61 feet at a specific address within the City of Alexandria and shows the current stage (bottom left corner) that is below flood stage.

[109] Mid-Atlantic River Forecast Center, Advanced Hydrologic Prediction Service. Retrieved at: https://water.weather.gov/ahps2/hydrograph.php?wfo=lwx&gage=axtv2

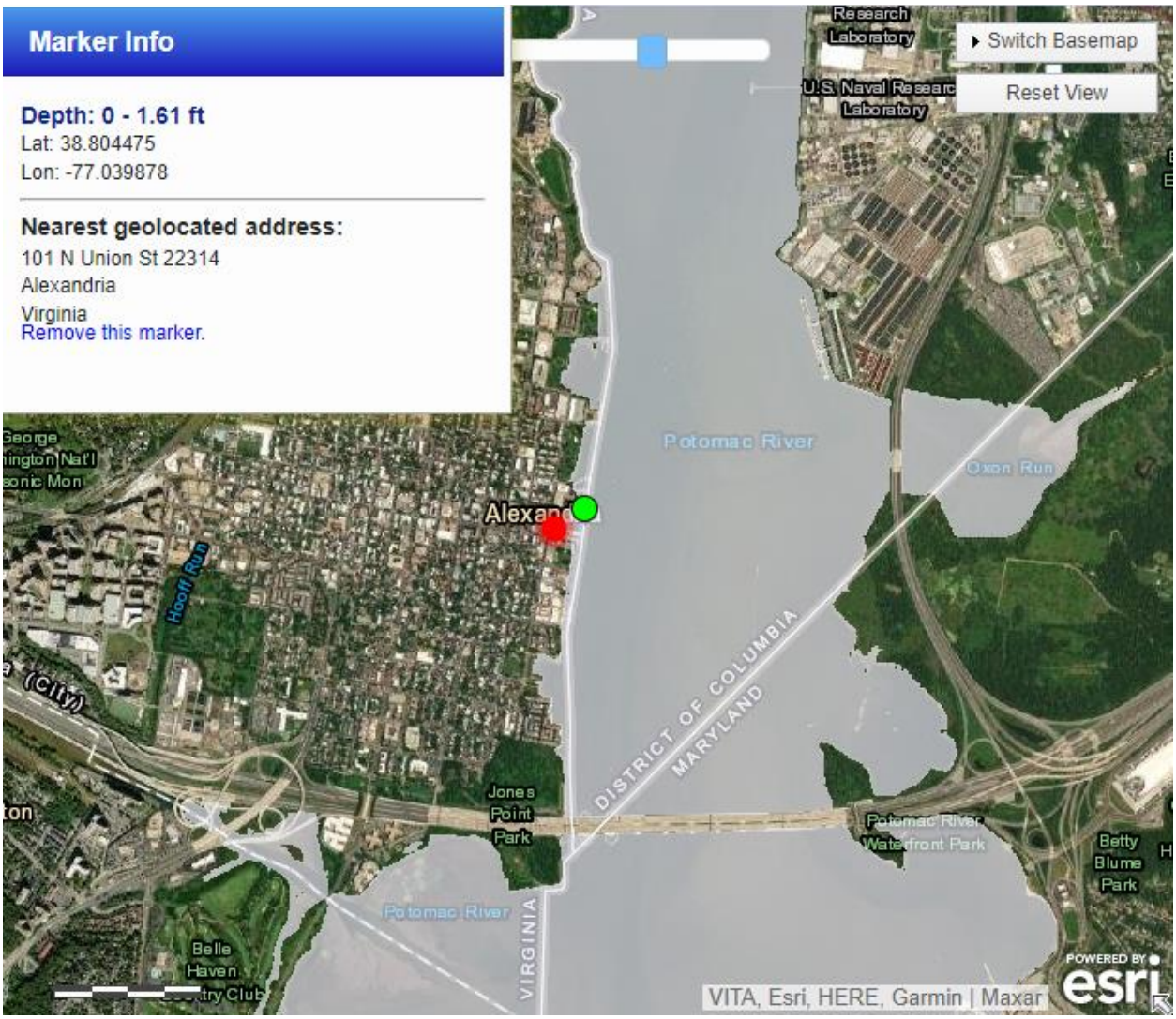


Figure 37: Sample Inundation Map, Potomac River at Alexandria[110]

The National Weather Service issues flood advisories, watches, and warnings to assist emergency management preparations, as well as to warn the public.[111]

- **Flood Advisory: Be Aware:** A Flood Advisory is issued when a specific weather event that is forecast to occur may become a nuisance. A Flood Advisory is issued when flooding is not expected to be bad enough to issue a warning. However, it may cause significant inconvenience, and if caution is not exercised, it could lead to situations that may threaten life and/or property.
- **Flood Watch: Be Prepared:** A Flood Watch is issued when conditions are favorable for a specific hazardous weather event to occur. A Flood Watch is issued when conditions are favorable for flooding. It does not mean flooding will occur, but it is possible.
- **Flood Warning: Take Action!** A Flood Warning is issued when the hazardous weather event is imminent or already happening. A Flood Warning is issued when flooding is imminent or occurring.

[110] Mid-Atlantic River Forecast Center, Inundation Map for Potomac River at Alexandria. Retrieved at: https://water.weather.gov/ahps2/inundation/index.php?gage=axtv2
[111] https://www.weather.gov/safety/flood-watch-warning

- **Flash Flood Warning: Take Action!** A Flash Flood Warning is issues when a flash flood is imminent or occurring. If you are in a flood prone area move immediately to high ground. A flash flood is a sudden violent flood that can take from minutes to hours to develop. It is even possible to experience a flash flood in areas not immediately receiving rain.
- **Flash Flood Emergency:** Issued for exceedingly rare situations when a severe threat to human life and catastrophic damage from a flash flood is happening or will happen soon.
- **Urban and Small Stream Advisory:** These advisory alerts the public to flooding, which is generally only an inconvenience (not life-threatening) to those living in the affected area and is issued when heavy rain will cause flooding of streets and low-lying places in urban areas. It is also used if small rural or urban streams are expected to reach or exceed bank full. Some damage to homes or roads may occur.
- **Coastal Flood Advisory:** Minor flooding is possible (i.e., over, and above normal high tide levels.
- **Coastal Flood Watch:** Flooding with significant impacts is possible.
- **Coastal Flooding Warning**: Flooding that will pose a serious threat to life and property is occurring, imminent or highly likely.

5.5.1.4. Previous Occurrences

Records of previous flood events are available through the Storm Events Database, maintained by the NOAA, National Centers for Environmental Information (NCEI). The database currently documents weather hazards between 1950 and September of 2021.[112] Flood incidents are reported by date, type and impacts to life safety, property, and agricultural crops. Flooding, as an event type, was first tracked in 1996. Where possible, NCEI tracks reports of these events separately by impacted jurisdiction, although it is not always possible to identify damages below a county or city level. In most cases, therefore, damages that were reported for counties and cities include damages that occurred within towns. Damage reports for towns are included in county reports.

Nearly 1,000 flood events have occurred throughout the planning area since 1950, and the occurrences range widely in terms of location, magnitude, and impact. The most frequent flooding events are localized in nature, resulting from heavy rainfall in areas that are unable to adequately handle storm water runoff. These events typically do not threaten lives or property and will not result in emergency or disaster declarations, therefore more detailed historical data is difficult to obtain.

Table 62: Flood Events in Northern Virginia, 1950–2021[113]

Jurisdiction	Number Events	Fatalities	Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
Arlington County	67	1	1	$8,978,000	$0	$8,978,000
City of Alexandria	44	0	0	$98,000	$0	$98,000
City of Fairfax	10	1	0	$0	$0	$0
City of Falls Church	13	0	0	$0	$0	$0

[112] Data maintained through September 30, 2021, as of January 2022. For the purpose of this update, data collection was cut off at June 30, 2021.
[113] NOAA, NCEI Storm Events Database, 1950 to June 30, 2021. The search encompassed a cross-section of NCEI flood-related categories: flood; coastal flood; flash flood; heavy rain; thunderstorm wind; heavy rain; storm surge/tide; and tropical storm. County reported events include impacts in towns, where applicable.

Jurisdiction	Number Events	Fatalities	Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
City of Manassas	17	0	0	$0	$0	$0
City of Manassas Park	3	0	0	$0	$0	$0
Fairfax County	394	2	0	$32,418,000	$35,000	$32,453,000
Loudoun County	153	0	0	$2,018,000	$170,000	$2,188,000
Prince William County	227	0	0	$15,591,000	$100,000	$15,691,000
TOTAL	962	5	27	$59,093,000	$305,000	$59,398,000

Table 63: Types of Flood Events Occurring in Northern Virginia, 1950–2021[114]

Jurisdiction	Coastal Flood	Flash Flood	Flood	Heavy Rain	Storm Surge/Tide	Tropical Storm	Total
Arlington County	15	19	13	12	3	5	67
City of Alexandria	2	24	8	9	2	0	44
City of Fairfax	0	5	5	0	0	0	10
City of Falls Church	0	6	0	10	0	0	16
City of Manassas	0	7	3	6	0	0	16
City of Manassas Park	0	2	1	5	0	0	8
Fairfax County	1	174	202	23	2	4	406
Loudoun County	0	59	70	15	0	0	153
Prince William County	0	69	150	17	2	4	242
TOTAL	**18**	**365**	**452**	**97**	**9**	**13**	**962**

Based on the historical record of 962 flood events occurring in the northern region of Virginia since 1950, the return interval for flooding would be 0.07 percent in any given year.[115]

Discussion of significant flood events for each participating jurisdiction is included in its jurisdictional annex.

Erosion

There is no known database of historic erosion events in the Northern Virginia region.

5.5.1.5. Probability of Future Occurrence

Based on historical occurrences, flooding of lands adjacent to rivers, streams, and shorelines (known as floodplains) can be expected to occur on an occasional basis.

[114] NOAA, NCEI Storm Events Database, 1950 to June 30, 2021.
[115] Return interval calculated on the number of years of record (70.5 years) divided by the number of flood events (962) identified within the NOAA, National Centers for Environmental Information, Storm Events Database, as of June 30, 2021.

A 100-year flood is not a flood that occurs every 100 years. In fact, the 100-year flood has a 26 percent chance of occurring during a 30-year period, or the typical length of many mortgages. The 100-year flood is a regulatory standard used by federal agencies, states, and NFIP-participating communities to administer and enforce floodplain management programs. The 100-year flood is also used by the NFIP as the basis for insurance requirements nationwide.

Table 64: Annual Probability Based on Flood Recurrence Intervals[116]

Flood Recurrence Interval	Annual Chance of Occurrence
10-year	10.0%
50-year	2.0%
100-year	1.0%
500-year	0.2%

Flooding remains occasional throughout the identified flood hazard areas of the Northern Virginia region. Smaller floods caused by heavy rains and inadequate drainage capacity in urbanized areas will be more common, but not as costly as the large-scale floods that may occur at much less frequent intervals.

Erosion

At this time, there is no comprehensive database related to erosion incidents in Northern Virginia jurisdictions on which to calculate the probability of future occurrences based on historical events. However, based on the historical occurrence of flooding, erosion of both shorelines and inland areas of natural run-off remain occasional in localized areas throughout the Northern Virginia region.

The Virginia Department of Conservation and Recreation (DCR) is the state-level agency responsible for monitoring erosion and sediment control through the Shoreline Erosion Advisory Service (SEAS). The SEAS website notes that “some Virginia shorelines have historic erosion rates of up to 30 feet per year,” but does not specifically identify the referenced locations.[117]

5.5.1.6. Future Occurrences Linked to Climate Change

Based on multiple scientific projections related to global warming and climate change, more excessive rainfall events leading to flood and flash flood could impact the Northern Virginia region in the future. Flooding linked to these events might result in riverine, coastal, or flash floods. An additional consideration for future flood events is sea-level rise, for which some jurisdictions within the Northern Virginia planning area are susceptible.

Since 2008, the NVRC has been engaged in a series of projects, studies, and efforts related to helping the region adapt to more frequent flooding, rising sea levels, and other projected impacts of climate change. These efforts have been funded in part by the National Oceanic and Atmospheric Administration (NOAA) through the Virginia Coastal Zone Management Program (VCZMP), which resulted in three Sustainable Shorelines and Community Management reports that document the projected impacts of sea level rise on tidal shorelines in the Northern Virginia region, as well as analyze potential adaptation strategies that could be implemented to reduce the regions’ vulnerability to future sea-level rise. These reports have laid the foundation for NVRC to continue working to provide technical assistance to local governments striving to build coastal resiliency.

[116] FEMA, National Flood Insurance Program
[117] Virginia Department of Conservation and Recreation, Shoreline Erosion Advisory Service website; Retrieved on December 22, 2021 at: https://www.dcr.virginia.gov/soil-and-water/seas

Additional data related to the impact of climate change on the extent of future flooding is described in **Section 6, Impacts of Climate Change**.

5.5.1.7. National Flood Insurance Program (NFIP)

The Flood Insurance and Mitigation Administration, a component of FEMA, manages the NFIP. The three components of the NFIP are:

5. Flood Insurance
6. Floodplain Management
7. Flood Hazard Mapping

Nearly 20,000 communities across the United States and its territories participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Community participation in the NFIP is voluntary.

Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods. Flood damage is reduced by nearly $1 billion a year through communities implementing sound floodplain management requirements and property owners purchasing flood insurance. Additionally, buildings constructed in compliance with NFIP building standards are exposed to approximately 80 percent less damage annually than those not built-in compliance with current codes.

In addition to providing flood insurance and reducing flood damages through floodplain management regulations, the NFIP identifies and maps the nation's floodplains. Mapping flood hazards creates broad-based awareness and provides the data needed for floodplain management programs to actuarially rate new construction for flood insurance.

Community Rating System

The Community Rating System (CRS) is a voluntary initiative for those communities participating in the NFIP that recognizes and encourages community floodplain management activities that exceed the minimum NFIP standards. Depending on the level of participation, individual flood insurance premium rates for policyholders can be reduced from 5 percent to 45 percent in Special Flood Hazard Areas. CRS activities also enhance public safety, reduce damages to property and public infrastructure, minimize economic disruption and losses, and protect the environment. Implementation of some CRS activities can help projects qualify for other federal assistance programs as well.

Table 65: Legend for Community Status Book Labels and Definitions

Legend: Community Status Book Labels and Definitions	
Community Name	Jurisdiction participating in the National Flood Insurance Program
County	County in which the jurisdiction is located
Initial FHBM Identified	Date the Flood Hazard Boundary Map (FHBM) was developed
Initial FIRM Identified	Date of the first Flood Insurance Rate Map (FIRM)
Current Eff Map Date	Date the most recent jurisdictional Flood Insurance Rate Map (FIRM) was developed
Reg-Emer Date	Date the jurisdiction joined NFIP as either a regular participant or on an emergency basis
CRS Entry Date	Date the jurisdiction joined the Community Rating System (CRS)

Legend: Community Status Book Labels and Definitions	
Current Eff Date	Effective date as of the most current CRS review.
CRS Class	CRS Class rating on a scale of 1 to 10, with 1 being the highest rating
% Disc SFHA	For CRS members, percentage of discount on flood insurance premium for structures located in a Special Flood Hazard Area
% Disc Non SFHA	For CRS members, percentage of discount on flood insurance premium for structures not located in a Special Flood Hazard Area

Table 66: Participating Communities in the National Flood Insurance Program, Northern Virginia Region[118]

Community Name	County	Initial FHBM Identified	Initial FIRM Identified	Current Eff Map Date	Reg-Emer Date	CRS Entry Date	Current Eff Date	CRS Class	% Disc SFHA	% Disc Non SFHA
Arlington County	Arlington		10/1/1969	8/19/2013	12/31/1976	10/1/1992	10/1/2008	8	10%	5%
Alexandria, City of	-	8/22/1969	8/22/1969	6/16/2011	5/8/1970	10/1/1992	10/1/2013	6	20%	10%
Fairfax, City of	-	5/5/1970	12/23/1971	6/2/2006	12/17/1971	-	-	-	-	-
Falls Church, City of	-	9/6/1974	2/3/1982	7/16/2004	2/3/1982	5/1/2007	10/1/2016	6	20%	10%
Manassas, City of	-	5/31/1974	1/3/1979	1/5/1995	1/3/1979	-	-	-	-	-
Manassas Park, City of	-	3/11/1977	9/29/1978	1/5/1995	9/29/1978	-	-	-	-	-
Fairfax County	Fairfax	5/5/1970	3/5/1990	9/17/2010	1/7/1972	10/1/1993	10/1/2014	6	20%	10%
Clifton, Town of	Fairfax	3/28/1975	5/2/1977	9/17/2010	5/2/1977	-	-	-	-	-
Herndon, Town of	Fairfax	6/14/1974	8/1/1979	9/17/2010	8/1/1979	-	-	-	-	-
Vienna, Town of	Fairfax	8/2/1974	2/3/1982	9/17/2010	8/1/1979			8	10%	5%
Loudoun County	Loudoun	4/25/1975	1/5/1978	2/17/2017	1/5/1978	10/1/1992	5/1/2003	10		0%
Leesburg, Town of	Loudoun	8/30/1974	9/30/1982	2/17/2017	9/30/1982	-	-	-	-	-
Lovettsville, Town of	Loudoun	4/15/1977	7/5/2001	2/17/2017	10/22/2013	-	-	-	-	-
Middleburg, Town of	Loudoun		7/5/2001	2/17/2017	7/31/2001	-	-	-	-	-
Purcellville, Town of	Loudoun	7/11/1975	11/15/1989	2/17/2017	11/15/1989	-	-	-	-	-
Round Hill, Town of	Loudoun		7/5/2001	2/17/2017	1/10/2006	-	-	-	-	-

[118] FEMA, National Flood Insurance Program, Community Status Report. Accessed September 9, 2021

Community Name	County	Initial FHBM Identified	Initial FIRM Identified	Current Eff Map Date	Reg-Emer Date	CRS Entry Date	Current Eff Date	CRS Class	% Disc SFHA	% Disc Non SFHA
Prince William County	Prince William	1/10/1975	12/1/1981	8/3/2015	12/1/1981	10/1/1996	10/1/2019	7	15%	5%
Dumfries, Town of	Prince William	6/18/1976	5/15/1980	8/3/2015	5/15/1980	-	-	-	-	-
Haymarket, Town of	Prince William	8/9/1974	1/17/1990	1/5/1995	1/31/1990	-	-	-	-	-
Occoquan, Town of	Prince William	7/19/1974	9/1/1978	1/5/1995	9/1/1978	-	-	-	-	-

As of August 17, 2022, there were a total of 7,030 flood active insurance policies in the Northern Virginia region. These policies amounted for more than $6.1 million in flood insurance premiums paid in the region. Approximately 2,712 claims have been filed, accounting for nearly $32.7 million in payments.

Floodplain management regulations are the cornerstone of NFIP participation. Communities that participate in the NFIP are expected to adopt and enforce floodplain management regulations that apply to all types of floodplain development and ensure that development activities will not cause an increase in future flood damages. Buildings in floodplains are required to be elevated at or above the Base Flood Elevation (BFE), as established by the local regulations.

Repetitive Loss Properties and Severe Repetitive Loss Properties

A Repetitive Loss Property (RL) is a property that is insured under the NFIP that has filed any NFIP-insured property that, since 1978 and regardless of any change(s) of ownership during that period, has experienced: a) four or more paid flood losses; b) two paid flood losses within a 10-year period that equal or exceed the current value of the insured property; or c) three or more paid losses that equal or exceed the current value of the insured property. Nationwide, RL properties constitute 2 percent of all NFIP insured properties but are responsible for 40 percent of all NFIP claims. Mitigation for RL properties are a high priority for FEMA, and the areas in which these properties are located typically represent the most flood-prone areas of a community.

A second category of RL properties has been identified for those properties that have sustained the highest levels of damages and claims, which are known as Severe Repetitive Loss (SRL) properties. The SRL properties are defined as buildings that are covered under a Standard Flood Insurance Policy (SFIP) and have sustained flood damage for which: (a) four or more separate claim payments have been made under a SFIP, with the amount of each claim exceeding $5,000, and with the cumulative amount of such claims exceeding $20,000; or (b) at least two separate claim payments have been main under an SFIP, with the cumulative amount of those payments exceeding the fair market value of the insured structure as of the day before the loss.

The identification of RL properties is an important element to conduct a local flood risk assessment, as the inherent characteristics of properties with multiple flood losses strongly suggest that they will be threatened by continual losses. The RL properties are also important to the NFIP as structures that floods frequently put a strain on for the National Flood Insurance Fund.

A primary goal of FEMA is to reduce the number of structures that meet these criteria, whether through elevation, acquisition, relocation, or a flood-control project that lessens the potential for continual losses.

According to FEMA, there are currently 195 Repetitive Loss properties and 20 Severe Repetitive Loss properties within the Northern Virginia region. The specific addresses of the properties are maintained by FEMA, VDEM, and local jurisdictions, but are deliberately not included in this Plan as required by Law. Of these 215 properties, fourteen (14) are unmitigated, and 112 of them are also uninsured. The insured properties have been paid more than $7.8 million from 247 payable claims.

Table 67 NFIP RL/SRL Summary shows the number of identified RL/SRL properties in the NOVA region. The table only identifies jurisdictions that have NFIP RL/SRL properties, and towns are included in the county count. Table 68 NFIP RL/SRL Properties gives greater detail of each property to include if they have been mitigated and the zone the property is in.

Table 67: NFIP RL/SRL Summary

COMMUNITY NAME	SINGLE FMLY RL	2-4 FAMILY RL	OTHR-RES RL	BUSI-NONRES RL	OTHR-NONRES RL	TOTAL RL	SINGLE FMLY SRL	2-4 FAMILY SRL	OTHR-RES SRL	BUSI-NONRES SRL	OTHR-NONRES SRL	TOTAL SRL
CITY OF ALEXANDRIA	80	8	5	1	6	100	3	0	1	1	1	6
ARLINGTON COUNTY	7	1	0	0	0	8	0	0	0	0	0	0
CITY OF FAIRFAX	4	1	1	0	1	8	0	0	0	0	0	0
FAIRFAX COUNTY	13	1	0	0	0	14	1	0	0	0	0	1
CITY OF FALLS CHURCH	22	0	0	0	0	22	4	0	0	0	0	4
LOUDOUN COUNTY	12	0	0	0	0	12	2	0	1	0	0	3
CITY OF MANASSAS	11	0	0	0	1	12	4	0	0	0	0	4

COMMUNITY NAME	SINGLE FMLY RL	2-4 FAMILY RL	OTHR-RES RL	BUSI-NONRES RL	OTHR-NONRES RL	TOTAL RL	SINGLE FMLY SRL	2-4 FAMILY SRL	OTHR-RES SRL	BUSI-NONRES SRL	OTHR-NONRES SRL	TOTAL SRL
CITY OF MANASSAS PARK	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**
PRINCE WILLIAM COUNTY	**13**	**1**	**0**	**0**	**1**	**13**	**1**	**0**	**0**	**0**	**1**	**2**

Table 68: NFIP RL/SRL Properties

Community Name	Mitigated	NFIP Insured	Rated Flood Zone 1	Occupancy 2
PRINCE WILLIAM COUNTY *	NO	NO	AE	SINGLE FMLY
PRINCE WILLIAM COUNTY *	YES	NO	AE	OTHR-NONRES
PRINCE WILLIAM COUNTY *	NO	NO	A	OTHR-NONRES
PRINCE WILLIAM COUNTY *	NO	SDF	AE	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	YES	AE	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	NO	A06	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	YES	AE	OTHR-NONRES
PRINCE WILLIAM COUNTY *	YES	NO	C	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	NO	X	SINGLE FMLY
PRINCE WILLIAM COUNTY *	YES	NO	X	SINGLE FMLY
PRINCE WILLIAM COUNTY *	YES	NO	C	SINGLE FMLY
PRINCE WILLIAM COUNTY *	YES	NO	X	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	SDF	AE	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	YES	AE	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	YES	A14	SINGLE FMLY
PRINCE WILLIAM COUNTY *	YES	NO	AE	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	NO	X	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	NO	AE	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	NO	X	2-4 FAMILY
PRINCE WILLIAM COUNTY *	NO	YES	X	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	NO	AE	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	NO	X	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	NO	AE	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	NO	X	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	YES	AE	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	YES	AE	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	YES	X	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	NO	X	SINGLE FMLY
PRINCE WILLIAM COUNTY *	NO	YES	AE	SINGLE FMLY
ARLINGTON COUNTY*	NO	YES	X	SINGLE FMLY
ARLINGTON COUNTY*	NO	NO	A04	2-4 FAMILY
ARLINGTON COUNTY*	NO	NO	B	2-4 FAMILY
ARLINGTON COUNTY*	NO	YES	X	SINGLE FMLY
ARLINGTON COUNTY*	NO	NO	X	SINGLE FMLY
ARLINGTON COUNTY*	NO	YES	X	SINGLE FMLY
ARLINGTON COUNTY*	NO	YES	X	SINGLE FMLY
ARLINGTON COUNTY*	NO	YES	X	SINGLE FMLY
ARLINGTON COUNTY*	NO	YES	X	SINGLE FMLY
LOUDOUN COUNTY *	NO	NO	A	SINGLE FMLY
LOUDOUN COUNTY *	NO	NO	A	OTHR-NONRES

Community Name	Mitigated	NFIP Insured	Rated Flood Zone 1	Occupancy 2
LOUDOUN COUNTY *	YES	NO	A	SINGLE FMLY
LOUDOUN COUNTY *	NO	YES	A	SINGLE FMLY
LOUDOUN COUNTY *	NO	NO	A	SINGLE FMLY
LOUDOUN COUNTY *	NO	YES	A	SINGLE FMLY
LOUDOUN COUNTY *	NO	YES	A	SINGLE FMLY
LOUDOUN COUNTY *	NO	YES	A17	SINGLE FMLY
LOUDOUN COUNTY *	NO	YES	X	SINGLE FMLY
LOUDOUN COUNTY *	NO	YES	B	SINGLE FMLY
LOUDOUN COUNTY *	NO	NO	AE	SINGLE FMLY
LOUDOUN COUNTY *	NO	NO	A	SINGLE FMLY
LOUDOUN COUNTY *	YES	NO	AE	SINGLE FMLY
LOUDOUN COUNTY *	NO	NO	AE	OTHR-NONRES
LOUDOUN COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	YES	NO	D	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	A	OTHR-NONRES
FAIRFAX COUNTY *	YES	NO	A06	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	YES	YES	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	SDF	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	YES	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	2-4 FAMILY
FAIRFAX COUNTY *	NO	YES	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	A	2-4 FAMILY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	A99	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	A	2-4 FAMILY
FAIRFAX COUNTY *	NO	YES	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY

Community Name	Mitigated	NFIP Insured	Rated Flood Zone 1	Occupancy 2
FAIRFAX COUNTY *	NO	NO	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	SDF	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	A	2-4 FAMILY
FAIRFAX COUNTY *	NO	NO	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	A	2-4 FAMILY
FAIRFAX COUNTY *	NO	NO	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	A	2-4 FAMILY
FAIRFAX COUNTY *	NO	NO	AE	2-4 FAMILY
FAIRFAX COUNTY *	NO	NO	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	A99	2-4 FAMILY
FAIRFAX COUNTY *	NO	YES	AE	2-4 FAMILY
FAIRFAX COUNTY *	NO	YES	AH	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY

Community Name	Mitigated	NFIP Insured	Rated Flood Zone 1	Occupancy 2
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	A	2-4 FAMILY
FAIRFAX COUNTY *	NO	NO	A99	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	A	2-4 FAMILY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	A	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	AE	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	YES	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
FAIRFAX COUNTY *	NO	NO	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	NO	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	NO	AE	OTHER RESID
ALEXANDRIA, CITY OF	YES	NO	A22	OTHR-NONRES
ALEXANDRIA, CITY OF	NO	NO	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	NO	AE	OTHER RESID
ALEXANDRIA, CITY OF	NO	SDF	AE	OTHR-NONRES
ALEXANDRIA, CITY OF	YES	YES	X	OTHR-NONRES

Community Name	Mitigated	NFIP Insured	Rated Flood Zone 1	Occupancy 2
ALEXANDRIA, CITY OF	NO	NO	A	OTHR-NONRES
ALEXANDRIA, CITY OF	NO	YES	AE	OTHR-NONRES
ALEXANDRIA, CITY OF	NO	NO	AE	OTHER RESID
ALEXANDRIA, CITY OF	NO	NO	AE	OTHER RESID
ALEXANDRIA, CITY OF	NO	NO	AE	OTHER RESID
ALEXANDRIA, CITY OF	NO	NO	AE	OTHER RESID
ALEXANDRIA, CITY OF	NO	NO	B	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	NO	AE	OTHR-NONRES
ALEXANDRIA, CITY OF	NO	NO	A04	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	OTHR-NONRES
ALEXANDRIA, CITY OF	NO	SDF	AE	BUSI-NONRES
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	NO	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	AE	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	2-4 FAMILY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	SDF	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	SDF	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	YES	X	SINGLE FMLY
ALEXANDRIA, CITY OF	NO	SDF	X	SINGLE FMLY
FAIRFAX, CITY OF	NO	NO	AE	SINGLE FMLY
FAIRFAX, CITY OF	NO	NO	A04	OTHR-NONRES
FAIRFAX, CITY OF	NO	NO	X	SINGLE FMLY
FAIRFAX, CITY OF	NO	NO	AE	OTHER RESID
FAIRFAX, CITY OF	NO	NO	AE	OTHER RESID
FALLS CHURCH, CITY OF	NO	NO	X	SINGLE FMLY
FALLS CHURCH, CITY OF	NO	NO	AE	SINGLE FMLY
FALLS CHURCH, CITY OF	NO	NO	AE	SINGLE FMLY
FALLS CHURCH, CITY OF	NO	YES	X	SINGLE FMLY

Community Name	Mitigated	NFIP Insured	Rated Flood Zone 1	Occupancy 2
FALLS CHURCH, CITY OF	NO	NO	X	SINGLE FMLY
FALLS CHURCH, CITY OF	NO	YES	C	SINGLE FMLY
FALLS CHURCH, CITY OF	NO	YES	AE	SINGLE FMLY
FALLS CHURCH, CITY OF	NO	NO	X	SINGLE FMLY
FALLS CHURCH, CITY OF	NO	YES	X	SINGLE FMLY
MANASSAS, CITY OF	NO	NO	A	SINGLE FMLY
MANASSAS, CITY OF	NO	YES	AE	SINGLE FMLY
MANASSAS, CITY OF	NO	NO	B	SINGLE FMLY
MANASSAS, CITY OF	NO	NO	X	SINGLE FMLY
MANASSAS, CITY OF	NO	YES	A	SINGLE FMLY
MANASSAS PARK, CITY OF	NO	YES	AE	SINGLE FMLY

5.5.2. Risk Assessment

Flooding impacts a community as it affects the lives of its citizens and overall community functions. As such, the most high-risk areas of a community will be those most affected by floodwaters in terms of potential loss of life, damage to homes and businesses, and disruption of community services and utilities. For example, an area with a floodplain near densely populated areas and a great deal of the built environment is more vulnerable to the impacts of flooding than a rural or undeveloped floodplain, where potential floodwaters would have little or no community impact.

The severity of flooding may be magnified to the degree that floodwaters affect vulnerable populations, or those that may require special assistance during a flood event or may not be able to protect themselves prior to an event or may not be able to understand potential risks. Populations such as non-English speaking persons, the elderly, the disabled, and those in lower socioeconomic groups may be at higher risk. Tourists and visitors to the area have also increased vulnerability, as they are less familiar with local geography and means by which residents are warned about potentially dangerous conditions.

5.5.2.1. Built Environment and Community Lifelines and Assets

The impacts of floodwaters on Community Lifelines, such as police and fire stations, hospitals, and water or wastewater treatment facilities can increase the overall impacts of a flood event on a community. In general, relatively few of these facilities in the Northern Virginia region are in areas with a high flood risk.

The built environment, especially along the shorelines of the Potomac River, is especially at risk to sea-level rise that is projected to occur as part of climate change. Climate change may include the region possibly experiencing more intense precipitation events that exacerbate flood impacts, creating higher levels of storm water run-off and damaging property and critical infrastructure.

5.5.2.2. Natural Environment and Economy

Many areas previously impacted by flood have been converted to open space or returned to their natural environment via jurisdictions. Recognition that filling in or paving over previously natural run-off areas along the region's rivers and creeks during earlier development has led to jurisdictions taking actions in recent years that return a waterway to its previous capacity to provide an alternate method for increasing water flow and storm-water run-off during rainfall events. Jurisdictions within the region are closely monitoring the increased incidence of flash flood specifically to identify localized trouble spots that may develop in the future.

The importance of recognizing each flood-related hazard is discussed in the publication Flood Risk Management Planning for Washington, DC,[119] which discusses flooding beyond the boundaries of the District of Columbia while assessing the risk from the Potomac River Watershed. The watershed encompasses the entire planning area and extends northward into Pennsylvania and westward to the Virginia/West Virginia state-line. In addition to addressing overall flood risk, the report describes riverine, interior, and coastal flooding, highlighting the need to identify and prepare for each flood hazard separately.

Additional resources are available to floodplain managers and other responsible departments and agencies to address flood risk.

[119] National Capital Planning Commission and The Silver Jackets, supported by United States Army Corps of Engineers (USACE), Flood Risk Management Planning for Washington, D.C.

Table 69: Flood Risk Management Resources[120]

		Flood Type			Tool Type		
Resource Name	**Agency**	**Riverine**	**Interior**	**Coastal**	**Projection**	**Map**	**Report**
Flood Insurance Rate Maps	FEMA	✓	✓	✓		✓	✓
Flood Inundation Mapping Tool	USACE	✓		✓		✓	
Storm Surge Inundation Maps	USACE			✓		✓	
Sea Level Rise Viewer	NOAA			✓		✓	
Surging Seas Risk Finder	Climate Central			✓	✓	✓	✓
Sea Level Change Curve Calculator	USACE			✓	✓		
Precipitation Modeling	DOEE		✓		✓		
CMIP Climate Data Processing Tool	DOT		✓	✓			

Publicly available flood risk data for each county in the planning area may be found online at the sites listed below, which indicate the degree to which each area takes flooding seriously and recognizes the need to disseminate hazard-related information to the public.

Table 70: Flood Preparedness and Risk Information Available from Northern Virginia Jurisdictions

Arlington County	Stormwater Management, Floodplains and Flood Insurance Maps https://www.arlingtonva.us/Government/Programs/Sustainability-and-Environment/Stormwater/Flood-Insurance-Rate-Maps
Fairfax County	Department of Emergency Management and Security https://www.fairfaxcounty.gov/emergency/readyfairfax/flooding
Loudoun County	Non-Regulatory Flood Risk Resources https://www.loudoun.gov/3944/Non-Regulatory-Flood-Risk-Products
Prince William County	Office of Emergency Management - Flooding https://www.pwcva.gov/flooding

As a resource for all communities located in the planning area, the Virginia Department of Conservation and Recreation provides information for each community to ascertain its flood risk,[121] and the National Weather Service website includes a page dedicated to Flooding in Virginia.[122]

5.5.2.3. Hazard Risk Ranking Summary

The hazard ranking process included consideration of probability and consequences in determining an overall risk score and ranking. Information presented within this section and the hazard risk ranking process present the quantitative and qualitative summary for flood/flash flood. The Hazard Identification and Risk Assessment methodology is described in **Section 4, Base Plan**.

[120] National Capital Planning Commission and The Silver Jackets, supported by United States Army Corps of Engineers (USACE), Flood Risk Management Planning for Washington, D.C.
[121] Commonwealth of Virginia, Department of Conservation and Recreation, Virginia Flood Risk, and Information, https://www.dcr.virginia.gov/dam-safety-and-floodplains/fpvfris, accessed November 12, 2021
[122] NOAA, National Weather Service, Flooding in Virginia, https://www.weather.gov/safety/flood-states-va, accessed November 12, 2021

Table 71: Hazard Risk Rankings for Flood, by Jurisdiction

Jurisdiction	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Arlington County	2.7	4.1	6.8	High
City of Alexandria	2.0	4.2	6.2	High
City of Fairfax	1.7	4.2	5.9	High
City of Falls Church	1.7	4.2	5.9	High
City of Manassas	1.7	4.2	5.9	High
City of Manassas Park	1.7	4.2	5.9	High
Fairfax County	2.7	4.2	6.9	High
Town of Clifton	1.7	4.2	5.9	High
Town of Herndon	1.7	4.2	5.9	High
Town of Vienna	1.7	4.2	5.9	High
Loudoun County	1.7	4.1	5.8	High
Town of Leesburg	1.7	4.1	5.8	High
Town of Lovettsville	1.7	4.1	5.8	High
Town of Middleburg	1.7	4.1	5.8	High
Town of Purcellville	1.7	4.1	5.8	High
Town of Round Hill	1.7	4.1	5.8	High
Prince William County	2.3	5.7	8.1	High
Town of Dumfries	1.7	4.2	5.9	High
Town of Haymarket	1.7	4.2	5.9	High
Town of Occoquan	4.0	6.9	10.9	High

5.5.3. Vulnerability Analysis

Multiple factors contribute to the relative vulnerabilities of certain areas in the floodplain. Development, or the presence of people and property in the hazardous areas, is a critical factor in determining vulnerability to flooding. Additional factors that contribute to flood vulnerability range from specific characteristics of the floodplain to characteristics of the structures located within the floodplain. Some of these factors, and how they may relate to the Northern Virginia planning region, include:

- **Flood depth:** The greater the depth of flooding, the higher the potential for significant damages.
- **Flood duration:** The longer duration of time that floodwaters are in contact with building components, such as structural members, interior finishes, and mechanical equipment, the greater the potential for damage.
- **Velocity:** Flowing water exerts forces on the structural members of a building, increasing the likelihood of significant damage.
- **Elevation:** The lowest possible point where floodwaters may enter a structure is the most significant factor contributing to its vulnerability to damage due to flooding.
- **Construction Type:** Certain types of construction are more resistant to the effects of floodwaters than others. Typically, masonry buildings, constructed of brick or concrete blocks, are the most

resistant to damages simply because masonry materials can come into contact with limited depths of flooding without sustaining significant damage. Wood frame structures are more susceptible to damage because the construction materials used are easily damaged when inundated with water.

5.5.3.1. Exposure

Estimations of potential exposure and loss in this section are based on data from both historical and scenario analysis.

Erosion vulnerability for the region is difficult to determine because there are no historical records for previous occurrences of erosion events. The Northern Virginia region's vulnerability to erosion is limited to those immediate areas along rivers, creeks, and streams, and to areas of loose soils with steep slopes such as valleys and road-cuts. In most cases where erosion poses an imminent threat to property, erosion control techniques are typically applied before damages occur. Therefore, future structural damages caused by long-term erosion and associated dollar losses are expected to be negligible.

As discussed previously in this section, the NVRC prepared a study that identified the erosion situation for various segments of the shoreline in the Northern Virginia region, as well as the locations of "priority" erosion concern. Future updates will re-assess progress in addressing shoreline erosion through the current and succeeding studies.

Estimation of Flood Losses

Hazus is a regional loss estimation model developed by FEMA and the National Institute of Building Sciences to provide both a methodology and software application for use in developing multi-hazard losses on a regional scale. Loss estimates are used primarily by local, state, and regional officials to plan and foster efforts to reduce risk from multi-hazards, and to help communities better develop their emergency response and recovery programs.

The 2022 Hazus for the Flood hazard analysis was completed using a 100-year scenario, or a scenario of flood extent determined as an event that includes a 1 percent annual chance of flooding in any given year. This section highlights points from the Hazus flood module summary report. Full reports on Hazus data generated for all three hazards are included in **Appendix B**.

The Hazus flood scenario extent (geographic breadth) that identifies exposed essential facilities and total exposure for a 100-year flood scenario was run for each county and city within the planning area. County-level reports and data include towns.

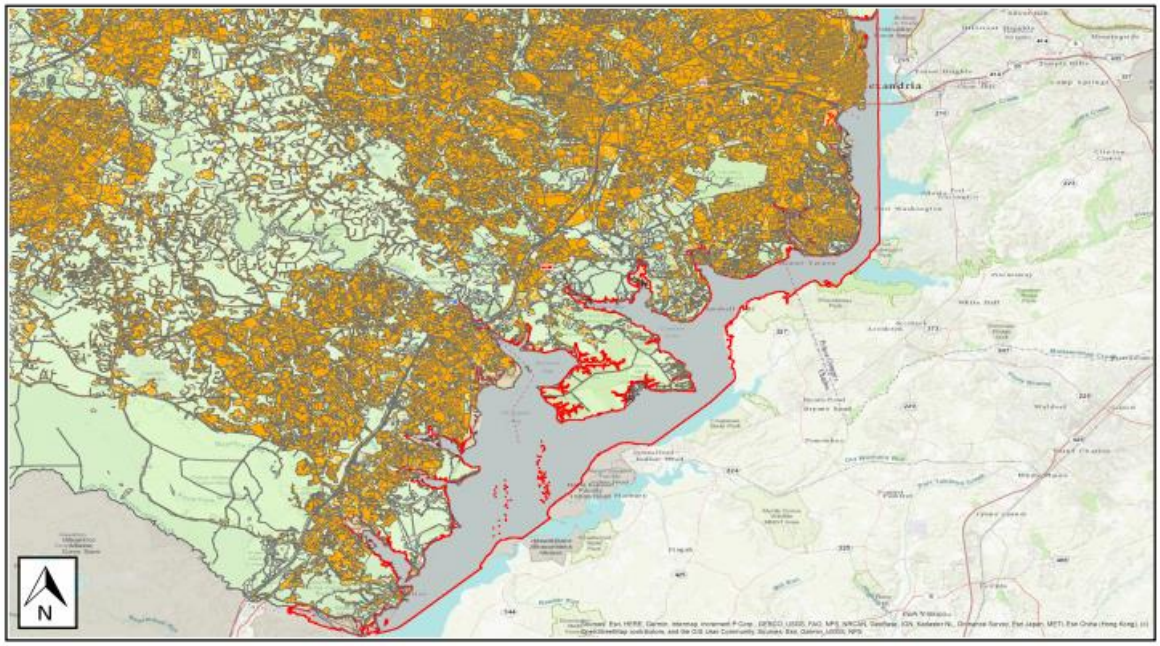


Figure 38: Area Included in the HAZUS Flood Model Run for a 100-Year Flood Scenario[123]

The Flood Hazus report includes summaries of physical damage to residential and commercial buildings, schools, essential facilities, and infrastructure, as well as economic loss including lost jobs, business interruptions, repair, and reconstruction costs.

Flood Hazard Elements Discussed in the 2022 Hazus Flood Model Report

8. Flood Vehicle Dollar Exposure (Night)
9. Flood Transportation System Dollar Exposure
10. Flood Utility System Dollar Exposure
11. Flood Building Stock Exposure by General Occupancy
12. Flood Building Stock Exposure by Building Type
13. Flood Building Damage by Building Type
14. Flood Vehicle Damage Exposure (Day)
15. Flood Building Damage Count by General Building Type
16. Flood Building Damage by General Occupancy (Pre-Firm)
17. Flood Building Damage by General Occupancy (Post-Firm)
18. Flood Building Damage by General Occupancy
19. Flood Building Damage Count by General Occupancy Pre-Firm
20. Flood Building Damage Count by General Occupancy Pre-Firm
21. Flood Building Damage by General Occupancy
22. Flood Fire Station Facilities Damage and Functionality
23. Flood Emergency Operation Center Damage and Functionality

[123] Hazus Flood Global Summary Report – Study Region Overview Map.

24. Flood School Damage and Functionality
25. Flood Police Station Facilities Damage and Functionality
26. Flood Care Facilities Damage and Functionality
27. Flood Potable Water System Facility Damage
28. Flood Light Rail Bridge Damage and Functionality
29. Flood Highway Bridge Damage and Functionality
30. Flood Global Summary Report
31. Flood Combined Wind and Flood Direct Economic Losses for Buildings
32. Flood Debris Summary Report
33. Flood Quick Assessment Report
34. Flood Waste Water Facility Damage
35. Flood Direct Economic Loss for Transportation
36. Flood Depreciated Direct Economic Loss for Buildings
37. Flood Direct Economic Annualized Losses for Buildings

A community's vulnerability to the flood hazard is calculated by relating potential flooding depth to the annual chance of inundation for that depth. An analysis of the 100-year return interval event was performed to assess risk to essential facilities.

Depth, duration, and velocity of water in the floodplain are the primary factors contributing to flood losses. Associated hazards that contribute to flood losses include channel erosion and migration, sediment deposition, bridge scouring, and the impact of flood-born truck. The Hazus Flood Model allows users to estimate flood losses due to flood velocity to the general building stock. The flood model does not currently estimate losses due to high velocity flash floods.

The Hazus flood assessment included streams and coastal reaches located in the planning region with a drainage area of ten square miles or more. The flood depth grid was developed for the 100-year return period. The flood model incorporates NFIP entry dates to distinguish pre-FIRM and post-FIRM census blocks. A 10-mile threshold was used to delineate stream reaches in the event of overflow. Loss estimation for this Hazus module is based on specific input data (i.e., square footage of buildings for specified types or populations) and local economic data for use in estimating the economic impact of flood hazards. Data for this analysis was provided at the census block level.

Table 72: Hazus Direct Economic Loss Categories and Descriptions[124]

Name	Data Input for HAZUS Model	HAZUS Output
Building	Cost per sq. ft. to repair damage by structural type and occupancy for each level of damage	Cost of building repair or replacement of damaged and destroyed buildings
Contents	Replacement value by occupancy	Cost of damage to building contents
Inventory	Annual gross sales in $ per sq. ft.	Loss of building inventory as contents related to business activities
Relocation	Rental costs per month per sq. ft. by occupancy	Relocation expenses (for businesses and institutions)

[124] Hazus Global Reports, August 3, 2021.

Name	Data Input for HAZUS Model	HAZUS Output
Income	Income in $ per sq. ft. per month by occupancy	Capital-related incomes losses as a measure of the loss of productivity, services,
Rental	Rental costs per month per sq. ft. by occupancy	Loss of rental income to building owners
Wage	Wages in $ per sq. ft. per month by occupancy	Employee wage loss as described in income loss

The Hazus flood analysis predicts that the direct economic losses to buildings and their contents due to a major 100-year flood event in Northern Virginia region is $1,616,891,000. This was calculated for Capital Stock and Income Losses and was broken down into respective subcategories: Capital Stock Losses include losses for building, contents, and inventory; Income Losses include relocation, capital-related, wages, and rental income losses.

Table 73: Direct Economic Losses for Buildings and Building Economic Losses for 100-Year Flood Scenario[125]

Jurisdiction	Capital Stock Losses				Income Losses				
	Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Arlington County	561,000	506,000	5,000	0.3	58,000	174,000	159,000	30,000	$1,493,000
Alexandria, City of	39,906,000	42,504,000	670,000	1.3	16,353,000	26,828,000	25,850,000	10,291,000	$162,402,000
Loudoun County *Including the Towns of Leesburg, Lovettsville, Purcellville, Middleburg, and Round Hill*	178,368,000	132,180,000	1,207,000	3.2	31,066,000	23,202,000	55,983,000	12,719,000	$434,725,000
Fairfax County *Including the Towns of Clifton, Herndon, and Vienna*	178,167,000	130,489,000	2,270,000	1.4	30,419,000	27,261,000	50,150,000	12,835,000	$431,591,000

[125] Hazus Report Flood Direct Economic Losses for Buildings, August 3, 2021

Jurisdiction	Capital Stock Losses				Income Losses				
	Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Prince William County *Including the Towns of Dumfries, Haymarket, and Occoquan, and Quantico*	240,638,000	175,751,000	3,039,000	2.4	41,114,000	41,151,000	54,676,000	18,434,000	$574,803,000
Manassas, City of	2,054,000	3,352,000	11,000	11.4	825,000	3,409,000	1,591,000	635,000	$11,877,000
Total	**$639,694,000**	**$484,782,000**	**$7,202,000**	**20.00%**	**$119,835,000**	**$122,025,000**	**$188,409,000**	**$54,944,000**	**$1,616,891,000**

For the flood scenario model, the built-in default inventory of assets included in the standard Comprehensive Data Management System (CDMS) was used, with no inventory adjustments accounting for locally reported critical assets (e.g., Level 1 analysis). As such, discrepancies may appear between self-reported critical asset data and Hazus-generated data included in this section. **Appendix D** includes a description of the methodology used for the flood scenarios described in this section, and the grouping of counties, cities, and towns in each model.

Essential Facilities at Risk

The vulnerability of the region's building stock was assessed using GIS analysis to identify an asset's location within the extent of known hazard areas that can be spatially defined. Determinations were made by using the most recent available data for critical facility locations and delineable hazard areas. The actual level of risk for each facility may only be determined by additional on-site assessment.

Table 74: Number of Critical Facilities Potentially at Risk to Flood[126]

Jurisdiction	Fire Stations	Hospitals	Police Stations	Schools	EOCs	Total
Arlington County	0	0	0	0	0	0
Fairfax County	1	0	0	0	0	1
Town of Clifton	0	0	0	0	0	0
Town of Herndon	0	0	0	0	0	0
Town of Vienna	0	0	0	0	0	0
Loudoun County	1	0	0	0	0	1
Town of Leesburg	0	0	0	0	0	0
Town of Lovettsville	0	0	0	0	0	0
Town of Purcellville	0	0	0	0	0	0
Town of Middleburg	0	0	0	0	0	0
Town of Round Hill	0	0	0	0	0	0
Prince William County	0	0	1	0	0	1
Town of Dumfries	0	0	0	0	0	0
Town of Haymarket	0	0	0	0	0	0
Town of Occoquan	0	0	0	0	0	0
City of Alexandria	0	0	0	1	0	1
City of Fairfax	0	0	0	0	0	0
City of Falls Church	0	0	0	0	0	0
City of Manassas	0	0	0	0	0	0
City of Manassas Park	0	0	0	0	0	0
TOTAL	**2**	**0**	**1**	**1**	**0**	**4**

Table 75: Estimated Shelter Requirements[127]

[126]Hazus Flood Reports: Fire Station Facilities Damage and Functionality; Care Facilities (Hospital) Damage and Functionality; Police Station Facilities Damage and Functionality; School Damage and Functionality; and Emergency Operation Center Damage and Functionality. Dated August 3, 2021.
[127] Hazus Flood Shelter Summary Report, August 3, 2021

Jurisdiction	Number of Displaced People	Number of People Needing Short-Term Sheltering
Arlington County	14	13
Fairfax County	5,039	2,858
Town of Clifton	0	0
Town of Herndon	0	0
Town of Vienna	0	0
Loudoun County	3,088	1,396
Town of Leesburg	0	0
Town of Lovettsville	0	0
Town of Purcellville	0	0
Town of Middleburg	0	0
Town of Round Hill	0	0
Prince William County	4,806	2,192
Town of Dumfries	0	0
Town of Occoquan	0	0
City of Alexandria	2,465	1,011
City of Fairfax	0	0
City of Falls Church	0	0
City of Manassas	0	0
City of Manassas Park	0	0
TOTAL	**15,412**	**7,470**

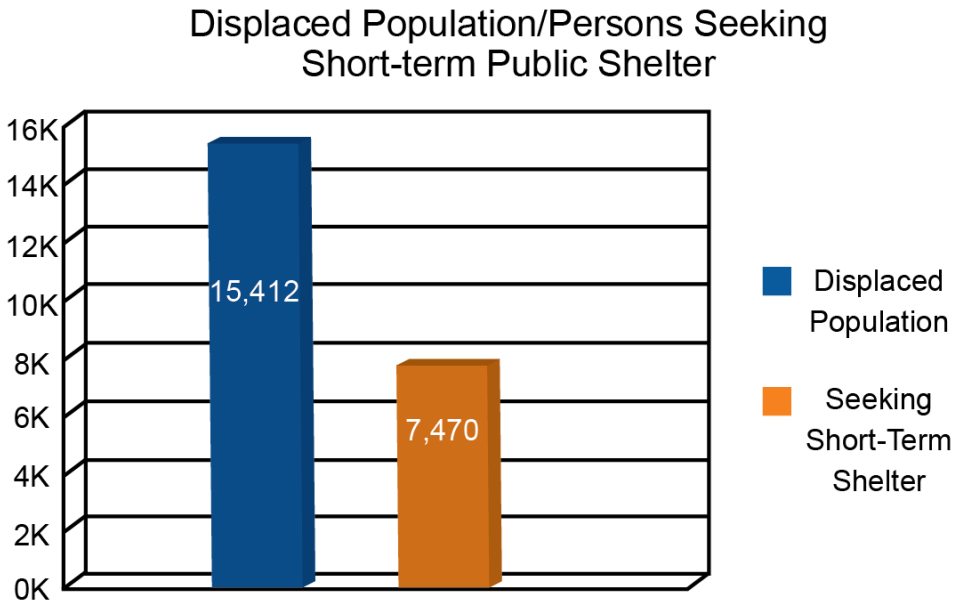


Figure 39: Comparison of Displaced Population/Persons Seeking Short-term Public Shelter in Northern Virginia Region[128]

Northern Virginia properties most vulnerable to flooding are in SFHAs identified by FEMA, which were produced after Flood Insurance Studies (FIS) for each area were completed. The Digital FIRMs for each jurisdiction illustrate the location of SFHAs based on the most recently available floodplain data provided by the FEMA Map Service Center. Digital data was available for all localities within the Northern Virginia planning region.

Overall Loss Estimates and Ranking

The loss estimates and ranking results for the flood hazard in the Northern Virginia region is primarily based on the results of the detailed GIS and Hazus analysis, NCEI Storm Events Database, the hazard analysis included in the 2018 Commonwealth of Virginia Hazard Mitigation Plan, and each jurisdiction's qualitative ranking.

A number of flooding events throughout the region have been documented by NCEI. Events range widely in terms of location, magnitude, and impact. The most frequent flooding events are localized and result from heavy rains in a short period of time over urbanized areas that are not able to appropriately handle storm water runoff. These events typically do not threaten lives or property and will not result in emergency or disaster declarations, thus historical data of this type of flooding is not readily available.

The Commonwealth of Virginia's 2018 Hazard Mitigation Plan ranking of the flood hazard was based on the NCEI database. This update to the NOVA HMP used this same framework to establish a common system for evaluating and ranking hazards. The geographic extent score for each jurisdiction is based on the percent of the jurisdiction that falls within the SFHA, as defined by FEMA.

5.5.3.2. Potential Impacts of Climate Change

The impacts of climate change related to future floods and flash floods, which includes related erosion, is discussed in **Section 6, Impacts of Global Warming**.

5.5.3.3. Future Population and Development Trends

Future development and the resulting population increase have the potential to elevate vulnerabilities to flood and flash flood in the future, depending on climate change variables and the capabilities of jurisdictions to balance development pressures in relation to appropriate use of floodplains. Continued focus on enhancing floodplain and stormwater management regulations and practices will be key to reducing the risk from future development.

5.5.3.4. Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluating, and updating of this Plan should consider the following factors related to flood/flash flood as well as other information from the Virginia COV-SHMP:

- Have any flood/flash flood events occurred since adoption of this plan?
- Has any new scientific research or methodology changed the ability to predict flood/flash flood events or to assess risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to flood/flash flood?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to flood/flash flood?

[128] HAZUS Flood Shelter Summary Report, August 3, 2021

5.6. High Winds/Severe Storms (Including Thunderstorms, Hurricanes, and Tropical Storms)

2022 HMP Update

For the 2022 updated HMP, Hurricanes and Tropical Storms are included with High Winds and Severe Storms.

The 2022 Plan update continued to incorporate formatting changes and analyses implemented in the 2017 Plan. These changes include but were not limited to the following:

- Re-examining High Winds, Severe Storms, Thunderstorms, Hurricanes, and Tropical Storms.
- Refreshing the hazard profiles for each hazard included in this section
- Updating the previous occurrences
- Updating the assessment of risk by jurisdiction based on new data
- Ranking of the hazards by jurisdiction using the methodology described in Section 4
- Reformatting the section to improve clarity and, as available and appropriate, incorporate new maps and imagery

Table 76: High Winds/Severe Storms Profile

<table>
<tr><th colspan="4">High Winds/Severe Storms[129]</th><th>Overall Vulnerability</th></tr>
<tr><th colspan="4">Definitions, Key Terms, and Overview</th><td rowspan="4">High</td></tr>
<tr><td colspan="4">High Winds: Winds not associated with a specific thunderstorm or hurricane that are 40 mph or greater, or wind gusts of 58 mph or greater.
Severe Storms/Thunderstorms: A thunderstorm that produces hail of one inch in diameter or larger and/or winds equal or exceeding 58 mph
Tropical Storm: A tropical cyclone that has maximum sustained surface winds of between 39 mph (34 knots) and 74 mph (64 knots).[130]
Hurricane: A tropical cyclone that has maximum sustained surface winds of 74 mph or greater (74 knots or greater).[131]</td></tr>
<tr><th>Frequency</th><th>Probability</th><th colspan="2">Potential Magnitude</th></tr>
<tr><td rowspan="2">High</td><td rowspan="2">Likely</td><td>Injuries/Deaths</td><td>Infrastructure</td><td>Environment</td></tr>
<tr><td>Low</td><td>High</td><td>Moderate</td></tr>
</table>

[129] NOAA National Weather Service, Hazard Weather Definitions. Retrieved at: https://www.weather.gov/unr/hwd
[130] National Hurricane Center, Tropical Cyclone Wind Speed Probabilities Products. Retrieved at: https://www.nhc.noaa.gov/aboutnhcprobs2.shtml
[131] National Hurricane Center, Tropical Cyclone Wind Speed Probabilities Products. Retrieved at: https://www.nhc.noaa.gov/aboutnhcprobs2.shtml

5.6.1. Hazard Profile: High Winds/Severe Storms

Wind is the motion of air past a given point caused by a difference in pressure between one location and another. Wind poses a threat to Northern Virginia in many forms, including wind produced by severe thunderstorms and tropical weather systems. The effects can include blowing debris and interruptions in elevated electrical power and communications utilities; wind can also intensify the effects of severe storms that occur in combination with winter weather. The hazard may harm people and animals and damage property and infrastructure.

More than 100,000 thunderstorms occur each year in the United States, though only about 10% of these storms are classified as *severe*. A thunderstorm with wind gusts in excess of 58 mph (50 knots) and/or hail with a diameter of 1 inch or more is classified as a severe thunderstorm. Although thunderstorms affect a small area, they are dangerous because they can generate tornadoes, hail, strong winds, flash flooding, and lightning. While thunderstorms can occur in all regions of the United States, they are most common in the central and southern states, because atmospheric conditions in those areas are ideal for generating and feeding these powerful storms.[132]

Thunderstorms occur when air masses of varying temperatures and moisture content collide. Rapidly rising warm, moist air is the driving force behind the creation of thunderstorms. These events may occur singularly, in lines, or in clusters. They can move through an area quickly or linger for hours. Straight-line winds, which in extreme cases may result in wind gusts that exceed 100 mph, are responsible for most thunderstorm-related wind damage. One type of straight-line wind, the downburst, can cause damage equivalent to that of a strong tornado and can be extremely dangerous to the aviation industry.

Lightning, which may accompany high winds, 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. As it flashes, lightning rapidly heats the surrounding air, which cools following the bolt. This rapid heating and cooling of the air causes thunder. On average, 89 people are killed each year by lightning strikes in the United States.

Some storms produce a particular type of high wind called a derecho. Derechos are widespread, long-lived, straight-line windstorms associated with severe thunderstorms. They can cause hurricane-force winds, tornadoes, heavy rains, and flooding. Derechos travel quickly, with sustained winds that often exceed the threshold for hurricane-force winds. They typically occur in the summer months, though they can occur any time of year and at any time of the day or night.

Hailstorms are another potentially destructive outgrowth of severe thunderstorms. Early in the development 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 inches (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.

Derechos are another type of severe storm. Though Derechos strike more frequently in the Mississippi River Valley, they also occur in the eastern United States often enough for the NWS to map their frequency of occurrence. In addition to high winds and hail associated with these events, severe storms

[132] National Weather Service

can also be accompanied by lightning, which may cause fires, property damage, and death, or serious injury to humans.

Hurricanes and tropical storms, as well as nor'easters and typhoons, are classified as cyclones and defined as a closed circulation developing around a low-pressure center in which the winds rotate counterclockwise in the Northern Hemisphere (and clockwise in the Southern Hemisphere) and whose eye diameter typically 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 buildup 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. Tropical cyclone formation requires a low-pressure disturbance, warm sea surface temperature, rotational force created by the earth's rotation, and the absence of significant wind shear in the lowest 50,000 feet of the atmosphere. Most hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea, or 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.

Such events can be dangerous and costly for affected communities, as was learned during Hurricane Isabel in 2003 when the region suffered approximately $32 million in damages (nearly $2 billion statewide). In 2011, the remnants of Tropical Storm Lee impacted Fairfax and Prince William Counties and the City of Alexandria. The storm dropped between five and seven inches of rain over the Northern Virginia area. In Fairfax County, the Virginia Department of Transportation estimated the storm caused approximately $10 million in damages to roads and bridges throughout the county. In late October 2012, Hurricane Sandy blanketed the region with heavy rain and high winds, resulting in downed trees, debris issues, and transportation interruptions.

This section includes NOAA, National Centers for Environmental Information (NCEI) data listed for the period January 1, 1950, through May 31, 2021 and the following hazards in the search criteria: High Wind, Hurricane (Typhoon), Marine High Wind, Marine Strong Wind, Marine Thunderstorm Wind, Strong Wind, Thunderstorm Wind, Tropical Depression, and Tropical Storm.

Table 77: Hazard Profile Summary

High Wind/ Severe Storm, Including Thunderstorms and Hurricanes **Assessment: High Risk Hazard**	**Location**	Jurisdiction-wide	**Potential Cascading Effects** • Power/utility outages • Traffic/roadway damage or closures • Visitor/staff safety • Need for increased security • Loss of deliverable services • Redirect industry/government assets (people/equipment) • Loss of revenue
	Extent	Moderate to significant	
	Duration	Several minutes to several hours	
	Probability	Likely	
	Seasonal Pattern	Year-round, but more intense in summer and hurricane season from June 1 to November 30	
	Speed of Onset	Slow	
	Warning Time	Minutes to hours and days	

	Repetitive Loss	N/A	

5.6.1.1. Location

Thunderstorms are relatively common across Northern Virginia and have been known to occur in all calendar months. No one portion of Northern Virginia is more likely than another to experience thunderstorms.

Although the Northern Virginia region rarely experiences the direct impact of a landfalling hurricane, all jurisdictions within the planning area are susceptible to the remnants of such storms, including hurricane- and tropical storm-force winds, heavy rains, and significant storm surge and tidal flooding. Coastal jurisdictions along the Potomac River can also experience storm surge or tidal flooding.

5.6.1.2. Extent

The extent of the High Winds Hazard depends on the assets affected when an event strikes the planning area, as well as the strength of the storm precipitating the high winds. Wind events can cause damage as slight as toppled patio chairs and as severe as uprooted large trees and destroyed structural roofing.

Several tools provide measurement of the magnitude and severity of high winds/severe storm events.

Beaufort Wind Scale

Force levels six through 12 on the Beaufort Wind Scale describe the impact high winds can have on the natural and built environment.

Table 78: Beaufort Wind Scale

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects
0	< 1	Calm	Calm; smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction; wind vanes still
2	4-7	Light Breeze	Wind felt on face; leaves rustle, vanes begin to move
3	8-12	Gentle Breeze	Leaves and small twigs constantly moving; light flags extended
4	13-18	Moderate Breeze	Dust, leaves, and loose paper lifted; small tree branches move
5	19-24	Fresh Breeze	Small trees begin to sway
6	25-31	Strong Breeze	Larger tree branches moving; whistling in wires
7	32-38	Near Gale	Whole trees moving; resistance felt walking against wind
8	39-46	Gale	Whole trees in motion; resistance felt walking against wind
9	47-54	Strong Gale	Slight structural damage occurs; slate blows off roofs
10	55-63	Storm	Seldom experienced on land; trees broken or uprooted, "considerable structural damage"

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects
11	64-72	Violent Storm	If experienced on land, widespread damage
12	73+	Hurricane	Violence and destruction

Wind Zone Map

FEMA's wind zone map (see Figure 40) shows how extreme windstorms vary in frequency and strength across the United States. The map 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 and the strongest tornadoes. Wind speeds in Zone IV can be as high as 250 mph. The planning area in the map is highlighted in green and falls within Zone II, a hurricane-susceptible region where winds can be as high as 160 mph.

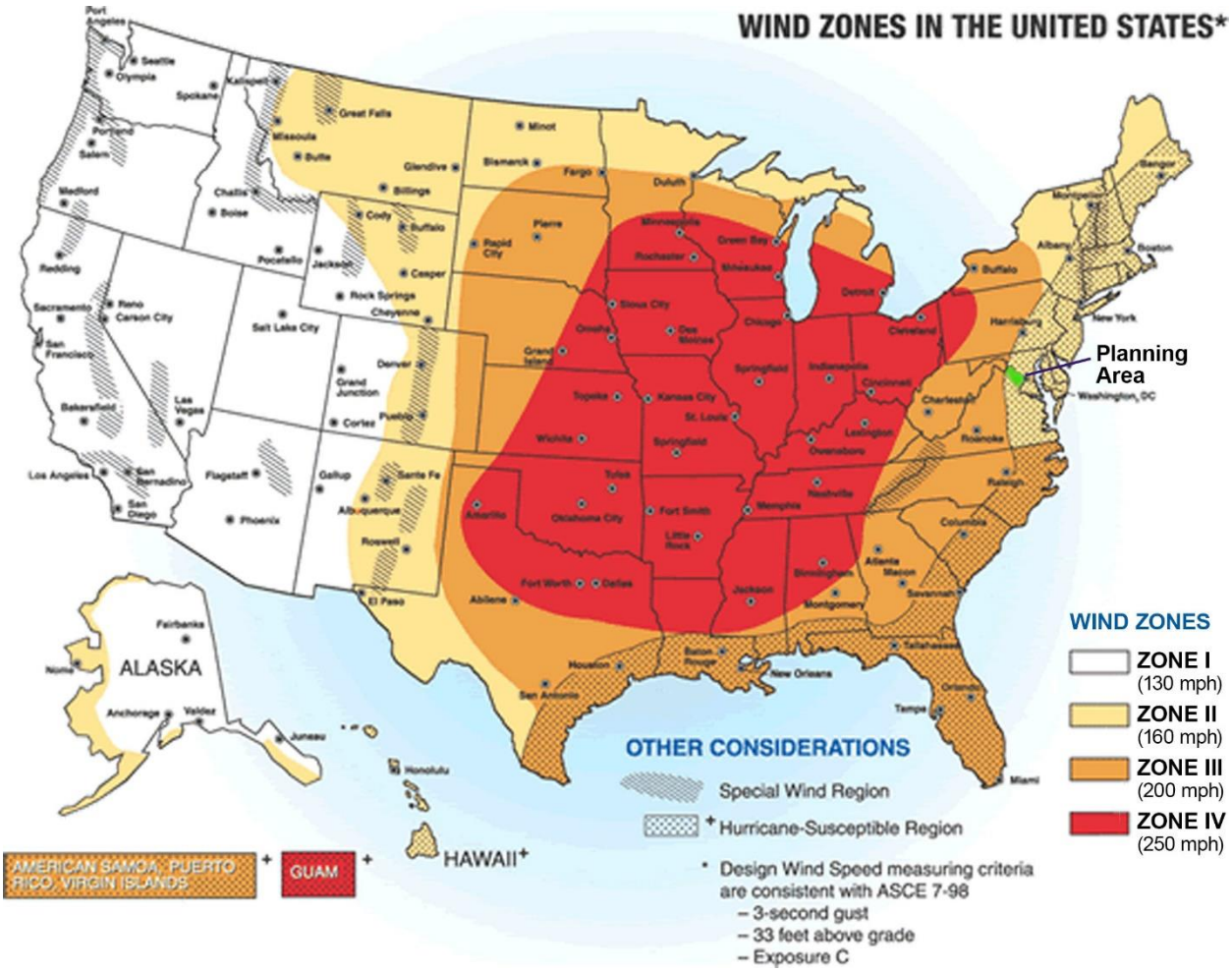


Figure 40: Wind Zones in the United States

Hurricanes develop when barometric pressure (measured in millibars or inches) at the center of a tropical disturbance falls and winds increase. If the atmospheric and oceanic conditions are favorable, this disturbance can intensify into a tropical depression. When maximum sustained winds reach or exceed 39

mph, the system is designated a tropical storm, given a name, and closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 mph, the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Scale currently used by NOAA's National Hurricane Center, which rates hurricane intensity on a scale of 1 to 5, with 5 being the most intense (see **Error! Reference source not found.**).

Saffir-Simpson Hurricane Wind Scale

The Saffir-Simpson scale provides examples of the type of damage and impacts in the United States associated with winds of the indicated intensity. Categories 3, 4, and 5 are classified as "major" hurricanes, and while hurricanes within this range comprise only 20% of total tropical cyclone landfalls, they cause 70% of the damage in the United States.

In general, the extent of damage rises by an estimated factor of four for every category increase.[133] It should be noted that the descriptions of wind-caused damage linked to the scale depend on local building codes and how well they are enforced. The scale does not address other hurricane-related impacts, such as storm surge, rainfall-induced floods, and tornadoes.

Table 79: Saffir-Simpson Hurricane Wind Scale[134]

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74–95 mph 64–82 kt 119–153 km/h	Very dangerous winds will produce some damage. Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles will likely result in power outages that could last several days.
2	96–110 mph 83–95 kt 154–177 km/h	Extremely dangerous winds will cause extensive damage. Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111–129 mph 96–112 kt 178–208 km/h	Devastating damage will occur. Well-built frame homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130–156 mph 113–136 kt 209–251 km/h	Catastrophic damage will occur. Well-built frame homes may sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157+ mph 137+ kt 252+ km/h	Catastrophic damage will occur. A high percentage of frame homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks to months.

[133] National Hurricane Center, The Saffir-Simpson Hurricane Wind Scale, May 2021. Retrieved at: https://www.nhc.noaa.gov/aboutsshws.php
[134] Ibid.

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 to 20 feet or more in a Category 5 storm; it is dependent on the topography of the land being impacted and other storm variables. The storm surge arrives ahead of landfall of the storm's eye, and, in general, the more intense the hurricane is, the higher the surge level. 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 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 and associated breaking waves can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast.

Hurricanes may also spawn damaging tornadoes and cause inland flooding associated with heavy rainfall that usually accompanies these storms. For example, Hurricane Floyd was at one time a Category 4 hurricane racing towards the North Carolina coast. As far inland as Raleigh, more than 100 miles from the coast, communities were preparing for extremely damaging winds exceeding 100 mph. However, Floyd made landfall as a Category 2 hurricane and will be remembered for causing the worst inland flooding disaster in North Carolina's history. In Virginia, Floyd dropped 10-20 inches of rain over the southeastern part of the Commonwealth, causing the closure of more than 300 roads from flooding and downed trees. A total of 64 jurisdictions were affected by the more than $255 million in storm damages.[135]

Like 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. These storms track 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.

Nor'easters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding. There are two main components to a nor'easter: (1) a Gulf Stream low-pressure system (counterclockwise winds) generated off the southeastern coast, gathering warm air and moisture from the Atlantic and pulled up the East Coast while generating strong northeasterly winds along the western forward quadrant of the storm; and (2) an Arctic high-pressure system (clockwise winds) which meets the low-pressure system with cold, air blowing down from Canada. When the two systems collide, the moisture and cold air produce a mix of precipitation and have the potential for creating dangerously high winds and heavy seas. As the low-pressure system deepens, the intensity of the winds and waves will increase and cause serious damage to coastal areas as the storm moves northeast.

Table 80: Dolan-Davis Nor'easter Intensity Scale, with Levels of Coastal Degradation[136]

Storm Class	Beach Erosion	Dune Erosion	Overwash	Property Damage
1 (Weak)	Minor changes	None	No	No
2 (Moderate)	Modest, mostly to lower beach	Minor	No	Modest
3 (Significant)	Erosion extends across beach	May be significant	No	Loss of many structures at local level
4 (Severe)	Severe beach erosion	Severe dune erosion	On low beaches	Loss of structures at community level

[135] National Weather Service, Wilmington, NC Weather Forecast Office. Hurricane Floyd: September 16, 1999. Retrieved at: https://www.weather.gov/ilm/Floyd
[136] North Carolina Division of Emergency Management

5 (Extreme)	Extreme beach erosion	Dunes destroyed over extensive areas	Massive, in sheets and channels	Extensive at regional level; millions of dollars

5.6.1.3. Previous Occurrences

Numerous severe storm and high wind events have been identified and recorded as reported to NCEI. They have occurred throughout the planning region but have varied widely in terms of location, magnitude, and impact. Where possible, NCEI tracks reports of these events separately by impacted jurisdiction, although it is not always possible to identify damages below a county or city level. In most cases, therefore, damages that were reported for counties and cities include damages that occurred within towns. Damage reports for towns are included in county reports. This report includes over 1,800 separately recorded events that caused approximately $61,543,400 in combined property and crop damage and resulted in 54 reported injuries and six fatalities in the region.

Table 81: High Wind and Severe Storm Events in Northern Virginia, 1950-2021[137]

Jurisdiction	Number of High Wind/ Severe Storm Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
Arlington County	182	0	29	$10,350,100	$5,750	$10,355,850
City of Alexandria	65	0	0	$450,000	0	$450,000
City of Fairfax	24	1	0	$87,000	0	$87,500
City of Falls Church	22	0	0	$395,000	0	$395,000
City of Manassas	33	0	0	$761,500	$2,000	$763,500
City of Manassas Park	1	0	0	$10,000	0	$10,000
Fairfax County *Including* *Town of Clifton* *Town of Herndon* *Town of Vienna*	595	4	17	$29,389,850	$62,250	$29,452,100
Loudoun County *Including* *Town of Leesburg* *Town of Lovettsville* *Town of Middleburg*	532	1	6	$2,224,650	$219,600	$2,444,250

[137] NOAA, National Centers for Environmental Information, High Wind and Severe Storm Events, as of May 31, 2021.

Jurisdiction	Number of High Wind/ Severe Storm Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
Town of Purcellville *Town of Round Hill*						
Prince William County *Including* *Town of Dumfries* *Town of Haymarket* *Town of Occoquan* *Town of Quantico*	301	0	2	$17,503,450	$81,750	$17,585,200
TOTAL	**1,820**	**6**	**54**	**$61,171,550**	**$371,350**	**$61,543,400**

Significant Wind Events

On **May 26, 2021**, fourteen jurisdictions throughout the planning area reported thunderstorm wind occurrences with wind speeds of between 50 and 72 mph. A pre-frontal trough and approaching cold front ignited multiple rounds of severe thunderstorms during the afternoon and evening hours. Some thunderstorms produced significant microbursts. Communities reported a collective damage total of $477,000.

On **July 22, 2020**, reports of damage totaling $136,000 were recorded by NCEI. An upper-level trough interacted with a stalled surface front draped over the Mid-Atlantic, resulting in numerous scattered showers and thunderstorms developing as early as midday in the lee of the Appalachian Mountains. The storms coalesced into a bow echo and moved eastward across central Maryland and Northern Virginia (including the Washington, D.C. metro region) during the midafternoon and exited the area by nightfall.

On **June 23, 2015**, 13 communities in all four Northern Virginia counties, plus the City of Alexandria, were affected by a front that moved south through the region. Southerly flow ahead of the front led to an unstable air mass, which combined with steepening mid-level lapse rates and increased shear leading to numerous severe thunderstorms being triggered ahead of the front. The collective damages reported by all communities equaled $19,000, but all jurisdictions were affected by downed trees and wind gusts of 50 mph and higher.

During the afternoon and evening of Friday **June 29, 2012**, an intense, long-lived line of thunderstorms raced eastward at nearly 60 mph from the Midwest to the Mid-Atlantic coast. In their wake, these storms left behind a swath of destruction that killed at least 20 people, caused millions in property damage, and caused massive power outages in major urban areas along the storm's path. Meteorologists use the term "derecho" to describe this special type of violent and long-lived windstorm.

In addition, with this derecho, communications were disrupted across large areas, including the national Capital/DC region. In northern Virginia, loss of power to a key communications facility knocked out the 911 service for a period of time. Other communications issues were loss of telephone landlines, disruptions to cellular network calling, and scattered outages to internet service among private, government, and commercial sectors.

On **August 5, 2010**, a hot and humid air mass hung over Virginia. A series of upper-level disturbances in a zonal flow passed through the Mid-Atlantic during this time. Showers and thunderstorms developed during the afternoon and evening hours. There was enough instability from the hot and humid air mass to produce thunderstorms accompanied by damaging winds and large hail. Nineteen reports from across the Northern Virginia region indicated a minimum of $125,000 in damage across the region.

On **June 4, 2008**, 41 jurisdictions across the planning region reported damage from thunderstorm winds ranging from 50 to 65 mph. A stalled front residing across the Mid-Atlantic during the afternoon and evening allowed moisture and instability to pool along the boundary. Combined with several strong upper-level disturbances, this resulted in numerous thunderstorms, many becoming severe. While penny-sized hail was reported in spots, damaging winds from the thunderstorms were widespread, and the event spawned several EF-1 tornadoes elsewhere in the state. NCEI-recorded damage to the planning area totaled $288,000, with one reported death.

On **July 2, 2006**, $5,164,000 in damage was reported by nine communities throughout Northern Virginia. A frontal boundary, combined with very strong daytime heating and instability, contributed to scattered severe thunderstorm activity. Much of north-central Virginia, including the Washington, D.C. metro region, experienced damages from the severe thunderstorms. The worst damages occurred in the Annandale area of Fairfax County. An NWS survey team concluded that damages were caused from a wet microburst. Winds associated with the microburst were around 70 mph. Extensive property damage occurred during these storms, including numerous downed trees and powerlines. Local power companies reported more than 100,000 power outages in the Washington, D.C. metro region from this bout of severe weather.
On **March 2, 2018**, a Nor'easter impacted Northern Virginia with sustained winds of 35 mph and gusts up to 70 mph. High wind warnings led to school closures in Prince William and Fairfax counties. Southbound lanes of I-95 were closed due to a large sign that was bent near travel lanes. Air and rail travel were also disrupted, and power outages also affected the region.

On **August 7, 2000**, scattered thunderstorms developed across northeast Virginia during the hot, humid afternoon and evening. These storms produced winds in excess of 55 MPH, large hail, frequent lightning, and heavy rainfall, causing downed power lines that led to widespread loss of electricity. Reported damage from nine communities totaled $933,000.

On **June 24, 1998**, thunderstorm wind damage reported in six locations totaled $1,710,000. Hundreds of trees and power lines were knocked down, and numerous structures incurred minor damage as downburst winds associated with a heavy precipitation supercell (and embedded tornado) raced through the area. The damaging winds were associated with the rear-flank downdraft portion of the storm.

Most hurricanes and tropical storms that affect Virginia originate in the Atlantic Ocean. Since 1851, a total of 32 storms came within 75 miles of the Northern Virginia region. Since 1972, one or more jurisdictions were affected by hurricanes or tropical storms that led to a FEMA Presidential Declaration. These were also awarded for events outside the planning area that caused people to evacuate, temporarily or permanently, to the planning area.

Table 82: Federal Disaster Declarations for Hurricanes and Tropical Storms, Northern Virginia Planning Area[138]

Date of Declaration	Event	Jurisdictions Included in Declaration								
		Arlington County	Fairfax County	Loudoun County	Prince William County	Alexandria, City of	Fairfax, City of	Falls Church, City of	Manassas, City of	Manassas Park, City of
10/15/2018	Hurricane Florence * (EM-3403-VA)	✓	✓	✓	✓	✓	✓	✓	✓	✓
11/26/2012	Hurricane Sandy (DR-4092-VA)	✓		✓	✓	✓		✓	✓	
10/29/2012	Hurricane Sandy (EM-3359-VA)	✓		✓	✓	✓		✓	✓	
11/17/2011	Remnants of Tropical Storm Lee (DR-4045-VA)		✓		✓	✓				
9/3/2011	Hurricane Irene (DR-4024-VA)				✓	✓				
9/12/2005	Hurricane Katrina Evacuation (EM-3240-VA)	✓	✓	✓	✓	✓	✓	✓	✓	✓
9/18/2003	Hurricane Isabel (DR-1491-VA)	✓	✓	✓	✓	✓	✓	✓	✓	✓
10/12/1999	Hurricane Floyd (DR-1293-VA)		✓				✓			
10/23/1996	Hurricane Fran/Severe Storm Conditions (DR-1135-VA)				✓					
6/29/1972	Tropical Storm Agnes (DR-339-VA)	✓	✓	✓	✓	✓	✓	✓		

The planning region may have felt residual or indirect impacts from 36 hurricanes and tropical storms between 1872 and 2020. Hurricane impacts may be felt up to 200 miles away from the center of circulation. Six of these storms were classified as hurricanes (including Isabel in 2003 and Irene in 2011) and 25 as tropical storms as they impacted the region.

[138] FEMA Disaster Declarations for Hurricanes and Tropical Storms, Virginia, 1972 – 2021.

Table 83: Historical Hurricane and Tropical Storms in the Northern Virginia Region, 1851-2021[139]

Year	Month	Name	Wind Speed (mph)	Intensity
1872	October	Not named	45	Tropical Storm
1874	September	Not named	60	Tropical Storm
1876	September	Not named	80	Category 1
1878	October	“Gale of ‘78”	105	Category 2
1882	September	Not named	45	Tropical Storm
1883	September	Not named	45	Tropical Storm
1888	September	Not named	50	Tropical Storm
1888	September	Not named	40	Tropical Storm
1893	August	Not named	70	Tropical Storm
1893	October	Not named	90	Category 1
1893	October	Not named	50	Tropical Storm
1896	September	Not named	80	Category 1
1899	October	Unnamed	65	Tropical Storm
1904	September	Unnamed	65	Tropical Storm
1928	September	Unnamed	45	Tropical Storm
1933	August	Unnamed	60	Tropical Storm
1943	October	Unnamed	40	Tropical Storm
1944	August	Unnamed	50	Tropical Storm
1945	September	Unnamed	40	Tropical Storm
1949	August	Unnamed	45	Tropical Storm

[139] 2017 Northern Virginia Hazard Mitigation Plan, and National Centers for Environmental Information.

Year	Month	Name	Wind Speed (mph)	Intensity
1952	September	Able	45	Tropical Storm
1954	October	Hazel	78	Tropical Storm
1955	August	Connie	60	Tropical Storm
1955	August	Diane	65	Tropical Storm
1979	September	David	45	Tropical Storm
1983	September	Dean	45	Tropical Storm
1992	September	Danielle	45	Tropical Storm
1996	July	Bertha	70	Tropical Storm
1999	September	Floyd	45	Tropical Storm
2003	September	Isabel	75	Category 1
2008	September	Hanna	40	Tropical Storm
2011	September	Irene	120	Category 1
2011	September	Lee (remnants)	60	Tropical Storm
2012	October	Sandy	80	Category 1
2018	September	Florence	65	Category 1
2020	August	Isaias	72	Category 1

Eight of the historic storms made direct tracks through the region. This includes the “Gale of ’78,” a Category 2 hurricane which is further described under Previous Occurrences. An additional 25 storm tracks for tropical depressions and extratropical systems came within 75 miles of the region. Although some narrative information has been gathered on the impacts of these events, data on estimated property damages could only be accessed through the NCEI since the mid-1990s. These events have amounted to more than $38 million in property and crop damages, most of which is attributable to the effects of storm surge and tidal flooding resulting from the storms.

Significant Historic Hurricane Events

Tropical storm and hurricane events discussed in this section affected the planning area overall. Those affecting one or more jurisdictions are included in the jurisdictional annexes.

On **August 4, 2020**, Tropical Storm Isaias moved up the East Coast, creating heavy rainfall and tropical storm-force winds and spawning tornadoes. The storm affected the I-95 corridor, as well as communities further inland. Arlington, Fairfax, and Prince William Counties collectively reported $24,000 in damage, including downed trees and numerous instances of flooding and flash flooding.

On **September 11, 2018**, all jurisdictions in the state of Virginia were included in Federal Emergency Declaration EM-3403-VA for the Public Assistance program in advance of anticipated impact from Hurricane Florence. Tropical storm watches and warnings were issued at various times after 2100 UTC 11 September for the Virginia coast from the North Carolina-Virginia border northward to the mouth of the Chesapeake Bay. Heavy rainfall caused multiple incidents of flash flooding and minor to moderate flooding across the state, although NWS has not recorded dollar amounts of damage in the Storm Events Database.

On **October 29, 2012**, Hurricane Sandy passed Northern Virginia on the way up the Atlantic Coast, before turning northwest and making landfall northeast of Maryland. On the way, Sandy brought high winds and heavy rains to Northern Virginia, resulting in tropical storm-force winds throughout the area, downed trees and power lines, river flooding, and some isolated flash flooding. Some structures were damaged throughout the area, mostly due to falling trees, which displaced some residents.

On **September 4, 2011**, Tropical Storm Lee made landfall in southern Louisiana. Several days later, the remnants of Lee arrived in Northern Virginia. Record rainfall, coming on the heels of Hurricane Irene a few days before, resulted in flooding of most of the creeks and waterways throughout Northern Virginia, leading to an estimated four fatalities, all from drowning. In Manassas Park, one home was displaced in a dry creek bed on the west side of the city.

On **August 27–28, 2011**, Hurricane Irene impacted the entire Northern Virginia area. Widespread power outages impacted utility production and distribution throughout the area, resulting in several utility service providers being offline and leaving tens of thousands of residents and businesses without electrical service. Trees were also downed throughout the area, and some minor flooding was reported, including basement flooding.

On **September 6–7, 2008**, Tropical Storm Hanna made landfall between North and South Carolina on September 6, 2008, with maximum sustained winds of near 70 mph. The storm tracked north and then northeast through eastern Virginia, traveling just to the east of Northern Virginia through the Chesapeake Bay, before moving into the Northeast and New England. As the storm slowly weakened, maximum sustained winds were between 40 and 50 mph at the time of the center's closest proximity to Northern Virginia. Peak winds across Northern Virginia gusted to between 35 and 45 mph, and the storm produced three to eight inches of rain across the area. Weak or decaying trees were downed, and flooding of low-lying areas was reported.

On **September 18–19, 2003**, Hurricane Isabel made landfall on the North Carolina coast. Its huge wind field was already piling water up into the southern Chesapeake Bay. By the time Isabel moved into central Virginia, it had weakened and was downgraded to a tropical storm. Isabel's eye tracked well west of the bay, but the storm's 40 to 60 mph sustained winds pushed a bulge of water northward up the bay and its tributaries, producing a record storm surge. The Virginia western shore counties of the Chesapeake Bay and the tidal tributaries of the Potomac, Rappahannock, and other smaller rivers experienced a storm surge which reached five to nine feet above normal tides.

On **September 16, 1999**, Hurricane Floyd made landfall just east of Cape Fear, NC and moved across the state of Virginia up through Maryland; the eye of the hurricane passed east of Chesapeake Bay and created wind gusts and heavy rainfall, including 4.57 inches recorded at Washington National Airport (Arlington County). A total of $150,000 in damage was reported by Arlington, Fairfax, and Prince William Counties.

5.6.1.4. Probability of Future Occurrence

It can be projected that Northern Virginia will continue to experience severe thunderstorms with high frequency. Based on analysis of previous events in the NCEI database, it appears that those events causing injury, death or damage have occurred on a seemingly random basis with no specific portion of Northern Virginia more likely to experience them than any other.

A total of 1,820 high wind events were recorded between 1950 and the first five months of 2021, or roughly 70.5 years. This averages out to 26 hazard events annually, which indicates a high likelihood of future occurrence.

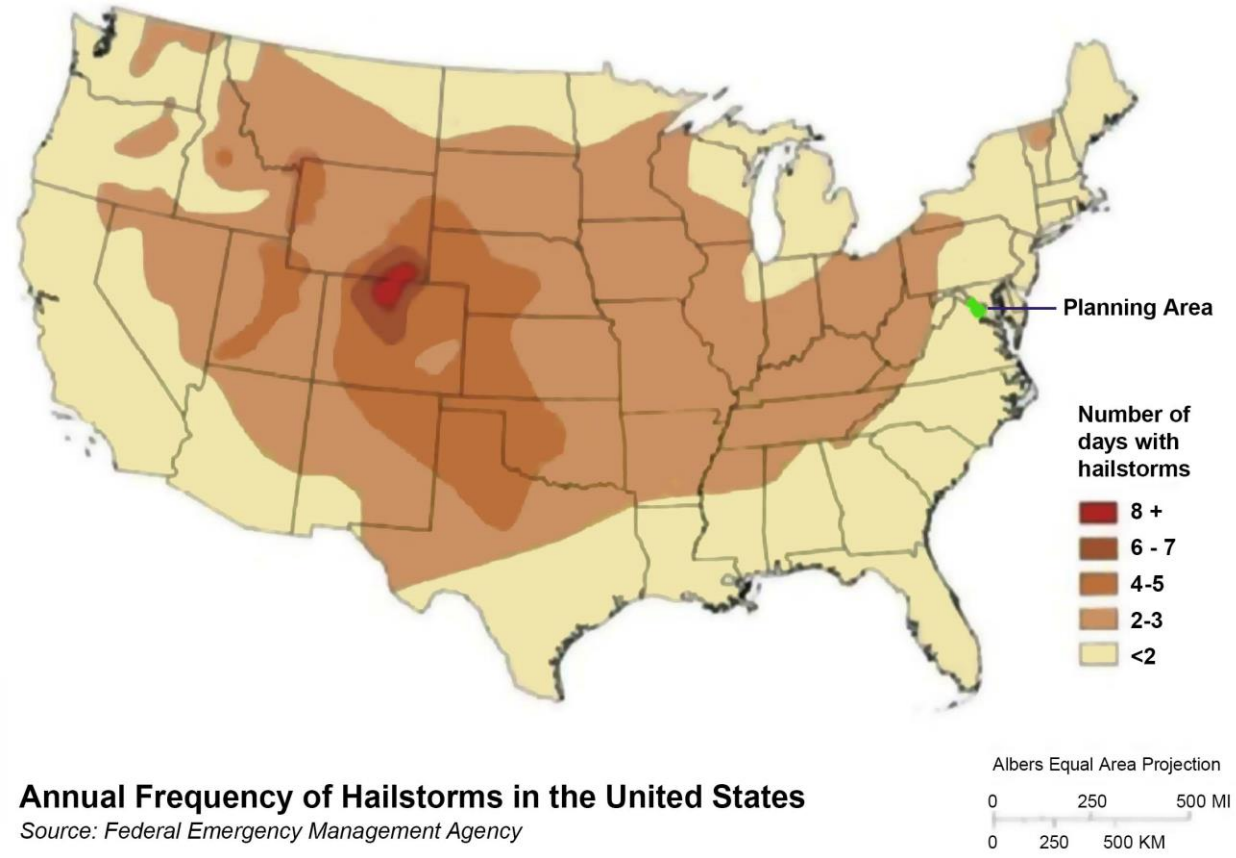


Figure 41: Annual Frequency of Hailstorms in the United States[140]

[140] Federal Emergency Management Agency

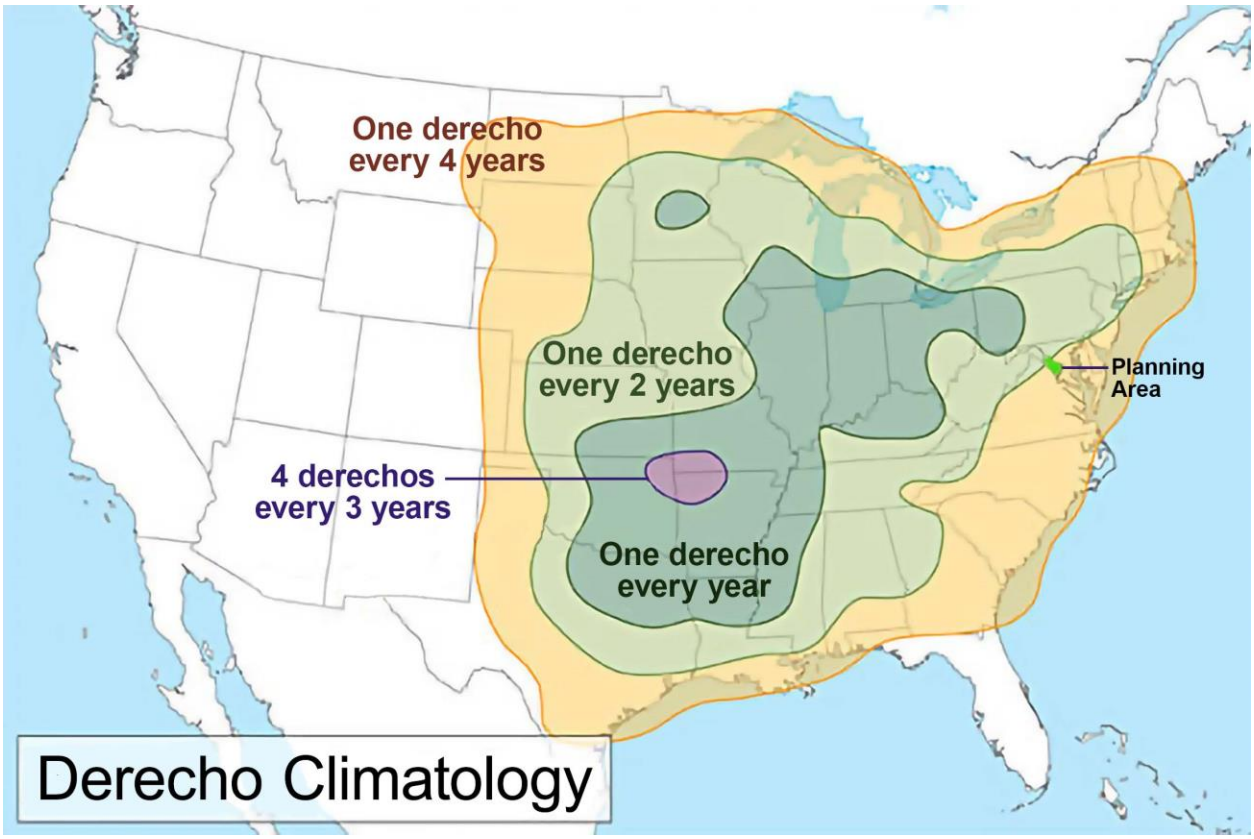


Figure 42: Derecho Climatology in the United States[141]

Based on derecho data from the National Weather Service, the planning area could expect to experience at least one derecho strike every 2-4 years, on average.

While Northern Virginia is unlikely to experience a direct hit from a Category 4 or Category 5 hurricane, the region remains susceptible to the effects of such storms making landfall elsewhere along the Atlantic Coast. Hazus-MH models show that the region can expect to see hurricane-force winds (with peak gust wind speeds of up to 59.1 mph) at least once every 50 years. The probabilistic hurricane model for the 1,000-year return period shows peak gusts of 92.2 mph.

Climate Change

Climate change is projected to increase the frequency and intensity of extreme weather events, including severe thunderstorms. Using global climate models and a high-resolution regional climate model, one study that investigated the link between severe thunderstorms and global warming found a net increase in the number of days with environmental conditions that foster the development of severe thunderstorms. This was true for much of the United States, including Northern Virginia.[142]

5.6.2. Risk Assessment: High Winds/Severe Storms

Risk cannot be fully estimated for damaging thunderstorm wind, hail, and lightning events due to the lack of intensity-damage models for these hazards. Instead, financial impacts of damaging thunderstorm

[141] National Weather Service Forecast Office, Cleveland, Ohio.
[142] IPCC Changes in Climate Extremes and their Impacts on the Natural Physical Environment https://www.ipcc.ch/site/assets/uploads/2018/03/SREX-Chap3_FINAL-1.pdf

events are illustrated using data included from the NCEI Storm Events Database. While multiple communities often submit reports for the same incident, each report describes how the event affected their jurisdiction. During the cited period, there were six deaths and 54 injuries directly related to severe storm events, so the population across the Northern Virginia is at risk. Given the regionwide reported property and crop damages total of $61,543,400, figures show that structures and agricultural assets are at risk of high wind/severe storms.

5.6.2.1. People

There are 2,230,623 residents in the planning area, according to the 2010 U.S. Census Bureau figures, the most recently available official data. High winds and severe thunderstorms may affect the entire population, but those living in communities along the Potomac River are particularly at risk from winds and storms approaching from over the waterway. More vulnerable communities include the City of Alexandria, the City of Arlington, and much of Fairfax and Loudoun Counties. In the planning area, the Towns of Lovettsville and Middleburg (Loudoun County) are among the communities that are the farthest from the lower Potomac River (over 30 miles), but they are also situated just a few miles from Occoquan Creek, a Potomac Tributary; thus, inland communities may also be impacted by a hazard event.

Lightning presents a significant threat to human safety and has historically caused injuries and death in the Northern Virginia region. According to the Virginia State Climatology Office, most lightning-related deaths and injuries in Virginia have involved males between the ages of 20 and 40 years old who were caught outdoors on golf courses, ball fields, near open water, or under trees.

5.6.2.2. Built Environment and Community Lifelines

While not a major threat to human safety, hail can be extremely destructive to crops and personal property (particularly vehicles, as well as roofs, siding, and windows of buildings). Most hail damage recorded for the Northern Virginia region has been in Fairfax and Loudoun counties, though all areas are equally at risk.

Quantitative assessment of Community Lifelines for thunderstorm wind risk was not feasible for this update because such events are not geographically specific and are likely to affect the entire planning area. What is known is that age of construction plays a role in vulnerability of facilities to thunderstorm winds. In general, concrete, brick, and steel-framed structures tend to fare better in thunderstorm wind events than older, wood-framed structures. It is important to note that not all critical facilities have redundant power sources, and structures may not be wired to allow the addition of an emergency backup generator for residential or commercial use. Future updates should consider including a more comprehensive examination of critical facility vulnerability to thunderstorm winds; upgrading generator capacity at essential facilities is determined to be a high mitigation priority and is included in the mitigation strategy actions.

Maintaining continuity of operations of transportation, infrastructure, utilities, and government assets is critical to minimizing economic damage that may result from businesses being unable to move equipment or product. Government and private employers must be able to maintain continuity of operations, especially in the Capital region, where thousands of employees perform work that affects national security and other nationwide priorities, as well as for staff in all sectors to carry out mission- and business-critical operations.

Community recreation areas with existing structures are also vulnerable to high wind events. Streetlights, power poles, and shelters set up in the area’s federal, state, and local parks are at risk of high winds. The region is a tourist destination for special events held outdoors, so high winds and severe storms may cause damage to temporary tents and stages erected to accommodate such festivities.

Power outages are caused by falling limbs, trees, and poles, by power lines slapping together, and by flying debris, all of which affects property, the population, and the economy.

5.6.2.3. Natural Environment

Communities within the planning area include natural assets vulnerable to high wind. High winds may topple trees, blocking roads, natural wetlands, and run-off areas. Lightning strikes have the potential to ignite wildland fires, causing loss of forested areas as well as structures.

5.6.2.4. Economy

As part of the Capital region, the planning area's economy is driven, in part, by its proximity to Washington, D.C. The already dense commuter traffic could be exacerbated by a high wind or severe storm event, as might area bus and rail transportation systems. Many people living in the suburban counties of the planning area travel to jobs outside the city. Tourist destinations may be affected by a reduced number of visitors and may lose the ability to maintain economic continuity of operations. If these and other attractions and business assets are impacted, they would realize fewer dollars coming from those sources. These include renowned assets such as Old Town Alexandria, Arlington National Memorial Cemetery, and an important Town of Quantico economic asset, the U.S. Marine Corps Base, which is also listed in the National Register of Historic Places.

5.6.2.5. Hazard Risk Ranking Summary

The hazard ranking process included consideration of probability and consequences in determining an overall risk score and ranking. Information presented within this section and the hazard risk ranking process presents the quantitative and qualitative summary for high winds/severe storms, including hurricanes and tropical storms. The Hazard Identification and Risk Assessment methodology is described in **Section 4, Base Plan**.

Table 84: Hazard Risk Rankings for High Wind/Severe Storms, by Jurisdiction

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Arlington County	2.7	3.0	5.7	High
City of Alexandria	2.7	3.3	6.0	High
City of Fairfax	2.7	3.2	5.9	High
City of Falls Church	2.7	3.2	5.9	High
City of Manassas	2.7	3.2	5.9	High
City of Manassas Park	2.7	3.2	5.9	High
Fairfax County	2.7	3.2	5.9	High
Town of Clifton	2.7	3.2	5.9	High
Town of Herndon	2.7	3.2	5.9	High
Town of Vienna	2.7	3.2	5.9	High
Loudoun County	2.7	3.4	6.1	High
Town of Leesburg	2.7	3.4	6.1	High
Town of Lovettsville	2.7	3.4	6.1	High
Town of Middleburg	2.7	3.4	6.1	High
Town of Purcellville	2.7	3.4	6.1	High
Town of Round Hill	2.7	3.4	6.1	High
Prince William County	3.3	5.4	8.7	High

Town of Dumfries	2.7	3.2	5.9	**High**
Town of Haymarket	2.7	3.2	5.9	**High**
Town of Occoquan	4.0	5.4	9.4	**High**

5.6.3. Vulnerability Analysis: High Winds/Severe Storms

The Northern Virginia region faces uniform susceptibility to the effects of severe thunderstorms, including high winds, lightning, and hail. The buildings most at risk of thunderstorm winds are assumed to include manufactured homes and older residential structures. Another great concern for the Northern Virginia region in relation to high winds is damage to electric power lines; power outages for residents and businesses across the area can disrupt the availability of emergency services, including 911. During past events, storm winds have downed trees across power lines, snapped utility poles, and even blown down transformers, resulting in widespread outages. Downed power lines create a dangerous threat to public safety; although difficult to quantify, long-term power outages can result in significant hardship for residents and major economic impacts for local businesses.

Historical data shows that the Northern Virginia region is vulnerable to damaging hurricane and tropical storms. For purposes of this assessment, vulnerability is quantified for hurricane and tropical storm-force winds. For the most part, the Northern Virginia region faces a uniform susceptibility to hurricanes and tropical storm winds. Though historical data and computer models indicate that Fairfax County may on average face higher wind speeds than other areas, the difference in peak gusts is not deemed significant (less than 20 mph). However, based on the higher amount of residential and commercial exposure, Fairfax and Arlington counties are slightly more vulnerable to these winds.

5.6.3.1. Hazus Scenario

The vulnerability analysis for hurricane was completed using the Hazus hurricane wind model, which uses state of-the-art wind field models and calibrated and validated hurricane data. Wind speed has been calculated as a function of central pressure, translation speed, and surface roughness. This assessment is based on a Level 1 analysis using Hazus-provided data with no local data adjustments. This is an acceptable level of information for mitigation planning. Future updates may be enhanced by using Level 2 and 3 analyses, which include additional local data inputs. Dollar values shown in this report provide the cost of an aggregation of building types. In some instances, detailed, building-specific loss estimations were not accessible for smaller communities and their values are included in county-level data. To include them would have required significant local data that was unavailable for this update. Note that storm surge and waves have not been implemented in the present version of the Hurricane Model.

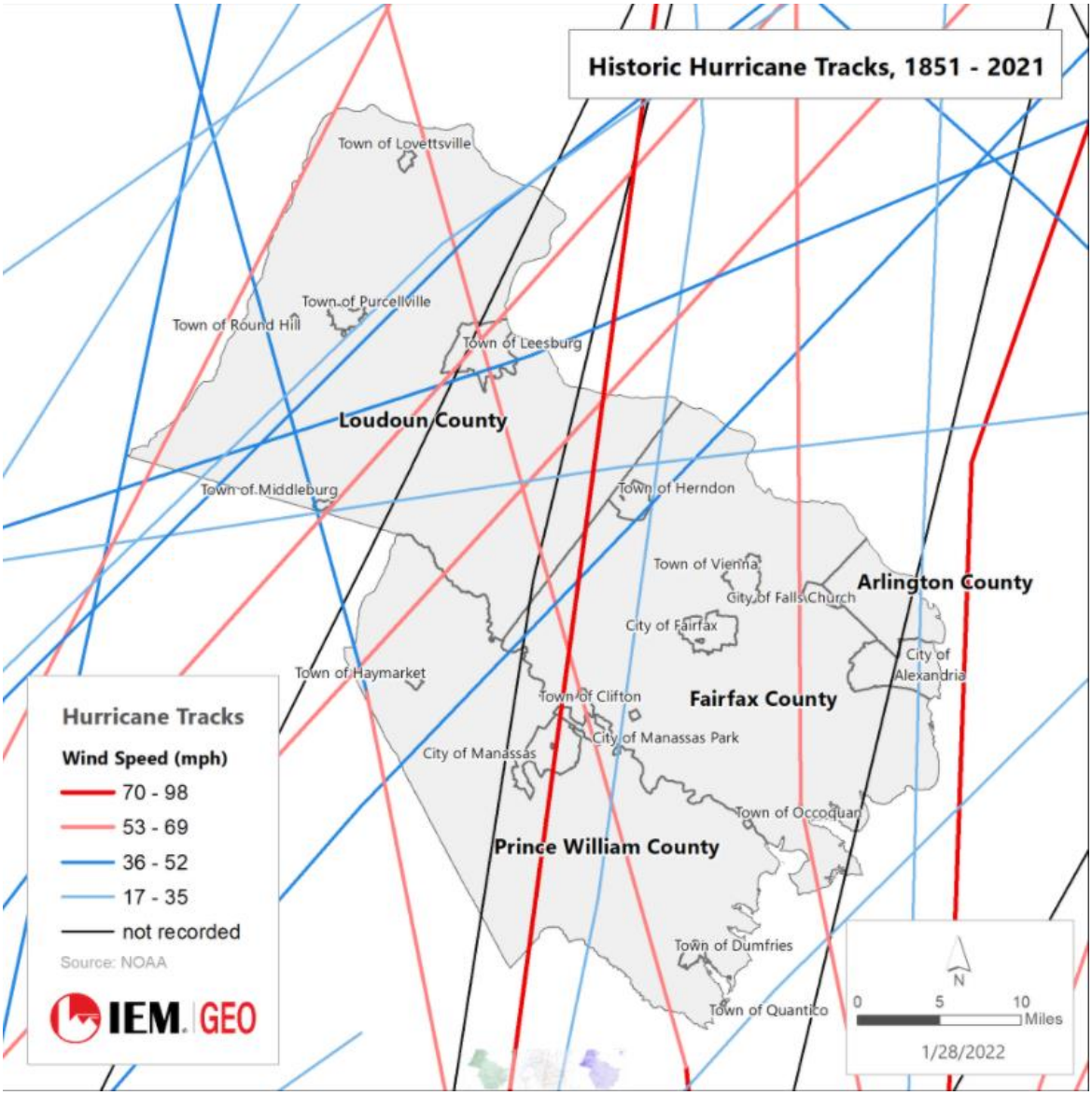


Figure 43: Historic Hurricane Tracks with Critical Facilities, 1851–2021[143]

Loss estimation for this Hazus module is based on specific input data: square footage of buildings for specified types or population, and information about the local economy, used in estimating losses. Additional data and reports generated by Hazus for the planning may be found in **Appendix D**.

[143] NOAA, National Hurricane Center, Historic Hurricane Tracks.

Table 85: Hazus Direct Economic Loss Categories and Descriptions[144]

Category Name	Description of Data Input into Model	Hazus Output
Building	Cost per sq. ft. to repair damage by structural type and occupancy for each level of damage	Cost of building repair or replacement of damaged and destroyed buildings
Contents	Replacement value by occupancy	Cost of damage to building contents
Inventory	Annual gross sales in $ per sq. ft.	Loss of building inventory as contents related to business activities
Relocation	Rental costs per month per sq. ft. by occupancy	Relocation expenses (for businesses and institutions)
Income	Income in $ per sq. ft. per month by occupancy	Capital-related incomes losses as a measure of the loss of productivity, services, or sales
Rental	Rental costs per month per sq. ft. by occupancy	Loss of rental income to building owners
Wage	Wages in $ per sq. ft. per month by occupancy	Employee wage loss as described in income loss

The hurricane wind scenario models were run using the Hazus built-in default inventory of assets from the Comprehensive Data Management System (CDMS). No additional, locally reported critical assets were added to the inventory. Therefore, discrepancies may appear if comparing locally generated reports to Hazus reports when considering and listing specific planning elements, such as critical assets and historic occurrences. **Appendix D** includes a description of the methodology used to create the model for the hurricane wind scenarios and the grouping of counties, cities, and towns included in each model.

Additionally, Hazus reports including population data are based on U.S. Census reports utilizing 2010 data, the most recently available official information available from that resource.

Annualized loss is defined as the expected value of loss in any one year. It is developed by aggregating the losses and exceedance probabilities for the 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year return periods. Hazus estimates direct and indirect economic losses due to hurricane wind speeds that include the following:

- Damage to buildings and contents
- Economic loss (business interruptions)
- Social impacts

[144] Hazus Scenario for Hurricane Wind. August 3, 2021.

Table 86: Direct Economic Annualized Hurricane Building Losses[145]

Jurisdictions	Capital Stock Losses				Income Losses				
	Building Damage	Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Arlington County, City of Arlington	15,425,000	3,893,000	0	0.05	692,000	2,000	3,000	112,000	20,128,000
Fairfax County	95,769,000	23,052,000	1,000	0.06	4,17,000	5,000	6.000	564,000	123,575,000
Loudoun County	23,570,000	5,396,000	0	0.05	1,18,000	1,000	1,000	174,000	30,325,000
Prince William County	35,903,000	8,722,000	0	0.07	1,729,000	1.000	2,000	247,000	46,603,000
Alexandria, City	11,570,000	2,976,000	0	0.05	528,000	2,000	3,000	88,000	15,168,000
Fairfax, City	2,012, 000	470,000	0	0.04	89,000	0	0	12,000	2,584,000
Falls Church, City	1,343,000	340,000	0	0.06	62,000	0	0	10,000	1,755,000
Manassas, City	2,503,000	601,000	0	0.05	141,000	0	0	21,000	3,266,000
Manassas Park, City	940,000	223,000	0	0.06	56,000	0	0	8,000	1,228,000
TOTAL	**$189,035,000**	**$445,674,000**	**$2,000**	**0.06**	**$8,657,000**	**$13,000**	**$15,000**	**$1,236,000**	**$244,632,000**

[145] Hazus Report: Hurricane Direct Economic Losses for Buildings. July 26, 2021.

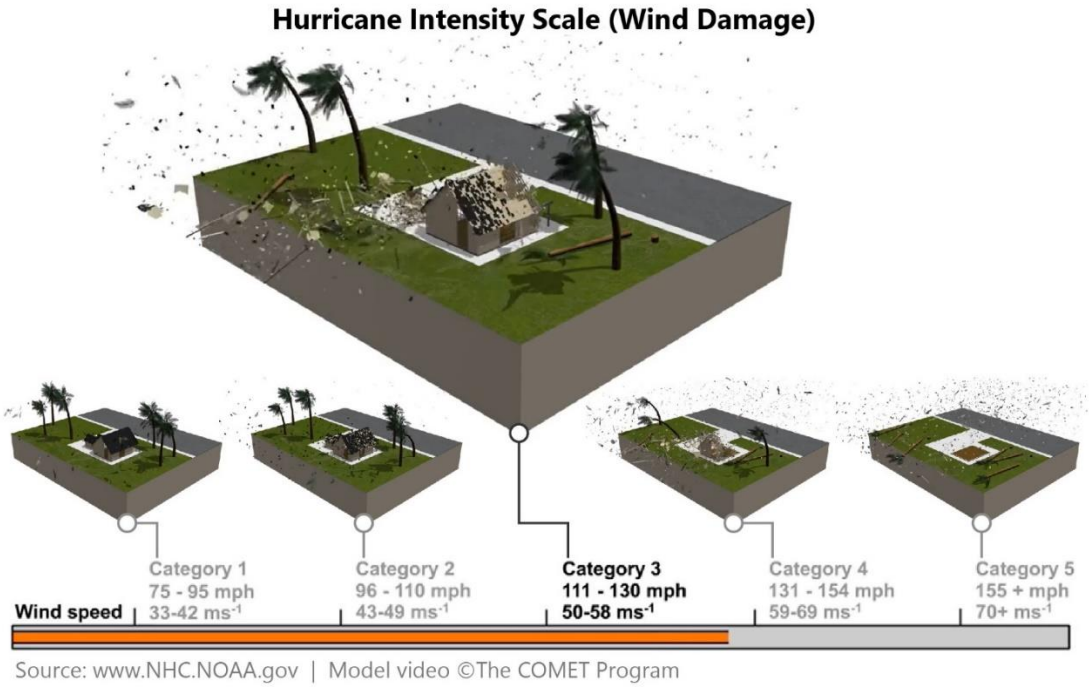


Figure 44: Potential Wind Damage to Building in Major Category 3 Hurricane[146]

Hazus reports included in **Appendix D** illustrate the 3-second peak wind gust speeds for the 100- and 1000-year return periods. Wind speeds are based on estimated 3-second gusts in open terrain at 10 meters above ground at the centroid of each census track. It is mandated that buildings in categories shown in this section must be designed as structurally resilient for a 100-year mean recurrence interval wind event. Among these designated as essential facilities, or facilities with a high degree of exposure, are those that:

- Serve as a congregate area for more than 300 people
- Are used as emergency shelter during a hurricane or other hazard
- House a day care center with capacity greater than 150 occupants
- Are designed for use during emergency preparedness, communication, or emergency operation center or response
- House critical national defense functions
- Contain sufficient quantities of hazardous materials

For Northern Virginia, Hazus wind gust data for the 1,000-year and 100-year return period events indicate that the southeastern portions of Northern Virginia are generally more likely to experience the highest wind gusts in both scenarios. This corresponds to the strongest winds associated with hurricanes typically occurring in the storm's right front quadrant (relative to the direction of the storm's movement). For a 1,000-year event, southeastern sections of Arlington, Fairfax, and Prince William counties can expect to see gusts topping 90 mph. Although the scenario projects slightly lower wind gusts in western Loudoun

[146] National Hurricane Center, Saffir-Simpson Hurricane Wind Scale. Retrieved at: https://www.nhc.noaa.gov/aboutsshws.php

County and far western Prince William County, gusts may still exceed 80 mph in both locations. For a 100-year event, wind gusts of nearly 70 mph may affect portions of Fairfax and Prince William counties, with gusts of between 55 and 65 mph expected elsewhere in Northern Virginia.

5.6.3.2. Exposure

Because severe storms are not geo-specific, the entire planning area population is exposed to such hazard events.

Building exposures were calculated by the Hazus Hurricane Wind scenario, which identifies the exposure of structures in the planning region that are also at risk of severe storms.

Table 87: Total Building Exposure by General Occupancy, Northern Virginia Region[147]

Occupancy	Exposure ($1000)	Percent of Total
Residential	$287,641,972,000	84.23%
Commercial	$39,194,388,000	11.48%
Industrial	$5,227,982,000	1.53%
Agricultural	$688,752,000	0.20%
Religious	$4,026,943,000	1.18%
Government	$1,401,09,0003	0.41%
Education	$3,334,545,000	0.98%
TOTAL	**$341,515,675,000**	**100.00%**

5.6.3.3. Community Lifelines Exposure

The Hazus scenario estimates that damage to community lifelines/critical facilities may be negligible during storms of lesser impact, but analyses for the longer return periods show they may be severely damaged.

- The expected loss of use for both healthcare facilities and Emergency Operation Centers following a 100-year event is less than one day for the planning area as a whole. The Hazus hurricane model return periods showed 100% functionality in all jurisdictions following a 10-year, 20-year, 50-year, 100-year, and 1,000-year events.
- The 2021 Hazus model showed that hospitals across the planning area are expected to retain full functionality even during a 1000-year hurricane.

Fire stations, police stations, and schools throughout the planning area may expect to retain a high degree of functionality even during a 1000-year hurricane event and would experience loss of function for less than one day.

The Hazus model also estimates the number of households expected to be displaced from their homes during the hurricane, as well as the number of displaced people who will require accommodations in temporary public shelters. A comparison of shelter needs in each jurisdiction for each event extent included in the Hazus model shows a progressive number of persons displaced and needing shelter for each event category.

[147] Hazus Report, Building Stock Exposure by General Occupancy. August 3, 2021.

Table 88: Displaced Households by Event Extent[148]

Jurisdiction	10-Year	20-Year	50-Year	100-Year	200-Year	500-Year	1000-Year
Alexandria, City	0	0	0	49	383	536	346
Arlington County	0	0	0	63	434	947	652
Fairfax County	0	0	1	466	2,501	9,458	13,578
Fairfax, City	0	0	0	10	40	231	301
Falls Church, City	0	0	0	7	34	103	87
Loudoun County	0	0	5	105	20	2,771	10,380
Manassas, City	0	0	0	6	50	435	1,370
Manassas Park, City	0	0	0	4	21	184	497
Prince William County	0	0	1	118	1,286	4,197	12,102
TOTAL	**0**	**0**	**7**	**828**	**4,769**	**18,862**	**39,313**

Table 89: Shelter Needs by Event Extent[149]

Jurisdiction	10-Year	20-Year	50-Year	100-Year	200-Year	500-Year	1000-Year
Alexandria, City	0	0	0	21	172	243	155
Arlington County	0	0	0	28	206	455	317
Fairfax County	0	0	1	275	1,418	5,266	7,565
Fairfax, City	0	0	0	6	22	123	161
Falls Church, City	0	0	0	3	16	51	42
Loudoun County	0	0	5	65	16	1,593	5,924
Manassas, City	0	0	0	6	35	302	953
Manassas Park, City	0	0	0	3	15	132	359
Prince William County	0	0	1	80	833	2,667	7,521
TOTAL	**0**	**0**	**7**	**487**	**2,733**	**10,832**	**22,997**

Debris Generation

Debris estimates for the various Hazus return models indicate that the tonnage of debris generated for a 10- or 20-year event would be negligible, while that generated by a 1,000-year is estimated at 536,264 tons. A 100-year event is expected to generate 63,991 tons of debris. If building debris tonnage is converted to an estimated number of truckloads, it will require 1,284 truckloads (25 tons per truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 15,668 tons of *Eligible Tree Debris* are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.[150]

[148] Hazus: Hurricane Shelter Summary Report. July 26, 2021.
[149] Ibid.
[150] Hazus: Hurricane Debris Generated Report, July 26, 2021. Reported by event return period.

5.6.3.4. Existing Buildings and Infrastructure Risk

It is generally assumed that the buildings most at risk from high wind events include manufactured homes and residential buildings constructed in earlier decades and designed to meet less stringent building codes. There may have been a lower degree of code enforcement at the time of construction. If not well-maintained, such buildings may have deteriorated over the years.

Table 90: Building Exposure by Type of Occupancy[151]

Occupancy	Exposure	Percent of Total
Residential	$287,641,972,000	84.23%
Commercial	$39,194,388,000	11.48%
Industrial	$5,227,982,000	1.53%
Agricultural	$688,752,000	0.20%
Religious	$4,026,943,000	1.18%
Government	$1,401,09,0003	0.41%
Education	$3,334,545,000	0.98%
TOTAL	**$341,515,675,000**	**100.00%**

[151] Hazus: Building Stock Exposure by General Occupancy Report. July 26, 2021.

Residential buildings are estimated to receive a majority of the damages from hurricane winds. The more frequent return periods result in fewer damages that fall within the moderate to destruction classifications. The 500- and 1000-year return periods result in severe damage and destruction to buildings in the Northern Virginia region.

Table 91: Number of Residential Buildings/Total Buildings Damaged, by Return Period[152]

Return Period	Damage Level									
	Minor		Moderate		Severe		Destruction		Total	
	Residential	Total	Residential	Total	Residential	Total	Residential	Total	Residential	Total
10	0	0	0		0	0	0	0	0	0
20	0	0	0		0	0	0	0	0	0
50	219	326	5,454	5,454	0	0	0	0	5,673	5,780
100	448	591	32,857	32,857	1	1	0	0	33,306	33,448
200	2,326	2,591	121,667	121,671	1,095	1,095	0	0	125,088	125,358
500	9,623	10,237	354,623	354,654	11,603	11,604	0	0	375,849	376,496
1000	26,619	27,624	481,896	481,981	40,381	40,389	307	307	548,897	550,301

In the case of a 100-year hurricane event, total building losses for Northern Virginia are estimated to run in excess of $4 billion according to the Hazus report *Direct Economic Losses for buildings – 100-year Event*. The same report indicates estimated losses for a 1000-year hurricane event, for which the model estimates regional building loss for the region at over $41 billion. Details for some participating jurisdictions are incorporated into county results reported by the model and could not be reliably separated out in this Level 1 assessment.

[152] Hazus: Hurricane Quick Assessment Report. July 26, 2021.

Table 92: Annualized Building Losses, by Type and Jurisdiction[153]

Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Loss
Arlington County	$15,425,000	$3,903,000	0	$692,000	$2,000	$112,000	$3,000	**$20,128,000**
Fairfax County *Including* *Town of Clifton* *Town of Herndon* *Town of Vienna*	$95,769,000	$23,052,000	$1,000	$4,178,000	$5,000	$564,000	$6,000	**$123,575,000**
Loudoun County *Including* *Town of Leesburg* *Town of Lovettsville* *Town of Middleburg* *Town of Purcellville* *Town of Round Hill*	$23,570,000	$5,396,000	0	1,182,000	$1,000	$174,000	$1,000	**$30,325,000**
Prince William County *Including* *Town of Dumfries* *Town of Occoquan*	$35.903,000	$8,722,000	0	1,729,000	$1,000	$247,000	$2,000	**$46,603,000**
City of Alexandria	$11,570,000	$2.976,000	0	$528,000	$2,000	$88,000	$3,000	**$15,168,000**
City of Fairfax	$2,012,000	$470,000	0	89,0000	0	12,000	0	**2,584,000**
City of Falls Church	$1.343,000	$340,000	0	$62,000	0	$10,000	0	**$1,755.000**
City of Manassas	$2,503,000	$601,000	0	$141.000	0	$21,000	0	**$3,266,000**
City of Manassas Park	$940,000	$223,000	0	$56,000	0	$8,000	$0	**$1,228,000**
TOTAL	**$189,035.000**	**$45,674,000**	**$1,000**	**$8,657,000**	**$13,000**	**$123,600**	**$15,000**	**$244,632,000**

[153] Hazus: Direct Economic Losses for Buildings, Annualized Losses Report. July 26, 2021.

Table 93: 100-Year Hurricane Building Losses, by Type and Jurisdiction[154]

Jurisdiction	Building	Contents	Inventory	Relocation	Capital	Wages	Rental	Total
Arlington County	$15,425,000.00	$3,893,000.00	0	$692,000.00	$2,000	$3,000	$112,000	$20,128,000
Fairfax County *Including* *Town of Clifton* *Town of Herndon* *Town of Vienna*	$95,769,000.00	$23,052,000.00	$1,000.00	$4,178,000.00	$5,000	$6,000	$564,000	$123,575,000
Loudoun County *Including* *Town of Leesburg* *Town of Lovettsville* *Town of Middleburg* *Town of Purcellville* *Town of Round Hill*	$23,570,000	$5,396,000	0	$1,182,000	$1,000	$1,000	$174,000	$30,325,000
Prince William County *Including* *Town of Dumfries* *Town of Occoquan*	$35,903,000	$8,722,000	0	$1,729,000	$1,000	$2,000	$247,000	$46,603,000
City of Alexandria	$11,570,000	$2,976,000	0	$528,000	$2,000	$3,000	$88,000	$15,168,000
City of Fairfax	$2,012,000	$470,000	0	$89,000	0	0	$12,000	$2,584,000
City of Falls Church	$1,343,000	$340,000	0	$62,000	0	0	$10,000	$1,755,000
City of Manassas	$2,503,000	$601,000	0	$141,000	0	0	$21,000	$3,266,000
City of Manassas Park	$940,000	$223,000	0	$56,000	0	0	$8,000	$1,228,000
TOTAL	**$189,035,000**	**$45,674,000**	**$1,000**	**$8,657,000**	**$11,000**	**$15,000**	**$1,236,000**	**$244,632,000**

[154] Hazus: Direct Economic Losses for Buildings, 100-Year Event Report. July 26, 2021.

Table 94: 1000-Year Hurricane Building Losses, by Type and Jurisdiction[155]

Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Arlington County	$1,050,560,000	$202,349,000	0	$49,194,000	0	$3,823,000	0	**$1,305,927,000**
Fairfax County *Town of Clifton* *Town of Herndon* *Town of Vienna*	$12,881,507,000	$3,504,069,000	$31,000	$695,584,000	$38,000	$67,354,000	$13,000	**$17,148,596,000**
Loudoun County *Town of Leesburg* *Town of Lovettsville* *Town of Middleburg* *Town of Purcellville* *Town of Round Hill*	$6,571,365,000	$2,179,669,000	$72,000	$412,575,000	$463,000	$52,166,000	$171,000	**$9,216,481,000**
Prince William County *Including* *Town of Dumfries* *Town of Occoquan*	$7,643,975,000	$2,560,577,000	$55,000	$462,850,000	$227,000	$57,614,000	$135,000	**$10,725,433,000**
City of Alexandria	$642,248,000	$115,292,000	0	$28,885,000	0	$2,148,000	0	**$788,572,000**
City of Fairfax	$296,715,000	$79,210,000	$2,000	$16,627,000	0	$1,583,000	0	**$394,137,000**
City of Falls Church	$121,529,000	$26,177,000	0	$6,144,000	0	$505,000	0	**$154,356,000**
City of Manassas	$690,045,000	$242,493,000	$18,000	$49,686,000	$107,000	$6,801,000	$39,000	**$989,190,000**
City of Manassas Park	$233,893,000	$79,303,000	$6,000	$17,610,000	$13,000	$2,324,000	$5,000	**$333,153,000**
TOTAL	**$30,131,839,000**	**$8,989,139,000**	**$183,000**	**$1,739,155,000**	**$847,000**	**$194,319,000**	**$363,000**	**$41,055,846,000**

[155] Hazus: Direct Economic Losses for Buildings, 1000-Year Event Report. July 26, 2021.

5.6.3.5. Overall Loss Estimates and Ranking

Based on the Hazus models run to cover the planning area, the annualized losses due to hurricanes in Northern Virginia total approximately $245 million. To compute loss, the models used the Hazus probabilistic hurricane scenario, which considers the expected value of loss in any one year and is developed by aggregating the losses and exceedance probabilities for the 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year return periods.

Another method of calculating potential losses from hurricanes and tropical storms is to annualize the NCEI data that documents estimated property and crop losses in Northern Virginia due to severe storm and high wind events, including tropical storms and hurricanes. This method results in annualized losses of approximately $1.5 million. This figure is very low compared to the data produced by the Hazus scenario; however, this can be explained by the fact that the annualized losses take into consideration worst case storms like the 500-year and 1,000-year, which have likely not occurred in the region in the past 70 years. In addition, NCEI data is mostly collected through initial damage reports, which do not account for more detailed follow-up damage assessment data.

Based on this analysis and available data, the high wind/severe storm hazard is ranked as being a hazard of “High” concern for all jurisdictions in Northern Virginia. The high wind/severe storm hazard incorporates thunderstorm winds and hurricane/tropical storm winds along with non-thunderstorm-related wind damage.

Given the widespread nature of the hazard, all counties, cities, and towns were determined to have the same risk of the hazard.

5.6.3.6. Future Population and Development Trends

Future development and the resulting population increase has the potential to elevate vulnerabilities to high winds/severe storms in the future, depending on climate change variables and jurisdictional ability to manage appropriate growth. An increase in structures and population has the potential to result in a higher threat to the population and higher levels of property damage in future events. The impacts and consequences from previous storm events can serve as a guide for future planning and regulatory actions based on appropriate development in the region’s jurisdictions.

5.6.3.7. Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluating, and updating of this Plan should consider the following questions related to High Winds/Severe Storms, including Hurricanes and Tropical Storms:

- Has more recent data about these hazards been discussed in the Commonwealth COV-SHMP expected to be updated in 2023?
- Have high wind, severe storm, thunderstorm, hurricane, or tropical events been recorded by professional weather experts in the NCEI database or other resources familiar with these hazards?
- Has new scientific research or methodology changed the ability to predict such hazard events?
- Has there been a significant change in the population, built environment, natural environment or economy that could affect the risk or vulnerability to wind-related hazard events?
- Is there new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to wind-related events?
- Review the updated Commonwealth 2023 COV-SHMP update for discussion of new or updated information included in the plan’s section on wind-related events.

5.7. Karst/ Sinkhole/Land Subsidence

2022 HMP Update

The karst/sinkholes/land subsidence hazard was reviewed, and a new analysis was performed that included but was not limited to the following:

- Reformatting the hazard section to improve flow and clarity.
- Refreshing the hazard profile with updated data, maps, and imagery, where available.
- Updating the assessment of risk and vulnerability by jurisdiction based on new data.
- Ranking the hazard by jurisdiction using the methodology described in Section 4.

Due to the determination of low overall vulnerability, this hazard is minimally profiled, and a comprehensive vulnerability analysis was not justified for this Plan update. Potential changes in risk and vulnerability will be monitored during the next planning cycle.

Table 95: Sinkhole/Karst Summary

<table>
<tr><th colspan="5">Sinkhole/Karst</th><th>Overall Vulnerability</th></tr>
<tr><th colspan="5">Definition, Key Terms, and Overview</th><td rowspan="4">Low</td></tr>
<tr><td colspan="5">Karst: A landscape made up of water-soluble soft rocks such as limestone, dolomite, and gypsum. Rainwater seeping into the rock can result in karst landscapes being worn away from the top or dissolved from weak points inside the rock. Karst landscapes feature caves, sinking or underground streams, and closed depressions on the surface. In the broadest sense, karst encompasses many surface and subsurface conditions that give rise to problems in engineering geology.

Sinkhole: A natural depression or hole in the land surface formed when underlying rock dissolves and collapses. Sinkholes generally occur in limestone regions and are connected to subterranean passages. Sinkholes are often caused by groundwater enlarging cavities in an underlying bedrock of highly soluble limestone.

Land subsidence: A gradual settling or sudden sinking of the Earth's surface due to removal or displacement of subsurface earth materials.</td></tr>
<tr><th>Frequency</th><th>Probability</th><th colspan="3">Potential Magnitude</th></tr>
<tr><td rowspan="2">Low</td><td rowspan="2">Unlikely</td><th>Injuries/Deaths</th><th>Infrastructure</th><th>Environment</th></tr>
<tr><td>Low</td><td>Low</td><td>Low</td></tr>
</table>

5.7.1. Hazard Profile

Sinkholes are a frequent occurrence in karst areas underlain by calcareous carbonate formations, especially limestone and dolomite. Groundwater flows through cracks, fissures, joints, and other discontinuities in the rock mass, dissolving the carbonate minerals and creating small voids. Over time, continued water seepage and dissolution of minerals enlarges the void to form caves and caverns in the rock. As the void increases in size, so does the load supported by the void roof. If the strength of the roof layer becomes less than the weight of the material above it, the roof fails, and the overburden materials

collapse into the void. When the collapse manifests itself at the surface, the resulting depression is referred to as a "sinkhole." Other calcareous carbonate materials include partially to well-cemented shell formations found in coastal areas of the southeastern United States.

The process of sinkhole formation depends on a complex set of variables including geologic structure, geochemistry, hydrologic conditions, and development activity. If the roof above the void is sound rock and the water level falls below the roof level, future growth of the void may not reduce the roof thickness and collapse may not occur. However, if the roof rock is fractured or otherwise cracked, shallow groundwater from above can flow into the void, bringing with it eroded overburden soil. The erosion of overburden soil into the rock void creates a corresponding soil void that can migrate to the surface, resulting in a collapse of the soil roof even though the underlying rock has not collapsed.

Changes in hydrologic conditions, whether natural or man-made, can increase the occurrence of sinkholes. An increase in the volume and/or velocity of flow through the rock brings more fresh water to dissolve soluble minerals and more energy to erode solid particles, expanding existing voids or creating new ones. Water supply and open-pit mining are common reasons for pumping large volumes of water through soluble calcareous formations.

Sinkholes vary in size, ranging from a few feet to a mile or more in diameter, and can reach several hundred feet below the surface. Areas of abundant sinkholes are referred to as "karst topography." Karst areas have few surface streams because drainage is primarily through underground solution channels.

Sinkholes can also occur in most geologic environments—including those not underlain by calcareous carbonate rocks—due to the impacts of constructed facilities. Undetected leaks in underground utility lines can result in subsurface erosion of soil from around the pipe. Left undetected, the erosion creates a void that expands upward until the soil roof cannot support the overburden load and the roof collapses.

Major natural hazards such as extreme storm events, flooding, seismic events, and wildfire can trigger an incident. Inadequate storm drainage or leaking water distribution systems may have the same cumulative effect as extreme storm events. The blockage of stream flow may have a significant impact on flood potential in topographic settings that constrict the flow of floodwaters during high-flow events. In addition to fatalities and the costs of repair to infrastructure, sinkholes also compromise access and traffic safety during these same storm events. Sinkholes in developed areas can cause significant damage to buildings and property.

The occurrence of land subsidence is seldom as obvious as it is in the case of catastrophic sinkholes or mine collapses. Where groundwater depletion is involved, subsidence is typically gradual and widespread. The detection of regional-scale subsidence has historically occurred with the identified movement of key benchmarks.

Table 96: Hazard Profile Summary

Karst/ Sinkhole/ Land Subsidence Assessment: Low-Risk Hazard	**Location**	Localized, site-specific	**Potential Cascading Effects (all site-specific)**
	Extent	Minimal	• Property damage • Infrastructure damage • Road closures • Environmental impact • Public safety threat
	Duration	Minutes to hours	
	Probability	Unlikely	
	Seasonal Pattern	No seasonal pattern, but may be exacerbated by snow melt in late spring or excessive rainfall events in summer	

	Speed of Onset	Slow to rapid	
	Warning Time	Minutes to hours	
	Repetitive Loss	N/A	

5.7.1.1. Location

Sinkholes are prevalent in the Great Valley region of central Virginia, including karst terrains in the Shenandoah Valley, where voids are formed by the natural dissolution of soluble rock such as limestone and dolomite.

According to the Virginia Department of Mines, Minerals and Energy, sinkholes are very rare in the Northern Virginia region and do not pose a significant risk. However, a band of metamorphosed limestone, dolostone, and marble is located in eastern Loudoun County and the Town of Leesburg, which has a history of sinkhole activity. The karst regions in Northern Virginia are classified as "short karst," which includes fissures, tubes, and caves generally less than 1,000 feet long and 50 feet or less in vertical extent.

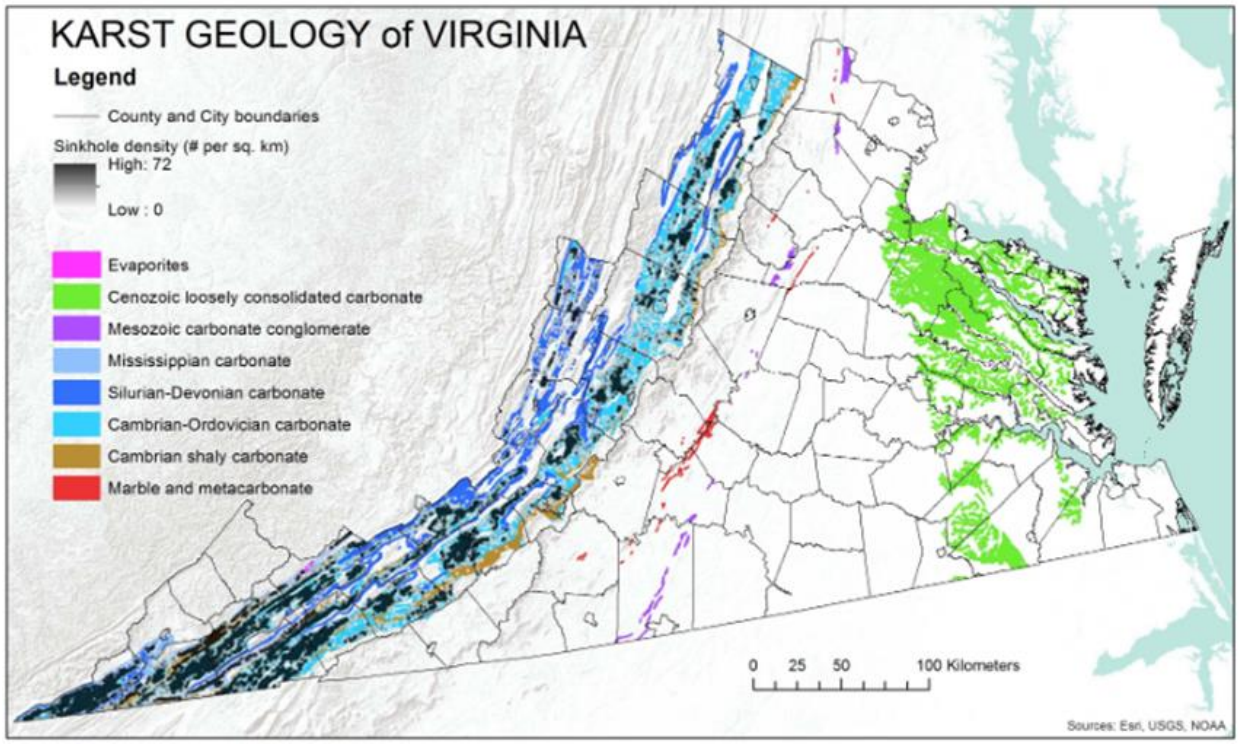


Figure 45: Karst Regions and Historical Subsidence in Virginia[156]

Loudoun County has a region of karst geology located in an area roughly one mile on either side of State Route 15 from just south of Leesburg, north to the Potomac River Bridge. The region is bounded sharply to the west by the Bull Run Fault, which runs at the base of Catoctin Mountain through Loudoun County. The area is primarily composed of the following geologic formations:

- Frederick Limestone

[156] A Resident's Guide to Sinkholes (virginia.gov)

- Tomstown Dolomite
- Catharpin Creek Formation
- Catharpin Creek Formation Goose Creek Member
- Balls Bluff Siltstone Leesburg Member

Figure 46: Loudoun County Limestone District[157]

[157] 2017 Northern Virginia Hazard Mitigation Plan

5.7.1.2. Extent

Although sinkholes frequently occur without notice, there are warning signs of potential sinkhole development, including the following:

- Slumping or leaning fence posts, utility poles, trees, etc.
- Discolored vegetation
- Visible tension cracks in the ground surface
- Discolored well water
- New cracks in building walls
- Newly sagging floors or pavements

Sinkhole formation is aggravated and accelerated by urbanization, which increases water usage, alters drainage pathways, overloads the ground surface, and redistributes soil. According to FEMA, the number of human-induced sinkholes has doubled since 1930, costing nearly $100 million. However, the apparent increase in sinkhole frequency may be attributable to reporting biases. Changes in ground water levels increase the overburden stress on the void roof, increasing the potential for roof collapse; thus, using that period as indicating a larger trend may not be appropriate, especially given the context of the initial data. Furthermore, naturally occurring sinkholes under expensively developed real estate result in higher insurance payouts and increase premiums, or loss of coverage for property owners.

5.7.1.3. Previous Occurrences

Sinkholes may occur in localized areas of the Northern Virginia region; however, most are shallow and tend to be caused by soil washed away under the ground surface due to flash flooding or broken utility lines, rather than karst conditions. To date, there have been no Federal Declared Disasters in Virginia for sinkholes/karst. Below are the only reported events of this hazard. All other jurisdictions in the planning area have not experienced an event.

Since 2017, three sinkholes in the planning area have been reported by local media sources:

- On **August 8, 2021**, a sinkhole was discovered outside of Leesburg on Route 15. The road was temporarily closed for repairs by the Virginia Department of Transportation.[158]
- On **August 12, 2020**, a large sinkhole, caused by flash flooding from a heavy rainfall, was reported in Manassas Park. It was estimated at 50 feet by 100 feet and washed a parked car into a nearby creek. The sinkhole temporarily blocked access to a community of about 400 residents.[159]
- In **April 2015**, a sinkhole opened in the Exeter Community of Loudoun County. The hole, which measured approximately 30 by 40 feet, formed in the parking lot of a townhouse community, and caused some damages, including the sinking of the roadway and disruption of water service to approximately 65 structures in the area. Reports indicate this was the second sinkhole in this same area in the previous two decades.

Other known events, although not comprehensive, were documented in the 2017 NOVA HMP. These include the following:

[158] Loudounnow.com. July 8, 2021. https://loudounnow.com/2021/07/08/rt-15-business-to-close-due-to-sinkhole/
[159] Hedgpeth, Dana. The Washington Post. Large sinkhole forms in Northern Virginia as flash flooding prompts water rescues. August 12, 2020. https://www.washingtonpost.com/dc-md-va/2020/08/12/sinkhole-manassas-virginia-flooding/

- In **June 2014**, heavy rain caused the collapse of a major thoroughfare in Loudoun County. The collapse occurred on Dry Mill Road and exposed a 48-inch water main, resulting in a five-mile detour for motorists.
- In **2008**, a sinkhole 20 feet deep and 25 feet wide closed Dale Boulevard west of Mapledale Avenue, about four miles from Interstate 95 in Prince William County.
- On **August 11, 2001**, heavy rainfall washed out a culvert and created a sinkhole in Arlington County; no damages were reported.

No other sinkhole events have occurred in the planning area. No karst events in Northern Virginia are identified in the 2018 COV-SHMP.

5.7.1.4. Probability of Future Events

It is impossible to predict incidents of land subsidence with precision; they can occur suddenly and without warning or over an extended period of several years. However, some factors associated with a decrease in roof strength are wet conditions, vibrations, and increased surface loading. Land subsidence resulting from a drawdown of the groundwater table is likely to occur over a number of years. Procedures for predicting the occurrence of land subsidence have not yet been developed.

To include karst in the risk assessment, some general assumptions were made. Geographical Extent, using USGS Karst Topography maps, was the primary basis for establishing risk and was calculated as a percent of the jurisdictional area. In lieu of probability of future occurrence, areas with more karsts were assumed to be at greater risk.

5.7.2. Risk Assessment

As discussed previously, sinkholes are relatively uncommon events in the Northern Virginia region. The existing soil types are not conducive to creating natural sinkholes, and those sinkholes that do occur are related to soil piping or the dissolution of sparse carbonate rock and typically cause very little damage. There are no known sources of sinkhole probability data for the region and no record of historical incidences causing property damages.

5.7.2.1. Built Environment and Community Lifelines

The vulnerability of each identified critical facility was assessed for the 2017 NOVA HMP update using GIS analysis by comparing their physical location with the extent of known hazard areas that can be spatially defined through GIS technology. Of those critical facilities identified in the region, some were determined to be in known hazard areas upon further GIS analysis and thereby determined to be "potentially at risk." This assessment was not updated for 2022 because there have been no significant changes in the physical locations of the facilities.

Loudoun County maintains a karst feature database (developers in the County are responsible for mapping karst features to determine whether all requirements or ordinances and provisions have been met). For applications within the LOD, all documentation and studies are outlined in Section 4-1900 of the zoning ordinance. This organization allows Loudoun County to significantly reduce sinkhole risk to facilities, property, and people.

Using the Limestone Layer available through Loudoun County's website, mapped critical assets in Loudoun County were viewed via the County's GIS portal. Of the mapped critical assets—which include schools, fire stations, police stations, other public safety assets, and emergency medical assets—at least one fire station was found to be located within the known limestone area of Loudoun County.

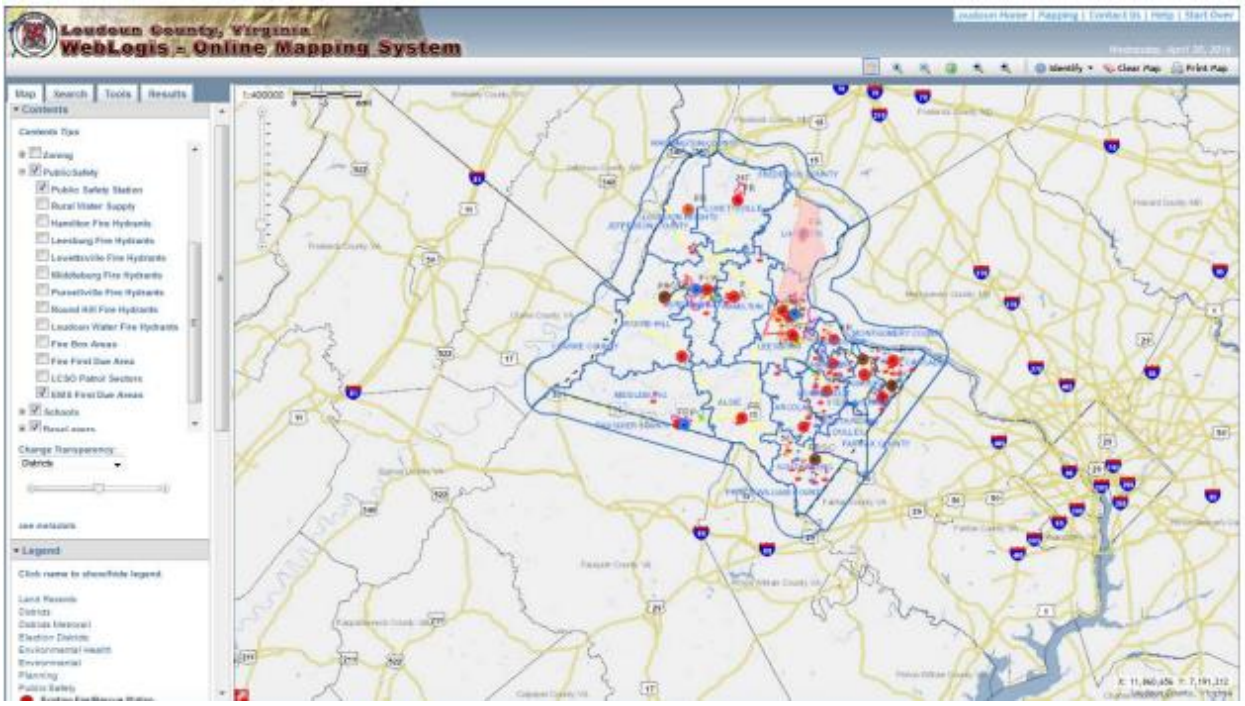


Figure 47: Loudoun County Limestone Overlay District and Critical Assets Map[160]

Loss estimates could not be calculated for sinkhole/karst events due to a lack of detailed and accurate information regarding structures and assets located in the previously determined hazard areas. In addition, due to the extremely localized and site-specific nature of typical karst events, any inventory of potential at risk structures may grossly over-estimate potential losses.

The *2018 COV-SHMP* provides a relative risk table for multiple jurisdictions in relation to sinkholes/karst. All jurisdictions in the planning area were determined to be medium-low or low risk for sinkholes/karst.

5.7.2.2. Future Population and Development Trends

Future development and resulting population increase have the potential to elevate vulnerabilities to karst/sinkholes in the future, depending on site-specific characteristics and interaction with other natural hazards, including variables related to climate change and jurisdictions' capabilities to manage appropriate growth.

With future growth, various non-structural mitigation actions—such as zoning and grading ordinances as well as structural methods—should be analyzed in terms of cost-effective mitigation alternatives. One non-structural method to reduce the likely consequences of debris flows would be zoning and grading ordinances to avoid building in areas of potential hazard or to regulate construction to minimize the potential for karst/sinkholes/land subsidence.

Loudoun County has adopted an LOD in its zoning ordinance that seeks to preserve and protect the unique geologic characteristics and the quality of the groundwater in its limestone area. The ordinance is intended to regulate land use and development in areas underlain by limestone and in areas with karst features and karst terrain in such a manner as to:

- Protect the health, safety, and welfare of the public;

[160] 2017 Northern Virginia Hazard Mitigation Plan, Figure 4.48.

- Protect groundwater and surface water resources from contamination; and
- Reduce potential for property damage resulting from subsidence or other earth movement.

5.7.2.3. Hazard Risk Ranking Summary

The hazard ranking process included consideration of probability and consequences of sinkholes/karst in determining an overall risk score and ranking. Information within this section and the hazard risk ranking process present the quantitative and qualitative summary for sinkhole-karst. The Hazard Identification and Risk Assessment methodology is described in **Section 4, Base Plan.**

Table 97: Hazard Risk Rankings for Karst/Sinkholes/Land Subsidence, by Jurisdiction

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Arlington County	1.3	2.7	4.1	**Low**
City of Alexandria	1.0	2.5	3.5	**Low**
City of Fairfax	1.0	2.5	3.5	**Low**
City of Falls Church	1.0	2.5	3.5	**Low**
City of Manassas	1.0	2.5	3.5	**Low**
City of Manassas Park	1.0	2.5	3.5	**Medium**
Fairfax County	1.0	2.5	3.5	**Low**
Town of Clifton	1.0	2.5	3.5	**Low**
Town of Herndon	1.0	2.5	3.5	**Low**
Town of Vienna	1.0	2.5	3.5	**Low**
Loudoun County	1.0	2.5	3.5	**Low**
Town of Leesburg	1.0	2.5	3.5	**Low**
Town of Lovettsville	1.0	2.5	3.5	**Low**
Town of Middleburg	1.0	2.5	3.5	**Low**
Town of Purcellville	1.0	2.5	3.5	**Low**
Town of Round Hill	1.0	2.5	3.5	**Low**
Prince William County	1.0	2.5	3.5	**Low**
Town of Dumfries	1.0	2.7	3.7	**Low**
Town of Haymarket	1.0	2.7	3.7	**Low**
Town of Occoquan	2.0	3.2	5.2	**Medium**

5.7.2.4. Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluating, and updating of this Plan should consider the following factors related to sinkholes/karst, as well as other information from the Virginia COV-SHMP:

- Have karst/sinkholes/land subsidence events occurred within the planning area since the adoption of 2022 HMP?

- Did karst/sinkholes/land subsidence events occur in areas adjacent to the planning area that impacted the planning area by virtue of their being in proximity?
- Have new scientific studies, research, or methodology changed the ability to predict karst/sinkholes/land subsidence events or assess risk and vulnerability?
- Has there been significant change in the population, built environment, natural environment, or economy that could affect the risk or vulnerability to karst/sinkholes/land subsidence, including expansion of critical infrastructure in landslide-susceptible areas?
- Is there new evidence related to the impacts of sinkholes/karst that could affect the level of risk or vulnerability?

5.8. Landslide

2022 HMP Update

The landslide hazard was reviewed, and a new analysis was performed that included but was not limited to the following:

- Reformatting the hazard section to improve flow and clarity.
- Refreshing the hazard profile with updated data, maps, and imagery, where available.
- Updating the assessment of risk and vulnerability by jurisdiction based on new data.
- Ranking the hazard by jurisdiction using the methodology described in Section 4.

Due to the determination of low overall vulnerability, this hazard is minimally profiled, and a comprehensive vulnerability analysis was not justified for this Plan update. Potential changes in risk and vulnerability will be monitored during the next planning cycle.

Table 98: Landslide Profile

<table>
<tr><th colspan="5">Landslide</th><th>Overall Vulnerability</th></tr>
<tr><th colspan="5">Definition, Key Terms, and Overview</th><td rowspan="4">Low</td></tr>
<tr><td colspan="5">Landslide/slope failure is the movement of rock, dirt, and debris down a slope. Landslides are occasionally referred to by other terms, such as creep, debris flow, rock fall, and others.</td></tr>
<tr><th>Frequency</th><th>Probability</th><th colspan="3">Potential Magnitude</th></tr>
<tr><td rowspan="2">Low</td><td rowspan="2">Unlikely</td><th>Injuries/Deaths</th><th>Infrastructure</th><th>Environment</th></tr>
<tr><td>Low</td><td>Low</td><td>Low</td></tr>
</table>

5.8.1. Hazard Profile

The United States Geological Survey (USGS) indicates that landslides occur in every state in the United States and kill between 25 and 50 people every year nationwide. They cause more than $1 billion in damage, making them one of the more costly natural hazards.[161]

Types of movement include rotational, translational, block, fall, topple, avalanche, earth flow, creep, and lateral spreading. Landslide materials in motion generally consist of fractured or weathered rock, loose or unconsolidated soils, and vegetative debris. Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening of slopes due to construction or erosion, earthquakes, volcanic eruptions, and changes in groundwater levels.

Inadequate storm drainage or leaking water distribution systems may also have the same cumulative effects as extreme storm events in contributing to landslides. The blockage of stream flow may have significant impact on flood potential in topographic settings that constrict the flow of floodwaters during

[161]United States Geological Survey (USGS). https://landslides.usgs.gov/learn/ls101.php

high flow events. Landslides/slope failures affect access and traffic safety during these storm events in addition to causing fatalities and major damage to infrastructure. Landslides/slope failures in developed areas can cause significant damage to buildings and property.

Table 99: Landslide Terms and Definitions[162]

Term	Definition
Block Slide	A block of rockslides as a unit along a slip plane down a slope.
Creep	Slow-moving landslide often noticed only due to crooked trees and disturbed structures.
Debris Landslide	Predominately gravel, cobble, boulder sediments and trees move quickly down slope.
Debris Flow	Coarse sediments flow downhill and spread out over relatively flat areas.
Earth Flow	Fine-grained sediments flow downhill and typically form a fan structure.
Rock Fall	Blocks of rock fall away from a bedrock unit *without* a rotational component.
Rock Topple	Blocks of rock fall away from a bedrock unit *with* a rotational component.
Rotational Slump	Blocks of fine-grained sediment rotate and move down slope.
Slip Plane	A **plane surface** through a crystal, along which **slip** can take place under some conditions without apparently disrupting the crystal.
Transitional Slide	Sediments move along a flat surface without a rotational component.

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 during heavy rainfall or rapid snowmelt, changing the soil into a flowing river of mud or "slurry." Slurry can flow rapidly down slopes or through channels and can strike with little or no warning at avalanche speeds. Slurry can travel several miles from its source, growing in volume 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.

Among the most destructive types of debris flows are those that accompany volcanic eruptions. A spectacular example in the United States was a massive debris flow resulting from the 1980 eruptions of Mount St. Helens in the State of Washington. Areas near the bases of many volcanoes in the Cascade Mountain Range of California, Oregon, and Washington are at risk from the same types of flows during future volcanic eruptions.

Nationally, landslides are considered a hazard of such concern that a recent federal policy was enacted to broaden the USGS's current activities and enhance coordination with other federal agencies. The *National Landslide Preparedness Act (P.L. 116-323*) was signed into law on January 5, 2021, authorizing a national landslide hazards reduction program. Section 3 of the Act authorizes landslide-related grant programs for research, mapping, assessment, and data collection.

[162] United States Geological Survey (USGS), Landslides Glossary. Retrieved on January 3, 2021, at: https://www.usgs.gov/programs/landslide-hazards/landslides-glossary

Table 100: Hazard Profile Summary

Landslide **Assessment: Low-Risk Hazard**	**Location**	Localized, site-specific	**Potential Cascading Effects (All Site-Specific)** • Property damage • Loss of life • Infrastructure damage • Road closures • Environmental impact • Public safety threat
	Extent	Minimal	
	Duration	Minutes to hours	
	Probability	Unlikely	
	Seasonal Pattern	No seasonal pattern, but may be exacerbated by snow melt in late spring or excessive rainfall events in summer	
	Speed of Onset	Slow to rapid	
	Warning Time	Minutes to hours	
	Repetitive Loss	N/A	

Table 101: Landslide Hazard Ranking Parameters for Northern Virginia Jurisdictions[163]

Jurisdiction	Population Vulnerability	Population Density	Injuries and Fatalities	Property Damage	Crop Damage	Events	Geographic Extent	Total Risk Ranking
Arlington	High	High	Low	Low	Low	Low	Low	Medium-Low
Alexandria, City of	Medium-High	High	Low	Low	Low	Low	Medium-High	Medium
Fairfax, City of	Medium	High	Low	Low	Low	Low	Low	Medium-Low
Falls Church, City of	Low	High	Low	Low	Low	Low	Low	Low
Manassas, City of	Medium	High	Low	Low	Low	Low	Low	Medium-Low
Manassas Park, City of	Low	High	Low	Low	Low	Low	Low	Low
Fairfax County (including towns)	High	High	Low	Low	Low	Low	Low	Medium-Low
Loudoun County (including towns)	High	Medium-High	Low	Low	Low	Low	Medium-High	Medium-Low
Prince William County (including towns)	High	Medium-High	Low	Low	Low	Low	Low	Medium-Low

[163] 2018 Commonwealth of Virginia State Hazard Mitigation Plan, Table 3.13-4.

The potential impacts of landslides depend on the type of landslide that occurs (specific site, slope, gradual, or sudden) and the location where the subsidence occurs. The impacts of landslides occurring in nonurban areas are likely to be less damaging than those that occur in heavily populated locations. The amount of structural damage depends on the type of construction, the structure location and orientation with respect to the landslide location, and the characteristics of the event.

Potential impacts from landslides include damage to residential, commercial, and industrial structures; damage to underground and above-ground utilities; damage to transportation infrastructure, including roads, bridges, and railroad tracks; and damaged or lost crops. The extent and value of the potential damage cannot be assessed because the nature of the damage is site- and event-specific.

5.8.1.1. Location

Although mountainous areas in Virginia are the most susceptible to landslide events, they do occur elsewhere in the state, including the Northern Virginia region; however, these events are quite rare and limited in terms of their impact on people and property. Minor landslide events are possible in localized, steep-sloped areas of the Northern Virginia region during extremely wet conditions. These areas are primarily located in western Loudoun County, as well as some areas of moderate risk in extreme eastern areas of Fairfax and Prince William counties.

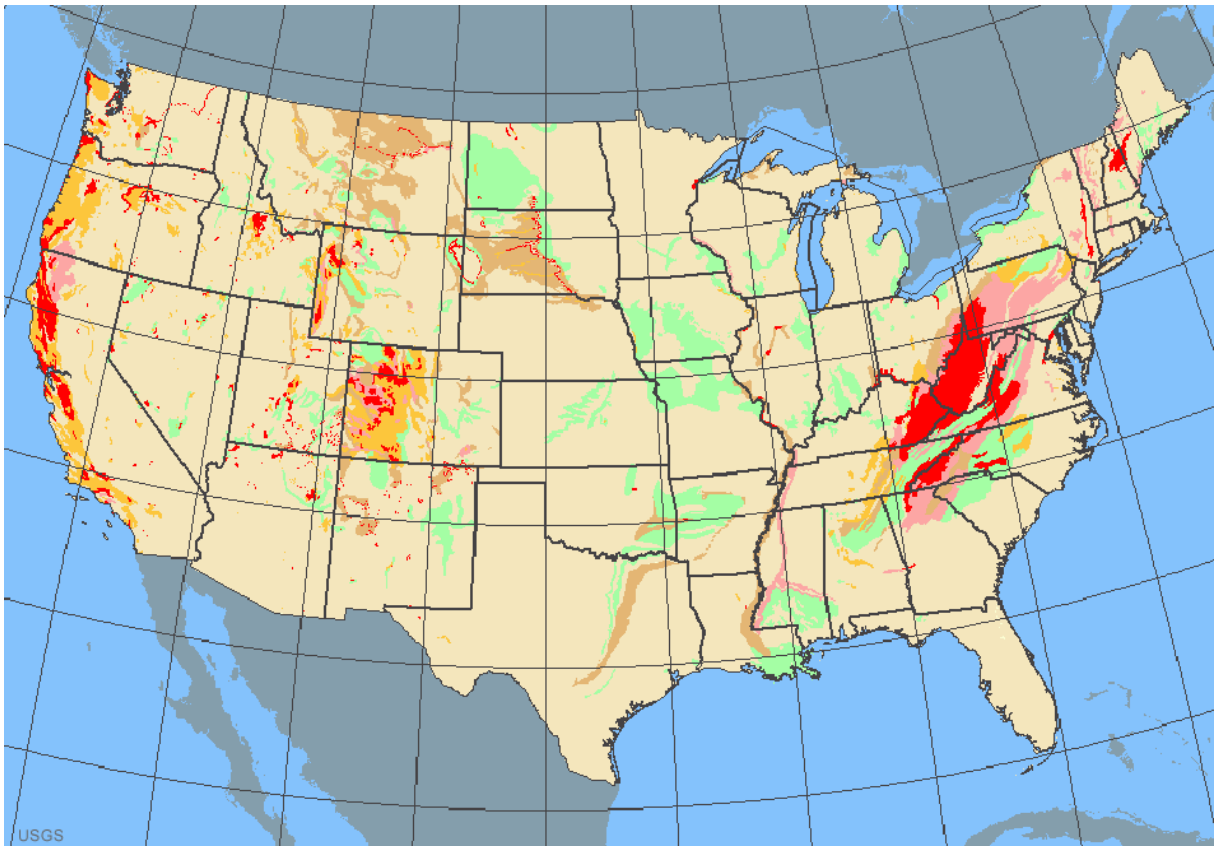


Figure 48: Relative Landslide Incidence and Susceptibility in the Conterminous United States[164]

Figure 48 provides a general indication of where landslide events are most likely to occur in Virginia based on landslide incidence and susceptibility data provided by the USGS and mapped by the Virginia

[164] United States Geological Survey (USGS).

Department of Emergency Management. (Red and pink areas have the highest incidence and susceptibility.)

Localized sites where slopes have been cut through (e.g., to accommodate roads, rail lines, utility lines, or other infrastructure) are susceptible to landslides. In addition, areas that have been previously filled for development may also be susceptible to slope failure, especially when accompanied by heavy rainwater run-off, earthquake, or other ground disturbance caused by human activity.

The U.S. Landslide Inventory provides an interactive map that indicates the level of confidence related to landslide incidents. As indicated on the map, there is one site in the planning area, near Dale City in Prince William County, that has been mapped in the Inventory with a noted level of confidence of "confident consequential landslide at this location."

5.8.1.2. Extent

The USGS divides landslide risk into six categories, which are grouped into three broader categories to be used for risk analysis and ranking; geographic extent is based on these groupings. These categories are as follows:

High Risk

1. High susceptibility to landslides, and moderate incidence.
2. High susceptibility to landslides, and low incidence.
3. High landslide incidence (more than 15% of the area is involved in landslide).

Moderate Risk

1. Moderate susceptibility to landslide, and low incidence.
2. Moderate landslide incidence (1.5%–15% of the area is involved in landslide).

Low Risk

1. Low landslide incidence (less than 1.5% of the area is involved in landslide).

Although landslides frequently occur without notice, there are warning signs of potential landslide development, including:

- Slumping or leaning fence posts, utility poles, trees, etc.
- Tension crack visible in the ground surface
- New cracks in building walls
- Newly sagging floors or pavements

5.8.1.3. Historical Occurrences

Although other areas of the state have documented incidents of landslide, the National Centers for Environmental Information (NCEI) indicates no incidents of "debris flow" in the Northern Virginia planning area between 1950 and June 30, 2021. In addition, the *2018 Commonwealth of Virginia Hazard Mitigation Plan (COV-SHMP)* records no incidents within the Northern Virginia jurisdictions through 2015.

5.8.1.4. Probability of Future Events

Based on historical occurrences and maps, the probability of a landslide is unlikely. Relative risk ranking is intended only for general comparison to the other hazards that impact Virginia.

The probability of occurrence for landslide is dependent on the amount of water present to mobilize the slide, the total size of the slide, and the amount of development in the area that could potentially be impacted. Landslides are more common in areas with steeper slopes (generally greater than 22 degrees) and in poorly drained soils. Some areas that are generally prone to landslides include old landslide sites, base of slopes, base of minor drainage hollows, base or top of old fill slope, base or top of a steep cut slope, and developed hillsides where leach field septic systems are used.

Landslide susceptibility or landslide risk maps can go beyond inventory maps and depict areas that have the potential for landslides. These areas are determined by correlating some of the principal factors that contribute to landslides—such as steep slopes, weak geologic units that lose strength when saturated, and poorly drained rock or soil—with the past distribution of landslides; however, none of these maps are available for the planning area.

5.8.2. Risk Assessment

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

5.8.2.1. Built Environment and Community Lifelines

For the purposes of this risk assessment, buildings potentially at risk for landslides were not considered because landslide incidence data is highly generalized owing to the small scale and the scarcity of precise landslide information for much of the country and is therefore unsuitable for local planning or actual site selection.

5.8.2.2. Natural Environment and Economy

Because some slope stability problems are associated with marine clay in Fairfax County (marine clay becomes loose as moisture content increases and is subject to slope creep if the natural slope is steepened during site development), the county has identified areas of marine clay and has established regulations requiring special engineering investigations and design procedures in these areas.

Without well-established occurrence probabilities as well as reliable historical data related to impacts, true risk and annualized dollar losses cannot be accurately estimated.

The 2018 COV-SHMP provides a relative risk table for multiple jurisdictions in relation to landslides. The Northern Virginia jurisdictions identified as high- or medium-high risk jurisdictions include the City of Alexandria and Loudoun County.

5.8.2.3. Future Population and Development Trends

Future development and the resulting population increase has the potential to increase landslide vulnerability in the future, depending on site-specific characteristics and interaction with other natural hazards, including variables related to climate change and jurisdictions' capabilities to manage appropriate growth.

With future growth, various non-structural mitigation methods, such as zoning and grading ordinances, as well as structural methods, should be analyzed in terms of cost-effective actions. One such non-structural method to reduce the likely consequences of debris flows would be zoning and grading ordinances to avoid building in areas of potential hazard or to regulate construction to minimize the potential for landslides. Loudoun County has adopted zoning ordinances preventing the development of building sites

with steep slopes along the Blue Ridge (defined in the ordinance as exceeding a 15% grade, equivalent to an 8-degree slope), which substantially reduces the hazards of landslides and debris flows within that area.

5.8.2.4. Hazard Risk Ranking Summary

The hazard ranking process included consideration of probability and consequences of a landslide in determining an overall risk score and ranking. Information within this section and the hazard risk ranking process presents the quantitative and qualitative summary for landslides. The Hazard Identification and Risk Assessment methodology is described in **Section 4, Base Plan**.

Table 102: Hazard Risk Rankings for Landslide, by Jurisdiction

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Arlington County	0	0	0	**NA**
City of Alexandria	1.0	2.5	3.5	**Low**
City of Fairfax	1.0	2.5	3.5	**Low**
City of Falls Church	1.0	2.5	3.5	**Low**
City of Manassas	0	0	0	**Low**
City of Manassas Park	1.0	2.7	3.7	**Low**
Fairfax County	1.0	2.5	3.5	**Low**
Town of Clifton	1.0	2.5	3.5	**Low**
Town of Herndon	1.0	2.5	3.5	**Low**
Town of Vienna	1.0	2.5	3.5	**Low**
Loudoun County	1.3	2.5	3.8	**Low**
Town of Leesburg	0	0	0	**Low**
Town of Lovettsville	1.3	2.5	3.8	**Low**
Town of Middleburg	1.3	2.5	3.8	**Low**
Town of Purcellville	1.3	2.5	3.8	**Low**
Town of Round Hill	1.3	2.5	3.8	**Low**
Prince William County	1.0	2.7	3.7	**Low**
Town of Dumfries	1.0	2.7	3.7	**Low**
Town of Haymarket	1.0	2.7	3.7	**Low**
Town of Occoquan	2.0	2.0	4.0	**Low**

5.8.2.5. Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluating, and updating of this Plan should consider the following factors related to landslides, as well as other information from the Virginia COV-SHMP:

- Have landslide events occurred within the planning area since the adoption of 2022 HMP?
- Did landslide events occur in areas adjacent to the planning area that impacted the planning area by virtue of their proximity?

- Have new scientific studies, research, or methodology changed the ability to predict landslide events or assess risk and vulnerability?
- Has there been significant change in the population, built environment, natural environment, or economy that could affect the risk or vulnerability to landslides, including expansion of critical infrastructure in landslide-susceptible areas?
- Is there new evidence related to the impacts of landslides that could affect the level of risk or vulnerability?

If risk factors related to landslide increase in the next planning cycle, the *National Landslide Hazards Mitigation Strategy – A Framework for Loss Reduction* (Circular 1244), published by the United States Department of the Interior, United States Geological Survey,[165] provides a comprehensive strategy to identify landslide mitigation options that consider appropriate actions within regulatory, research, detailed engineering studies, public awareness and education, and resiliency through emergency preparedness, response and recovery alternatives.

[165] Spiker, Elliott C., & Gori, Paula L (2003). National Landslide Hazards Mitigation Strategy – A Framework for Loss Reduction (Circular 1244), United States Department of the Interior, United States Geological Survey. https://pubs.usgs.gov/circ/c1244/c1244.pdf

5.9. Tornado

2022 HMP Update

The 2022 Plan updated continued to incorporate formatting changes and analyses implemented in the 2017 Plan. These changes include, but were not limited to the following:

- Refreshing the hazard profile
- Updating the previous occurrences
- Determining the number of hazard events and losses by jurisdiction using NCEI and other data sources (where available)
- Updating the assessment of risk by jurisdiction based on new data
- Ranking of the hazard by jurisdiction using the methodology described in Section 4
- Reformatting sections to improve clarity and, as available and appropriate, incorporate new maps and imagery

Table 103: Tornado Profile

<table>
<tr><th colspan="5">Tornado</th><th>Overall Vulnerability</th></tr>
<tr><th colspan="5">Definition, Key Terms, and Overview</th><td rowspan="4">Medium</td></tr>
<tr><td colspan="5">Tornado: 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 tropical storms) when cool, dry air intersects and overrides a layer of warm, moist air, forcing the warm air to rise rapidly.

Funnel Cloud: A rotating column of air like that of a tornado; however, the column does not touch the ground.

Waterspout: A tornado that forms over warm water and may move inland.</td></tr>
<tr><th rowspan="2">Frequency</th><th rowspan="2">Probability</th><th colspan="3">Potential Magnitude</th></tr>
<tr><th>Injuries/Deaths</th><th>Infrastructure</th><th>Environment</th></tr>
<tr><td rowspan="2">Low</td><td rowspan="2">Unlikely</td><td>Low</td><td>Moderate</td><td>Low</td></tr>
</table>

5.9.1. Hazard Profile

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 tropical storms) when cool, dry air intersects and overrides 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 (NWS), 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, turning ordinary objects into deadly missiles.

On average, more than 800 tornadoes are reported each year in the U.S., according to the National Oceanic and Atmospheric Agency (NOAA), resulting in an average of 80 deaths and 1,500 injuries annually. Tornadoes are more likely to occur during the spring and early summer months of March through June, but they can also develop in other months. They are also more likely to form in the late afternoon and early evening but can occur at any time of day. Most tornadoes are a few dozen yards wide and touch down only briefly; however, even small, short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes can carve out a path of devastation more than a mile wide and several miles long.

Tornado Warning vs. Watch[166]

- **Tornado Watch**- Be Prepared! Tornadoes are possible in and near the watch area.
- **Tornado Warning**- Take Action! A tornado has been sighted or indicated by weather radar. There is imminent danger to life and property.

Waterspouts are weak tornadoes that form over warm water; they are most common along the Gulf Coast and southeastern states where the water is warmer. Waterspouts occasionally move inland, becoming tornadoes that cause damage and injury. However, most waterspouts dissipate over the open water, causing threats only to marine and boating interests. Typically, a waterspout is weak and short-lived, and because they are so common, most go unreported unless they cause damage.

The destruction caused by tornadoes ranges from light to devastating, depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction such as residential homes (particularly mobile homes) and tend to remain localized in impact. The Fujita–Pierson Scale for Tornadoes (F Scale) was developed in 1971 to rate tornado intensity based on associated damages. The Enhanced Fujita Scale (EF Scale) was developed and implemented operationally in 2007.

Table 104: Hazard Profile Summary

Tornado **Assessment: Medium-Risk Hazard**	**Location**	Jurisdiction-wide	**Potential Cascading Effects** • Impact on infrastructure, including roads and bridges • Impact on critical facilities, such as bridges, major roadways, water, and wastewater treatment plans • Loss of natural resources • Economic losses if businesses must close because employers or employees are unable to reach the workplace
	Extent	Minor to significant	
	Duration	Several minutes	
	Probability	Unlikely	
	Seasonal Pattern	Typically, March through November	
	Speed of Onset	Slow to rapid, depending on conditions	
	Warning Time	None, or a few minutes	
	Repetitive Loss	N/A	

[166] Understand Tornado Alerts (weather.gov)

5.9.1.1. Location

Tornadoes are a non-spatial hazard, meaning they can occur anywhere in the planning area and may affect all or part of the region. According to the NOAA Storm Prediction Center (SPC), historically, the highest concentration of tornadoes in the United States has been in Oklahoma, Texas, Kansas, and Florida. 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"), the trend in frequency and location of tornadoes in recent years has shifted to southeastern states, especially Alabama, Mississippi, and Tennessee. Although the planning area is located outside of "tornado alley" and does not experience as many tornadoes as other regions, there are nonetheless many examples of tornadoes tracking through Northern Virginia.

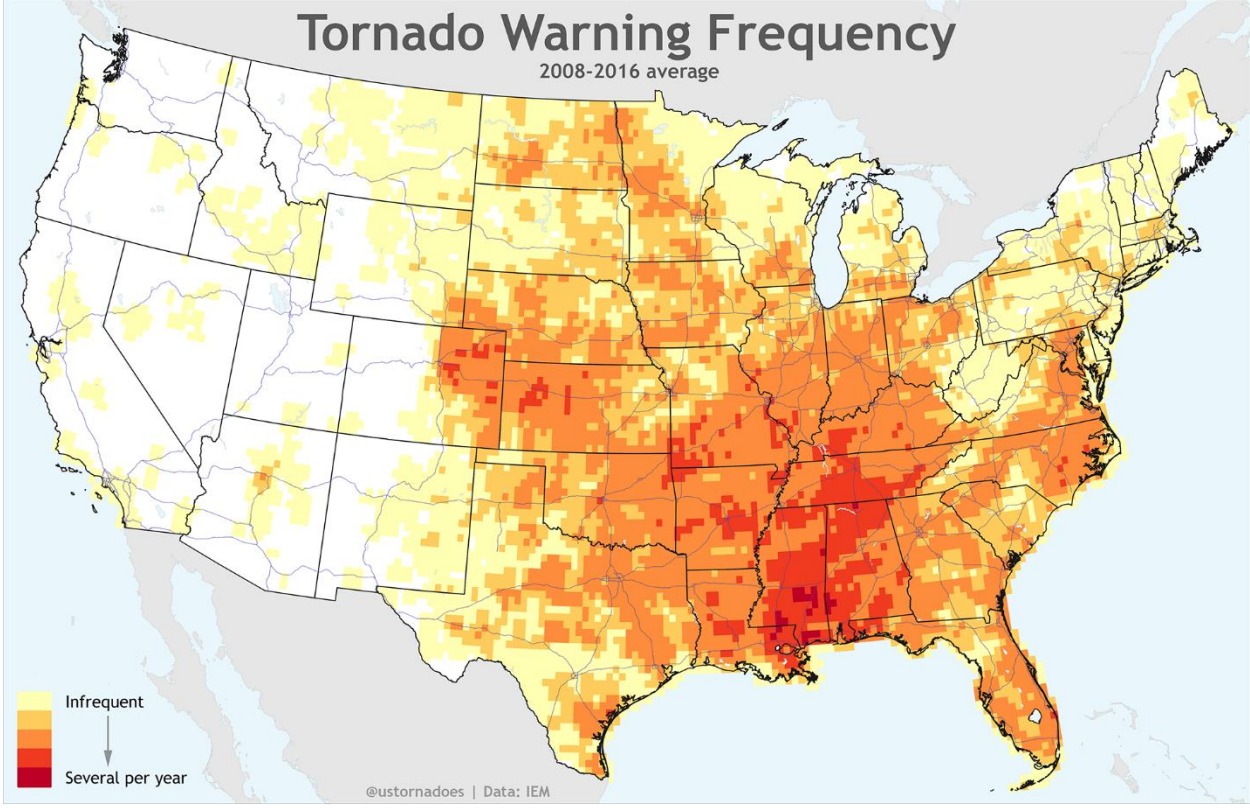


Figure 49: Annual Average Tornado Warning Frequency, 2008–2016[167]

Tornadoes most often occur in the United States east of the Rocky Mountains, but they are not limited to those regions; all jurisdictions within the planning area are susceptible to tornadoes. National Centers for Environmental Information (NCEI) data indicates that tornadoes most frequently occur between the months of May and November. However, tornadoes associated with tropical cyclones that may affect coastal areas are most common in September and October when the incidence of tropical storm systems is highest. This type of tornado usually occurs around the perimeter of the storm, most often in the northeast quadrant and ahead of the storm path or the storm center as it comes ashore. These tornadoes commonly occur as part of large outbreaks and generally move in an easterly direction.

[167] U.S. Tornadoes, 2020.

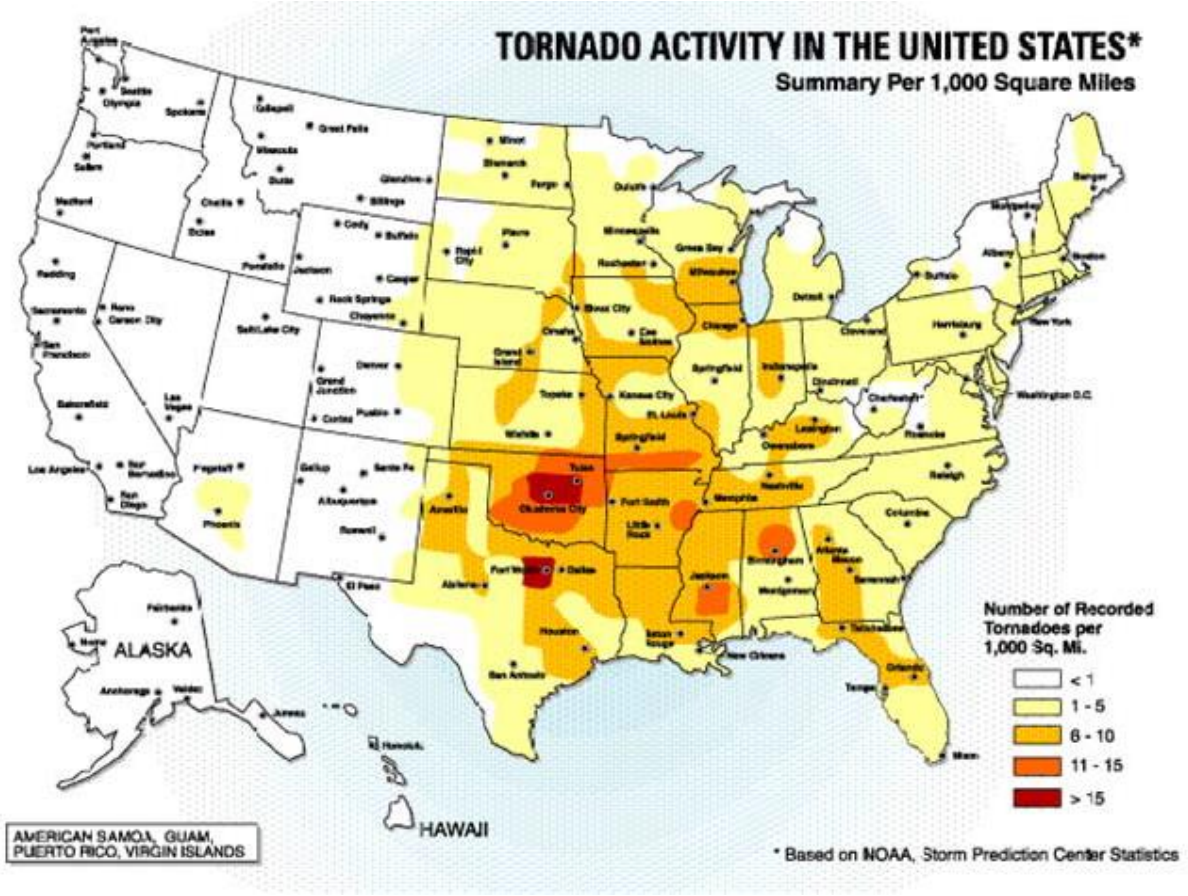


Figure 50: Tornado Activity in the United States[168]

5.9.1.2. Extent

The magnitude or severity of a tornado is measured by the Enhanced Fujita scale.

The magnitude of tornadoes was first measured by intensity on the Fujita-Pearson Tornado Scale, or simply the Fujita Scale, or F-Scale. The Fujita Scale, however, did not measure tornadoes by their size or width, but rather the amount of damage to human-built structures and trees. The scale ranged from F0 for the weakest, to F6 for the most powerful, although an F6 has never been recorded. The Fujita Scale was updated in 2007 to the Enhanced F-Scale. The enhanced scale classifies EF0-EF5 damage as developed by engineers and meteorologists across 28 different types of damage indicators (DI) and degrees of damage (DoD). To establish a rating, the National Weather Service will examine the damage to different structures and use their formulated chart to assign an EF-number to the tornado.

Most tornadoes that occur in Virginia are less intense (EF0 through EF2 on the EF-Scale) than those that occur elsewhere in the country, but occasionally they are of sufficient magnitude to inflict major damage and destruction.

[168] American Society of Civil Engineers

Table 105: Comparison Between the Fujita Scale (F-Scale) and Enhanced Fujita (EF) Scale, Including Potential Damage Descriptions[169]

Fujita Scale Developed in 1971 and Used Until 2007			Enhanced Fujita Scale (EF) Used as Measure of Magnitude in the U.S. Since 2007		
F Category	**Wind Speed (mph)**	**Potential Damage**	**EF Category**	**Wind Speed (mph)**	**Potential Damage**
F0	< 73	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.	EF0	65–85	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-
F1	73–112	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.	EF1	86–110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows/other glass broken.
F2	113–157	Considerable damage. Roofs torn from frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.	EF2	111–135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off
F3	158–206	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.	EF3	136–165	Severe damage. Entire stories of well-constructed homes destroyed; severe damage to large buildings, (e.g., shopping malls); trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak
F4	207–260	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown, and large missiles generated.	EF4	166–200	Devastating damage. Well-constructed houses and whole frame houses completely leveled; cars thrown, and small missiles generated.

[169] National Weather Service, The Enhanced Fujita Scale (EF Scale). Retrieved at: https://www.weather.gov/oun/efscale

Fujita Scale Developed in 1971 and Used Until 2007			Enhanced Fujita Scale (EF) Used as Measure of Magnitude in the U.S. Since 2007		
F Category	**Wind Speed (mph)**	**Potential Damage**	**EF Category**	**Wind Speed (mph)**	**Potential Damage**
F5	261–318	Incredible damage. Well-constructed houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd); trees debarked; incredible phenomena will occur.	EF5	> 200	Incredible damage. Well-constructed houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd.); high-rise buildings have significant structural deformation; incredible phenomena will occur.

Most tornadoes that occur in Virginia are less intense (EF0 through EF2 on the EF-Scale) than those that occur elsewhere in the country, but occasionally they are of sufficient magnitude to inflict major damage and destruction.

5.9.1.3. Previous Occurrences

From 1950 through the June 2021, 944 tornadoes were documented in Virginia—an average of 13.4 tornadoes per year. However, the average number of tornadoes in Virginia within the past twenty years (2000- 2020) was 28.6, indicating either an increase in the frequency of these events, more accurate reporting, or both. Nationwide statistics have suggested that prior to 1990, only one third of all tornadoes were recorded. Many occurred in unpopulated areas or caused little property damage and therefore were not reported to the NWS, while others may have been recorded separately as high wind events instead of tornadoes. Thus, the actual average number of tornadoes that Virginia experiences, in a given year, is likely higher than historical NOAA records indicate. Tornado fatality records began in 1916.

During the period 2000 to June 30, 2021, 48 tornado events were reported in the Northern Virginia jurisdictions—an average of 2.34 tornado events per year.

According to NCDC records, the Northern Virginia region experienced approximately 79 funnel cloud and tornado events from 1950 through June 30, 2021. Most of these events were recorded as either F0/EF0 or F1/EF1 events, although there have been some stronger events recorded as F2 and F3.

In total, these tornado events are reported to have caused at least two fatalities, 59 injuries and approximately $52.8 million in property and crop damages. More detailed information on each of these historical tornado events can be obtained through the NCEI Storm Events Database.

Table 106: Tornado Events in the Northern Virginia Region (1950–2021), by Jurisdiction[170]

	Annualized Property and Crop Damage	Total Property and Crop Damage	Injuries	Fatalities	Number of Events
Arlington County	$15,603	$1,100,000	0	2	3
City of Alexandria	$0	$7,500	0	0	2
City of Fairfax*	$0	$0	0	0	0
City of Falls Church	$35,461	$2,500,000	0	0	1
City of Manassas	$0	$0	0	0	2
City of Manassas Park	$0	$0	0	0	1
Fairfax County *Including Town of Clifton, Town of Herndon, Town of Vienna*	$487,957	$34,401,000	45	1	26
Loudoun County *Including Town of Leesburg, Town of Lovettsville, Town of Purcellville, Town of Middleburg, Town of Round Hill*	$154,085	$10,863,000	2	0	27

[170] NOAA, National Centers for Environmental Information, Storm Events Database, 1950 to June 30, 2021.

	Annualized Property and Crop Damage	Total Property and Crop Damage	Injuries	Fatalities	Number of Events
Prince William County *Including Town of Dumfries, Town of Haymarket, Town of Occoquan, Town of Quantico*	$55,489	$3,912,000	0	1	17
TOTAL	**$748,595**	**$52,783,500**	**59**	**2**	**79**

*NCEI does not provide a detailed breakdown of tornado events in all towns within each county. Consequently, town events are included with the county data.

Some of the previous occurrences recorded by NCEI are described below.

On **July 24, 2018**, an EF0 tornado struck Thomas Jefferson High School and tracked north towards Little River Turnpike. The tornado touched down briefly just south of the softball field, damaging fences, two sheds, light poles and several trees. Damage was minimal and proximal to the high school grounds. A shipping container was lofted over 100 yards as the tornado crossed the softball field moving northeast over an adjacent athletic field. Damages were approximately $10,000.

On **June 20, 2015**, an EF-0 tornado produced a 2.1-mile path of damage that was approximately 100 yards wide. The bulk of the damage occurred at the Broad Run Golf Training center in Prince William County, where about a half-dozen softwood trees between 12 and 18 inches in diameter were snapped approximately 4 feet above the ground. The damage at the baseball fields at the intersection of Route 28 and Godwin Road included a scoreboard secured by 4x4s being snapped, along with baseball dugout roofs lifted and blown away. Damage was sporadic along the 2.1-mile path.

On **October 15, 2014**, severe thunderstorms produced a confirmed EF-0 tornado near Belle Haven in Eastern Fairfax County. The tornado created a path of vegetative damage approximately 1.5 miles long. The tornado continued north across the Belle Haven Country Club, where larger tree limbs were snapped. The tornado then briefly moved into the City of Alexandria, likely lifting across Interstate 495 at the intersection of George Washington Parkway, where large tree branches were also downed. Several large tree branches were snapped in the adjacent neighborhood to the north before the radar signature weakened. Estimated maximum winds were 55–65 mph.

On **May 16, 2014**, a tornado touched down near Sunny Bank Lane in Loudoun County. A large tree was uprooted, and other trees and large branches were found uprooted and collapsed in different directions, along with branches snapped or twisted at various points along Light Horse Court.

On **April 27, 2011**, an EF-1 tornado snapped numerous trees along Carriage Ford Road, Aden Road and Garman Drive in Prince William County. Siding and shingles were removed from several homes in the area. Horse run-ins and sheds were also damaged. The doors of a detached garage were blown in. A fence was also damaged along with some signs and small trees in the parking lot of a shopping center. A few trees were snapped along Linton Hall Road before the tornado lifted.

On **October 13, 2011**, thunderstorms developing behind a front that contained strong aloft winds produced damaging wind gusts. Rapidly changing winds in both direction and speed caused some of the stronger thunderstorms to produce tornadoes near the warm front. Trees were sporadically uprooted and snapped along a path some three miles long, starting near Clifton and ending just west of Fairfax City.

On **July 23, 2008**, a weak tornado touched down in Prince William County in an industrial park near Wellington. The tornado produced siding and roof damage to homes and toppled trees. It also damaged the roof of a retail home center in Sudley Towne Plaza before lifting after crossing Sudley Road near Route 234.

On **June 4, 2008**, strong upper-level thunderstorms developed over the area, resulting in several severe thunderstorms. An EF-1 tornado crossed into south-central Loudoun County, producing a damage path near the town of Aldie.

On **July 4, 2007**, a funnel cloud was spotted near Pickett Road in Fairfax by the Department of Public Works and Environmental Services. Severe weather in the area caused the need for sheltering those attending Fourth of July celebrations. No reports of damage or injuries were received as a result of this funnel cloud; however, a man was killed in Annandale when a tree fell onto his car during storms earlier in the afternoon.

On **September 17, 2004**, a tornadic thunderstorm entered western Fairfax County from Prince William County. The storm had a path approximately seven miles in length. Beginning on Old Centerville Road, the storm produced scattered tree damage and minor roof damage in the Loudoun Town area. A line of damage was carved from Lee Highway northward into the Centerville and Chantilly areas. The tornado destroyed one home, damaged approximately 50 other structures, and was responsible for downed trees and powerlines. The parent thunderstorm produced another tornado on the east side of the City of Manassas that caused structural and tree damage before continuing into Manassas Park, where several dwellings were damaged in the Yorkshire subdivision. At its strongest, this tornado produced F2 damage estimated at $1 million.

On **September 24, 2001**, five tornadoes touched down in Northern Virginia during the afternoon and early evening. One tornado, which remained on the ground for 15 miles, passed through densely populated areas of eastern Fairfax County, the western portion of the City of Alexandria, and Arlington County, causing minor injuries and significant damage to trees, residences, and businesses. Its strength varied between F0 and F1 as it crossed the interstates three times during rush-hour traffic. Cars were hit with flying debris and some windows were blown out. Hundreds of homes and numerous parked vehicles were also damaged. Most of the damage was minor and limited to the exteriors and roofs of homes. A few homes suffered more significant damage, mainly in the Shirlington area of Arlington County. Total damages were estimated at $1 million. Only two people are known to have been injured. Before the tornado moved into Washington, DC, it passed right by the Pentagon City Mall and the Pentagon itself. Numerous recovery workers at the Pentagon in the aftermath of the 9-11 attack had to take cover from the tornado in underground tunnels. One of the tornadoes touched down in Prince William County, where it downed some trees in the Prince William Forest Park area. The tornado moved north into the Lake Montclair community, where it took down a few trees, broke branches, and bent siding on homes. The weak tornado lifted shortly thereafter.

On **May 25, 1997**, a small, short-lived tornado with winds up to 70 miles per hour, knocked down between 75 and 100 trees and limbs, some of which fell onto residences, vehicles, and other property in South Arlington. Scattered structural damage included aluminum siding, gutters, shingles, and plastic fascia.

On **June 24, 1996**, a tornado associated with the mesocyclone of a heavy-precipitation super cell touched down in extreme southeastern Loudoun County near Bull Run Creek, then proceeded east-southeast for 20 miles, knocking down more than 1,000 trees and causing substantial property damage, especially in western Fairfax County, before lifting along the Capital Beltway at the Braddock Road interchange less than two miles west of Annandale. The most significant damage occurred along Tree Line Drive, where 11 of 17 homes incurred moderate to major damage. The combined effort of several agencies produced property damage estimates along the track (not including flora) totaling $2.9 million. Included in that total are 323 homes that sustained minor damage. An estimated 80,000 homes lost power along the track of the tornado in Fairfax County; for some homes, power was not restored until several days after the event.

On **April 16, 1993**, a tornado touched down approximately half a mile southwest of Saint Louis in the southern part of Loudoun County and moved east-northeast for about 1.7 miles. The storm knocked down and damaged hundreds of trees. The roofs of two barns were blown off, windows were blown out, and fences were ripped up.

On **September 5, 1979**, Hurricane David spawned six tornadoes across Virginia. A strong F3 tornado struck Fairfax County and the City of Fairfax, tracking 18 miles, killing one person and injuring six. It struck the same school hit by a tornado on April 1, 1973, this time causing $150,000 in damage. Numerous cars were demolished, 90 homes were damaged, and trees and debris blocked roads. Damages in Fairfax County reached $2.5 million dollars.

On **April 1, 1973**, a strong F3 tornado struck a populated area of Northern Virginia. It touched down in Prince William County and traveled 15 miles northeast through Fairfax and into Falls Church. Extensive damage occurred along a six-mile stretch in Fairfax. A high school, two shopping centers, an apartment complex, and 226 homes were damaged. Thirty-seven people were injured. It could have been much worse, but it was Sunday, and "Blue Laws" were still in effect—the normally busy shopping center, which had extensive damage, was closed and school was not in session. Damage totaled an estimated $14 million.

On **May 2, 1929**, on a day known as "Virginia's Deadliest Tornado Outbreak," the town of Hamilton in Loudoun County (six miles northwest of Leesburg) experienced one of the five tornadoes that caused widespread destruction across the state. The tornado's path was reportedly 200 yards in breadth and two miles long, and it destroyed a house, barn, as well as some smaller buildings at one farm. It caused several injuries but no deaths. Other nearby farms were damaged, as well as a brick church.

On **November 17, 1927**, a tornado touched down in a rural part of Fairfax County and moved northeast across the western part of Alexandria, across the Potomac River and Washington, DC, and into Maryland. More than 100 people were injured in Alexandria and more than 200 homes were unroofed and torn apart.

Although tornado events have occurred in the planning area, none were of a damage level that would warrant a Presidential Disaster Declaration.

5.9.1.4. Probability of Future Occurrence

The probability of future tornado events was examined through analysis of the NCEI historical data and in consideration of data presented in the *2018 Commonwealth of Virginia State Hazard Mitigation Plan (COV-SHMP)*, dated March 2018. The *COV-SHMP* identified multiple jurisdictions within the planning area that were considered to be at higher risk for tornadoes:

- Arlington County
- City of Alexandria
- City of Fairfax
- City of Manassas
- Fairfax County
- Loudoun County
- Prince William County

Based on this analysis, the overall probability of a tornado in the Northern Virginia region is unlikely, with a recurrence level of less than 1 event per year. It is unlikely that very strong tornadoes (F4 or F5) will strike the area, although it remains a possibility. Climate change is projected to increase the frequency and intensity of extreme weather events, including severe thunderstorms. At this time, it remains uncertain whether this may also translate into an increased frequency of tornadoes.

5.9.2. Risk Assessment

Tornadoes are a high-impact, low-probability hazard. A tornado's impact is dependent on its intensity and the vulnerability of development in its path.

Risk cannot be fully estimated for tornadoes due to the lack of intensity–damage models for this particular hazard. Instead, estimates of the financial impacts of tornadoes can be developed based on historical data contained within the NCEI storm events data. Examination of data shows that there were 79 tornado events in Northern Virginia between 1950 and June 2021, causing approximately $53 million in property and crop damages. Loudoun County has recorded more tornado damage than any other Northern Virginia jurisdiction. NCEI data shows that the county has suffered more than $14.5 million in property and crop damages since 2000.

5.9.2.1. People

There is no completely safe place during a tornado, but there are some that are safer than others. Those who are unable to reach a storm shelter in a timely manner are at risk for injury or death during a tornado event. Given the large number of "superhighways" in the Capital Region, it is conceivable that the people tied up in traffic during rush hour would need to shelter in their cars; however, tornadoes could lift vehicles to become flying debris. Those who live in areas not served by a warning siren or other notification system would be at risk if they do not see the impending event advancing or receive some type of warning. Many jurisdictions now use automated warning systems as a means of notification, although access to mobile phones, computers, or other digital equipment is necessary to receive the warning.

If the building you are in or close to does not have a shelter, go to the basement or an inside room without windows on the lower floor. If there is no basement, go to the center of the building and avoid mobile homes.

5.9.2.2. Economy

Even a tornado that is fast-moving or of short duration can severely impact the economy. Commercial and government structures, if not built to high construction standards, may be damaged or destroyed by a tornado. Those affected by a tornado event may not be able to reach their workplace because they themselves are busy recovering from the event, sorting through debris from a damaged house, or inspecting their property. The Capital Region includes a high concentration of government structures, museums, high-rise buildings, major employers, and small businesses that are at risk for economic loss as a result of a tornado impact.

5.9.2.3. Built Environment and Community Lifelines

The destruction of buildings and critical infrastructure by tornadoes ranges from light to devastating depending on the intensity, size, and duration of the tornado. Typically, tornadoes cause the greatest damage to structures of light construction such as residential homes (particularly mobile homes) and tend to remain localized in impact.

Northern Virginia includes a significant number of assets that are an extension of services provided by the federal government and based in the District of Columbia. The disruption of utilities and transportation systems, as well as lost hours of government and commercial operations (as well as decreased productivity) are the consequences of tornado events. Vulnerability to these damages varies in large part due to specific factors, including proactive measures such as regular tree maintenance and placing utility systems underground, which can minimize property vulnerability. Localities that have experienced tornado events are likely to be more prepared to deal with them and are less vulnerable than localities that have not experienced tornadoes.

5.9.2.4. Natural Environment and Cultural and Historic Assets

Northern Virginia is fortunate with many open spaces, forests, and other natural environments indigenous to the region. It is conceivable that a formidable tornadic event might also affect national assets, including Arlington National Cemetery with its many monuments and headstones.

5.9.2.5. Hazard Risk Ranking Summary

The hazard ranking process included consideration of probability and consequences in determining an overall risk score and ranking. Information presented within this section and the hazard risk ranking process present the quantitative and qualitative summary for tornadoes. The Hazard Identification and Risk Assessment methodology is described in **Section 4, Base Plan.**

Table 107: Hazard Risk Rankings for Tornadoes, by Jurisdiction

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Arlington County	1.3	4.2	5.5	**Medium**
City of Alexandria	1.3	4.5	5.8	**Medium**
City of Fairfax	1.3	4.2	5.5	**Medium**
City of Falls Church	1.3	4.2	5.5	**Medium**
City of Manassas	1.3	4.3	5.6	**High**
City of Manassas Park	1.3	4.3	5.6	**Medium**
Fairfax County	1.3	4.2	5.5	**Medium**
Town of Clifton	1.3	4.2	5.5	**Medium**
Town of Herndon	1.3	4.2	5.5	**Medium**
Town of Vienna	1.0	4.2	5.2	**Medium**
Loudoun County	1.7	4.1	5.8	**High**
Town of Leesburg	1.7	4.1	5.8	**High**
Town of Lovettsville	1.7	4.1	5.8	**High**
Town of Middleburg	1.7	4.1	5.8	**High**
Town of Purcellville	1.7	4.1	5.8	**High**
Town of Round Hill	1.7	4.1	5.8	**High**
Prince William County	1.3	4.8	6.1	**Medium**
Town of Dumfries	1.3	4.3	5.6	**Medium**
Town of Haymarket	1.3	4.3	5.6	**Medium**
Town of Occoquan	4.0	6.0	10.0	**Medium**

5.9.3. Vulnerability Assessment

Tornado vulnerability is based on construction codes and standards for buildings and infrastructure, the availability of shelters or safe rooms, and advanced warning capabilities.

A quantitative analysis of tornado impact was performed for the *2017 NOVA HMP* and was retained for the 2022 update. For the purposes of this assessment, no assumption was made as to the level of damage that the asset would sustain; therefore, the values displayed represent the entire value of the asset and its contents.

Table 108: Scenario Vulnerability Assessment for Tornadoes, by Jurisdiction[171]

Jurisdiction	Number of Assets Damaged	Value of Assets	Value of Contents	Total
Arlington County	83	$488,255,187	$27,000,723	$515,255,910
City of Alexandria	6	$55,873,350	$50,000,000	$105,873,350
City of Fairfax	0	$0	$0	$0
City of Falls Church	3	$18,662,700	$0	$18,662,700
City of Manassas	7	$10,191,160	$796,050	$10,987,210
City of Manassas Park	6	$40,408,100	$0	$40,408,100
Fairfax County	61	$511,768,862	$78,281,693	$590,050,555
Town of Clifton	-	-	-	-
Town of Herndon	8	$18,762,385	$2,514,029	$21,276,414
Town of Vienna	6	$13,250,000	$700,000	$13,950,000
Loudoun County	22	$245,335,780	$245,335,780	$490,671,560
Town of Leesburg	14	$26,397,517	$1,517,642	$27,915,159
Town of Lovettsville	$0	$0	$0	$0
Town of Middleburg	4	$297,620	$297,620	$595,240
Town of Purcellville	2	$28,030	$28,030	$56,060
Town of Round Hill	0	$0	$0	$0
Prince William County	0	$0	$0	$0
Town of Dumfries	0	$0	$0	$0
Town of Haymarket	6	$3,187,813	$205,877	$3,393,690

The type and age of construction plays a role in facilities' vulnerability to tornadoes. In general, concrete, brick, and steel-framed structures tend to fare better in tornadoes compared to older, wood-framed structures or manufactured homes. However, even well-constructed buildings are vulnerable to the effects of a stronger (generally EF2 or higher) tornado. Finally, not all critical facilities have redundant power sources, and some may not even be wired to accept a generator. Plan updates should consider closer examination of critical facilities' risk by looking at those facilities' construction type in jurisdictions considered to be at higher risk of tornadoes.

[171] 2017 Northern Virginia Hazard Mitigation Plan

5.9.3.1. Future Population and Development Trends

Future development and the resulting population increase has the potential to increase tornado vulnerability in the future, depending on climate change variables and jurisdictions' capabilities to manage growth appropriate to zoning ordinances, building codes, and population distribution. The impacts and consequences from previous tornado events can serve as a guide for future planning and regulatory actions based on appropriate development in the region's jurisdictions.

5.9.3.2. Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluating, and updating of this Plan should consider the following factors related to tornadoes as well as other information from the *COV-SHMP*:

- Have any tornadic events occurred since this Plan was adopted, or did events occur in adjacent jurisdictions that impacted people or property in the planning area?
- Have any of the communities installed warning sirens or other systems that would enable the population to take cover in the event of an expected tornado?
- Have the results of new scientific research or methodology changed the ability to predict tornado events or assess risk and vulnerability?
- Has the community developed—or is it planning to develop—additional storm shelters?
- Have there been significant changes in the demographics, built environment, natural environment, or economy that could affect the risk or vulnerability to tornado events?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to tornado events?
- Has there been a significant increase in the number of persons who fall into one or more of the vulnerable population categories, thereby increasing the number and types of persons or groups at higher risk from tornado events?
- Closely examine critical facilities at risk by determining their construction type in all or some areas of the planning area.

5.10. Wildfire

2022 HMP Update

The Wildfire hazard was reexamined, and a new analysis was performed. This new analysis included but was not limited to the following:

- Reformatting the hazard section to improve flow and clarity
- Refreshing the hazard profile with updated data, maps, and imagery, where available
- Updating the assessment of risk and vulnerability by jurisdiction based on new data
- Ranking the hazard by jurisdiction using the methodology described in Section 4

Table 109: Wildfire Profile

<table>
<tr><th colspan="5">Wildfire</th><th>Overall Vulnerability</th></tr>
<tr><th colspan="5">Definition, Key Terms, and Overview</th><td rowspan="4">Low</td></tr>
<tr><td colspan="5">Any fire occurring in a wildland area (i.e., grassland, forest, brush land), except for prescribed burns. (Prescribed, or “controlled,” burning is the practice of igniting fires under specific conditions and in accordance with strict parameters by land management agencies).</td></tr>
<tr><th>Frequency</th><th>Probability</th><th colspan="3">Potential Magnitude</th></tr>
<tr><td rowspan="2">Low</td><td rowspan="2">Low</td><th>Injuries/Deaths</th><th>Infrastructure</th><th>Environment</th></tr>
<tr><td>Low</td><td>Low</td><td>Moderate</td></tr>
</table>

5.10.1. Hazard Profile

Wildfires are part of the natural management of the Earth’s ecosystems but may also be caused by natural or human factors. Nearly 85% of wildland fires in the United States are started by negligent or intentional human behavior, such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause of wildfire is lightning.[172] Wildland fires are usually signaled by dense smoke that fills the area for miles around.

States are responsible for responding to fires on nonfederal (state-owned, local, and private) lands, except for land that is protected by federal agencies under cooperative agreements. Although a small percentage of fires account for most acres burned, most wildland fires cannot be classified as catastrophic. Only about 1% of fires become conflagrations—raging, destructive fires—and predicting which ones will turn into conflagrations depends on multiple factors, including geography and weather conditions.

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,

[172] United States National Park Service, Wildfire Causes and Evaluations, based on 2000-2017 Wildland Fire Management Information and U.S. Forest Service Research Data Archive. Retrieved at: https://www.nps.gov/articles/wildfire-causes-and-evaluation.htm

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.

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.) may 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, and damage pavement and underground utilities.

Table 110: Definitions of Wildfire Types

Term	Definition
Surface Fire	A surface fire, the most common type of wildfire, burns along the floor of a forest, moving slowly and killing or damaging trees.
Ground Fire	A ground fire (muck fire) is usually started by lightning or human carelessness and burns on or below the forest floor.
Crown Fire	A crown fire spreads rapidly by wind and moves by jumping along the tops of trees.

Human activities are the leading cause of wildfire incidents in Virginia. The cause of the greatest number of fires during the period from 1995 to 2016 was debris burning and the intentional setting of fires.[173] Lacking a distinct beginning and end period, a wildfire's duration varies based on location, weather, fuel source, and available firefighting resources.

Virginia's wildfire season normally occurs in the spring (March and April) and fall (October and November). During these times, the relative humidity is usually lower, winds tend to be higher, and the fuels are cured to the point where they readily ignite. Also, during these times, hardwood leaves are on the ground, providing more fuel and allowing sunlight to reach the forest floor, which warms and dries the surface fuels.

Fire activity varies from month to month and year to year based on precipitation amounts. During years of adequate rain and snow, wildfire occurrence is typically low. Lack of moisture during other years means extended periods of warm, dry, windy days and therefore increased fire activity. The damage caused by Hurricane Isabel in 2003 increased the threat of wildfires in Virginia and created a major threat to lives and homes in the eastern half of Virginia for several years to come. The dead and downed timber caused by the storm had time to cure and produce large wildfires that were difficult to suppress.

[173] 2018 Commonwealth of Virginia Hazard Mitigation Plan, March 2018.

Table 111: Hazard Profile Summary

Wildfire **Assessment: Low Risk Hazard**	**Location**	Rural, forested areas	**Potential Cascading Effects**
	Extent	Low	• Water supply shortage • Loss of natural resources • Low of wildlife • Loss of natural resources • Economic loss
	Duration	Hours to days	
	Probability	Low	
	Seasonal Pattern	No seasonal pattern, but may be more likely during winter and, in summer, exacerbated by severe storms with lightning	
	Speed of Onset	Slow to rapid	
	Warning Time	Minutes to hours	
	Repetitive Loss	N/A	

5.10.1.1. Location

Wildfires commonly begin unnoticed and spread quickly through vegetative fuels. As discussed in the ranking methodology section, the Virginia Department of Forestry (VDOF) risk assessment presented in the *2017 Northern Virginia Hazard Mitigation Plan (NOVA HMP)* represents the geographic extent and locations throughout the Commonwealth that have a higher risk for wildfire. The geographic extent score for a given jurisdiction is based on the percent of the jurisdiction that falls within the “high” risk area as defined by VDOF. Fairfax and Prince William Counties have the highest percent of land area within the high-risk classifications, compared to the other jurisdictions in the planning region. Several areas in Northern Virginia are conducive to wildfires—among them, the Conway-Robinson State Forest and Prince William Forest Park in Prince William County.

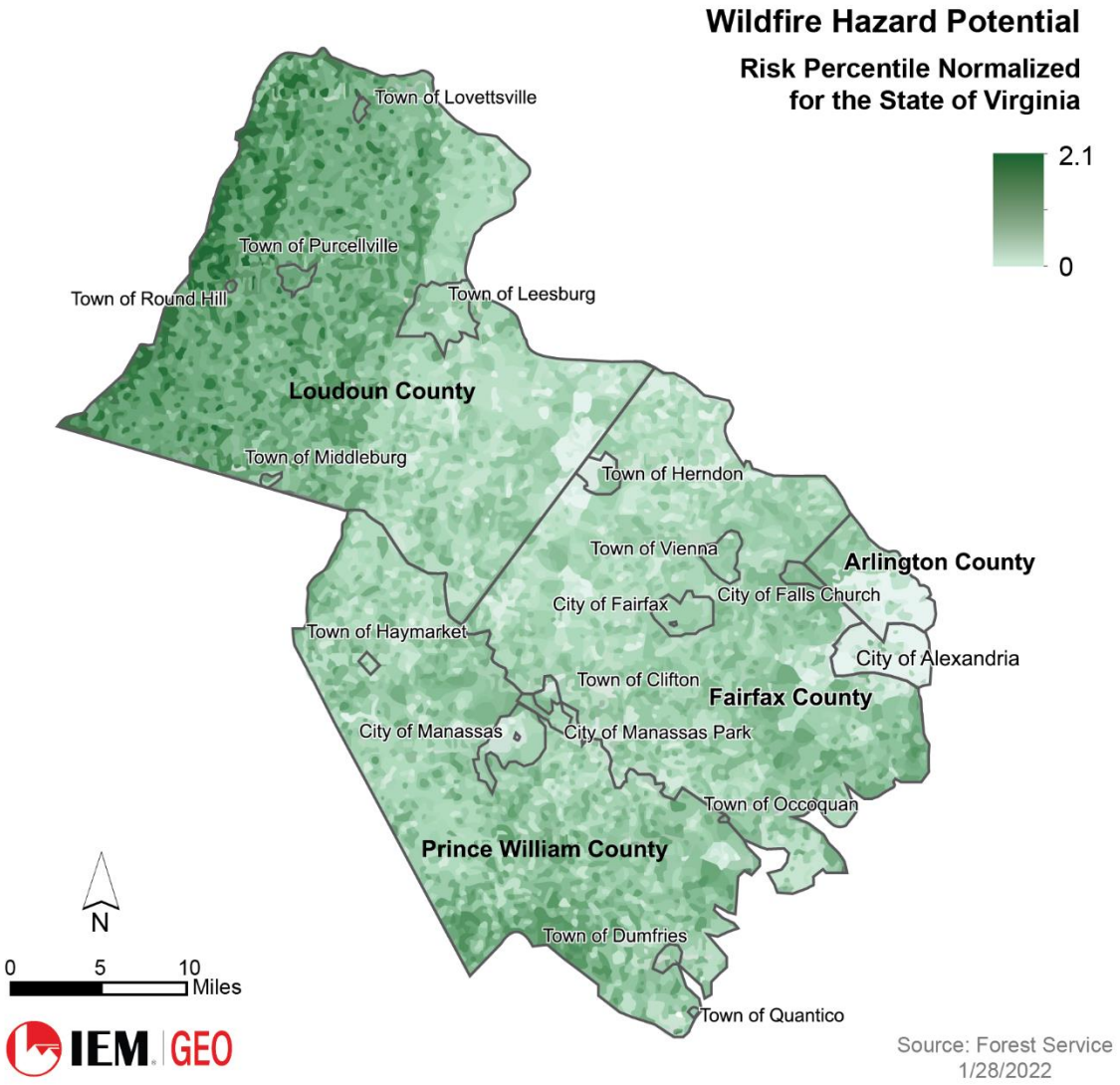


Figure 51: Wildfire Risk Assessment of Northern Virginia[174]

Individual homes and cabins, resorts, recreational areas, camps, subdivisions, businesses, and industries are sometimes located within high fire-hazard areas. The increasing demand for outdoor recreation puts more people in wildlands during holidays, weekends, and vacation periods. Unfortunately, wildland residents and visitors are rarely educated or prepared for the inferno that can sweep through brush and timber and destroy property in minutes. The Northern Virginia region is not considered as at risk of wildfire as other areas of the state, but wildfires do occur.

5.10.1.2. Extent

In the planning area, fires are typically small, burning an average of approximately 16 acres before being suppressed. Of the 141 recorded historical incidents during this period, six fires burned an area greater than 10 acres (all in Loudoun or Prince William County). This is a significant increase in the last few years, as ten of these fires occurred between 2009 and 2013.

[174] United States Forest Service, January 28, 2022.

5.10.1.3. Previous Occurrences

There are an average of 700 fires a year in Virginia which burn just under 9,500 acres (10-year average). More than 60 homes and other structures are damaged or destroyed by wildland fire throughout the Commonwealth.

Limited data is available through the Virginia Department of Forestry, primarily due to the lack of reporting for small fires. Below is the list of identified wildfire occurrences from the Virginia Department of Forestry. The other jurisdictions in this plan did not report any occurrence of a wildfire event.

Table 112: Wildfire Events in Northern Virginia (1995-2020) by Jurisdiction[175]

Jurisdiction	Number of Fires	Total Acres
Fairfax County	2	3
Loudoun County	100	379
Town of Leesburg	2	2
Prince William County	36	615
Town of Dumfries	1	6
TOTAL	**120**	**368**

The available data illustrates that majority of the wildfire occurrences in the Northern Virginia region were caused by debris burning and other human activities.

Based on the number of historical occurrences, wildfires are somewhat prevalent in the Northern Virginia region. These events, however, are usually contained to very small areas and have caused minimal damages to property due to strong fire response and suppression capabilities and resources.

Local records of wildfire occurrences do exist, though the recorded detail varies significantly from jurisdiction to jurisdiction. Thus, it is difficult to determine the incidence and impacts of wildfire for comparison purposes. Most wildfires that do occur are contained before they grow large and are handled by local fire resources, which means that most data regarding previous occurrences is stored, in some form, at the local level. For this update, no jurisdictions reported wildfire events.

Given the amount of wildland/urban interface acreage within the planning area, it is expected that there are numerous wildfire events to which local responders are called, sometimes multiple times in a single day. For example, on February 19, 2011, Fairfax County responded to a 20-acre wildfire, a 2-acre wildfire, a 5-acre wildfire, and numerous other incidents.

5.10.1.4. Probability of Future Occurrence

While the VDOF Wildfire Risk Assessment does indicate the relative propensity for wildfires in the planning area, this assessment does not assign probabilities of occurrence or return intervals as is common with some of the other hazards. Based on past events, the probability of a wildfire in the Northern Virginia region is unlikely, with a recurrence interval of less than 1 event per year.

Although the entire Northern Virginia region is vulnerable to wildfire and events have occurred in the planning area, it is difficult to calculate the probability of future occurrences due to human interaction and the unpredictable and localized nature of the hazard. In addition, the link between drought conditions and wildfire presents an additional challenge to calculating a specific return interval for probability.

[175] Virginia Department of Forestry,

Based on U.S. Forest Service data, the annual wildfire burn probability risk for the planning area ranges from 0% to 2.17%. All jurisdictions are at low or very low risk for potential wildfires.

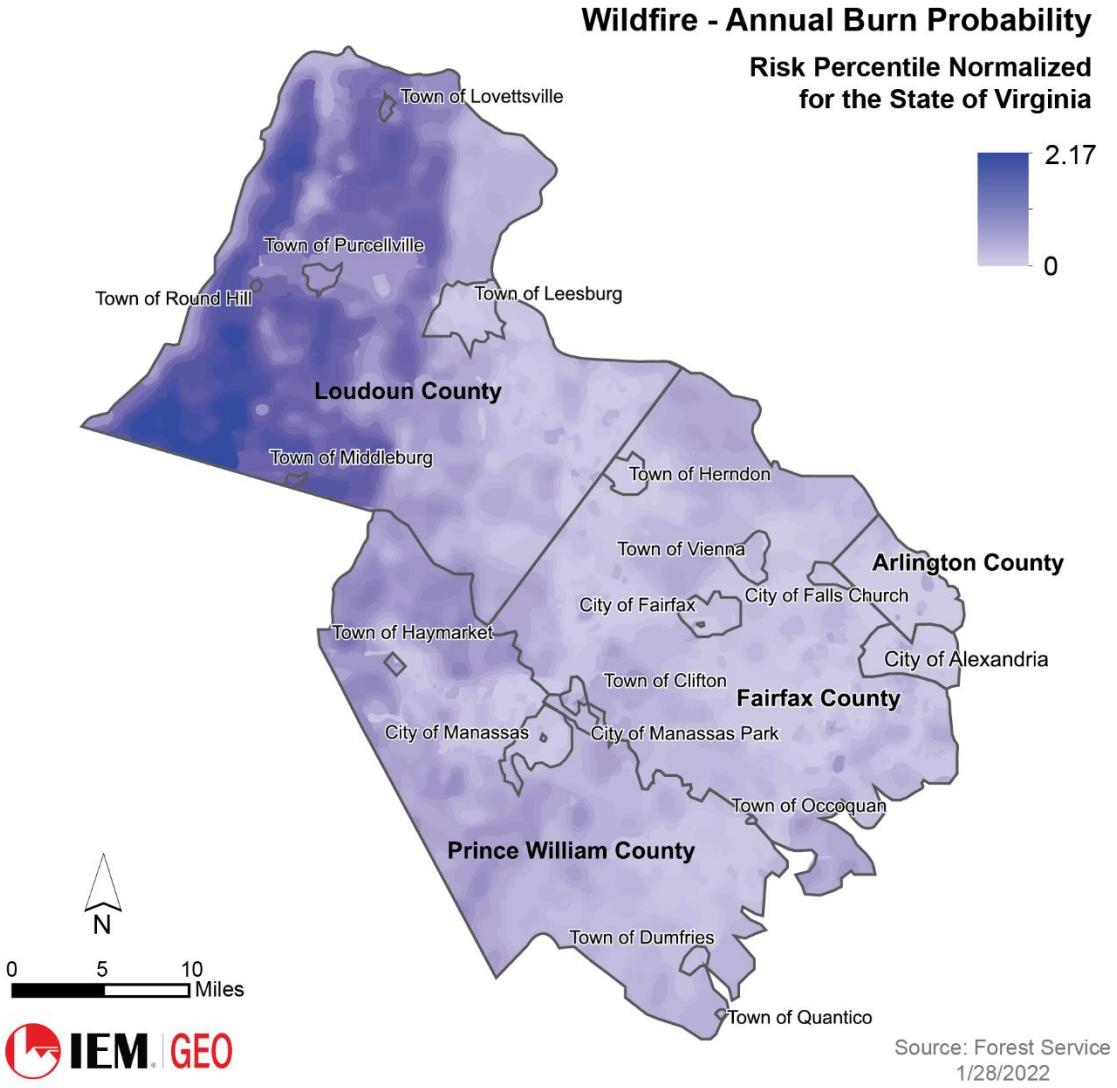


Figure 52: Wildfire Hazard Potential, VDEM Region 7[176]

One tool utilized for monitoring the development of conditions that may impact wildfire activity is the Keetch-Byram Drought Index (KBDI). The KBDI assesses the risk of fire by indicating the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff (accumulated layers on the forest floor) and upper soil layers. The KBDI utilizes a scale from 0 to 800, with the higher number indicating a higher probability of fire activity and a higher likelihood of extreme fire behavior. The KBDI is most often used by fire response agencies as a guide to ensure that adequate resources, such as personnel, equipment, and water supplies, are on hand to respond to more frequent or severe wildfires.

[176] United States Forest Service, January 28, 2022.

The KBDI image presented in this section indicates that most of the Mid-Atlantic states, including Virginia and the planning area, are at low risk for wildfire on the date indicated.

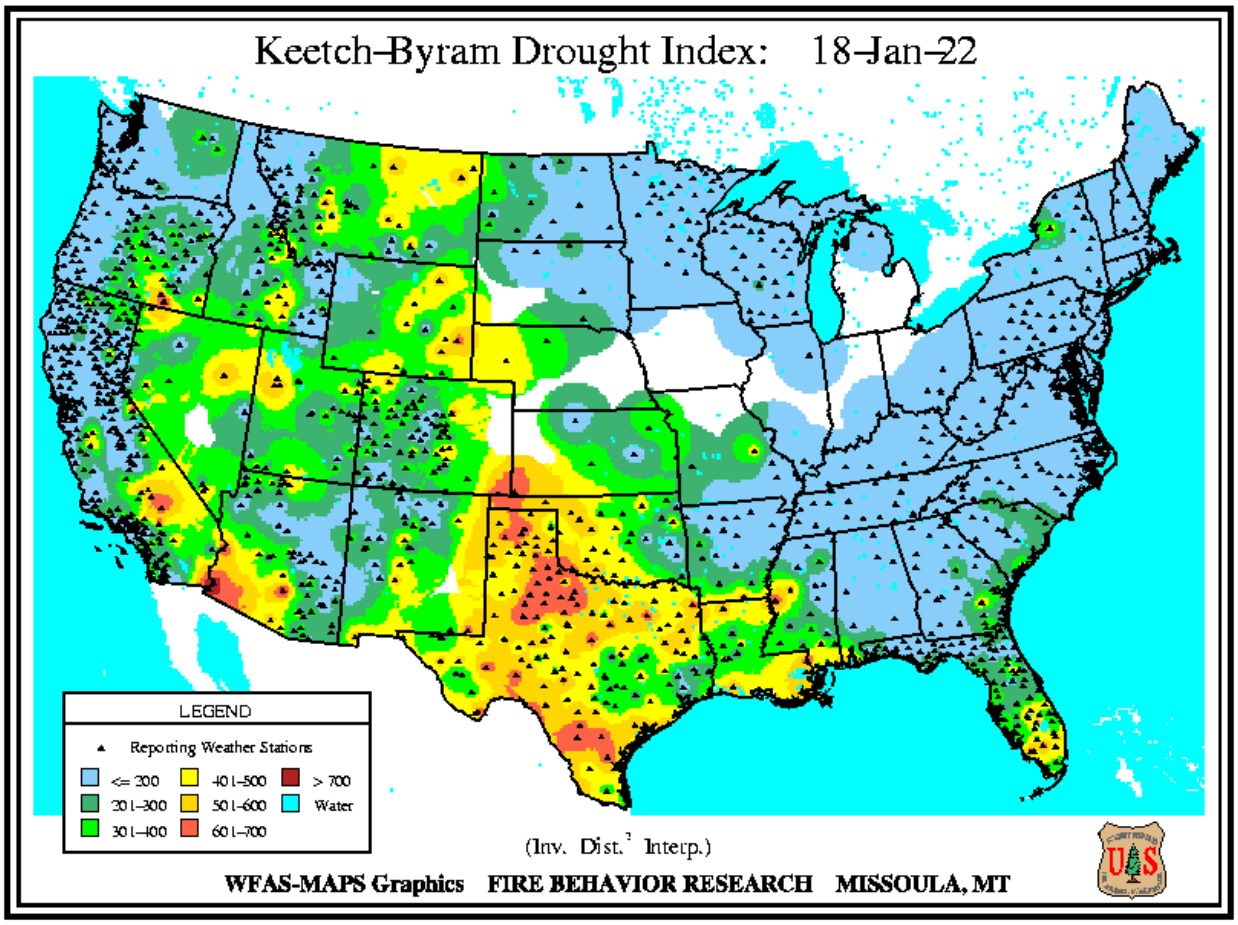


Figure 53: Keetch-Byram Drought Index, January 18, 2022[177]

5.10.2. Risk Assessment

The risk associated with wildfire in the planning area has not been formally quantified, due to the lack of precise information on probability and impact. A VDOF wildfire risk assessment conducted in 2002 and 2003[178] identified specific factors that could influence the occurrence and advancement of wildfires, including the following:

- Density of historical wildfires
- Land cover (fuel)
- Percent slope
- Slope orientation/aspect
- Population density

[177] National Drought Monitoring Center, University of Nebraska, Lincoln. Accessed January 18, 2022 at: https://droughtmonitor.unl.edu/data/png/current/current_usdm.png (Note: This map is updated frequently.)
[178] 2018 Commonwealth of Virginia Hazard Mitigation Plan, March 2018.

- Distance to roads
- Railroad buffer
- Road density and developed areas

For this update, risk of wildfire is focused on damages to infrastructure and population, rather than a discussion of the risk of fires starting or spreading.

5.10.2.1. Population and Property

There is low risk of human injury or death due to wildfire in Northern Virginia; however, people residing in areas of the wildland/urban interface are at greater risk. In addition, visitors to forested recreational areas are also at higher risk.

5.10.2.2. Built Environment, Community Lifelines, and Assets

A number of jurisdictions in the planning area included a review by the Insurance Services Office (ISO), an outside auditing group noted as a source of information about risk with its Building Code Effectiveness Grading Schedule (BCEGS). ISO performs a periodic review to assess a community's building codes and the degree to which the codes are enforced. The program emphasizes mitigation of loss from natural hazards. A community with safer buildings is likely to experience lower fire-related damages and losses, ultimately lowering insurance costs.

The agency has developed advisory rating credits that apply to BCEGS classifications ranging 1–3, 4–7, 8–9, and 10, and other scores that may be applied to different types of residential or commercial structures.

Table 113: BCEGS Ratings for Participation Northern Virginia Jurisdictions

Jurisdiction	Year of Evaluation	BCEGS Rating(s)
Arlington County		Awaiting response from ISO
City of Alexandria	1998	Class 3
City of Fairfax	2016	Class 3
City of Falls Church	2014	3- Residential 2- Commercial
City of Manassas	2018	3- 1 and 2 Family Residential 2- Commercial and industrial
City of Manassas Park	2000	Class 3
Fairfax County	2018	2- Residential 1- Commercial Class 2
Town of Clifton	Falls under county's score	
Town of Herndon	Falls under county's score	
Town of Vienna	Falls under county's score	
Loudoun County	2020	Class 3
Town of Leesburg	Falls under county's score	
Town of Lovettsville	Falls under county's score	

Jurisdiction	Year of Evaluation	BCEGS Rating(s)
Town of Middleburg	Falls under county's score	
Town of Purcellville	Falls under county's score	
Town of Round Hill	Falls under county's score	
Prince William County	2018	Class 2
Town of Dumfries	Falls under county's score	
Town of Haymarket	Falls under county's score	
Town of Occoquan	Falls under county's score	

One area of concern related to wildfires is the potential for extreme heat and flames to damage gas pipelines and other above-ground facilities associated with their operation. Damage to this infrastructure could result in temporary or long-term shutdown.

5.10.2.3. Natural Environment and Economy

Environmental damages due to wildfire are uncertain because locations vary, and magnitude is unknown. However, as evidenced by past events, the natural environment, including forested land, is at a moderate risk of impacts from wildfire. These impacts may lead to economic consequences for timber and agricultural losses, business disruption or loss, and loss of revenues from recreation and tourism.

5.10.2.4. Hazard Risk Ranking Summary

The hazard ranking process considered probability and consequences in determining an overall risk score and ranking. Information presented within this section and the hazard risk ranking process present the quantitative and qualitative summary for wildfire. The Hazard Identification and Risk Assessment methodology is described in **Section 4, Base Plan.**

Table 114: Hazard Risk Rankings for Wildfire, by Jurisdiction

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Arlington County	1.0	3.0	4.0	**Low**
City of Alexandria	1.0	3.0	4.0	**Low**
City of Fairfax	1.0	3.0	4.0	**Low**
City of Falls Church	1.0	3.0	4.0	**Low**
City of Manassas	0	0	0	**Low**
City of Manassas Park	1.0	3.0	4.0	**Low**
Fairfax County	1.0	3.0	4.0	**Low**
Town of Clifton	1.0	3.0	4.0	**Low**
Town of Herndon	1.0	3.0	4.0	**Low**
Town of Vienna	1.0	3.0	4.0	**Low**
Loudoun County	1.0	2.8	3.8	**Low**
Town of Leesburg	1.0	2.8	3.8	**Low**
Town of Lovettsville	1.0	2.8	3.8	**Low**

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Town of Middleburg	1.0	2.8	3.8	**Low**
Town of Purcellville	1.0	2.8	3.8	**Low**
Town of Round Hill	1.0	2.8	3.8	**Low**
Prince William County	1.0	3.0	4.0	**Low**
Town of Dumfries	1.0	3.0	4.0	**Low**
Town of Haymarket	1.0	3.0	4.0	**Low**
Town of Occoquan	2.0	2.0	4.0	**Low**

5.10.3. Vulnerability Analysis

Vulnerability to wildfire is influenced by many factors, such as land cover, weather, and the effectiveness of land management techniques. Although highly urbanized areas may be less vulnerable to wildfire, suburban neighborhoods located at the urban/wildland interface are vulnerable. The primary impacts of most wildfires are timber loss and environmental damage, although the threat to nearby buildings is always present. Secondary impacts may also include landslides and mudslides caused by the loss of groundcover which stabilizes the soil.

There is no single standardized methodology for estimating vulnerability to the wildfire hazard; however, the Virginia Department of Forestry's *Wildfire Risk Assessment* model identified the level of risk based on the areas where conditions are more conducive to wildfire occurrence and advancement. This assessment also identified areas that required further investigation at larger scales and highlighted the spatial relationships between areas of relatively high risk and other geographic features of concern, such as woodland home communities, fire stations, and fire hydrants.[179] The data presented in the assessment was determined to be valid for this update.

Table 115: Wildfire Risk by Jurisdiction[180]

Jurisdiction	Low (acres)	Low % Area	Medium (acres)	Medium % Area	High (acres)	High % Area	Total Acres
Arlington County	16,064	96.30%	435	2.61%	183	1.10%	16,682
Fairfax County	143,682	57.22%	77,244	30.76%	30,174	12.02%	251,100
Town of Clifton	43	26.06%	95	57.58%	27	16.36%	165
Town of Herndon	2,734	99.93%	1	0.04%	0	0.00%	2,736
Town of Vienna	2,795	99.25%	21	0.75%	0	0.00%	2,816
Loudoun County	136,046	42.16%	166,511	51.60%	20,114	6.23%	322,672
Town of Leesburg	4,670	58.46%	2,635	32.98%	684	8.56%	7,989
Town of Purcellville	278	13.69%	1,738	85.62%	14	0.69%	2,030

[179] Virginia Department of Forestry, Wildfire Risk Assessment, 2003. Data presented in the 2017 Northern Virginia Hazard Mitigation Plan, Table 4.104.
[180] Ibid.

Jurisdiction	Low (acres)	Low % Area	Medium (acres)	Medium % Area	High (acres)	High % Area	Total Acres
Town of Middleburg	219	33.08%	389	58.76%	55	8.31%	662
Town of Round Hill	0	0.00%	165	69.62%	71	29.96%	237
Prince William County	87,118	39.77%	98,129	44.79%	33,828	15.44%	219,076
Town of Dumfries	745	73.40%	255	25.12%	14	1.38%	1,015
Town of Haymarket	240	78.43%	66	21.57%	0	0.00%	306
Town of Occoquan	83	74.77%	27	24.32%	0	0.00%	111
City of Alexandria	9,644	98.83%	114	1.17%	0	0.00%	9,758
City of Fairfax	3,801	94.65%	215	5.35%	0	0.00%	4,016
City of Falls Church	1,275	100.00%	0	0.00%	0	0.00%	1,275
City of Manassas	6,130	95.50%	287	4.47%	2	0.03%	6,419
City of Manassas Park	741	65.29%	265	23.35%	129	11.37%	1,135
TOTAL	**416,352**	**48.97%**	**348,595**	**41.00%**	**85,295**	**10.03%**	**850,247**

Based on the Wildfire Risk Assessment, Prince William County has over 15% of its acreage in the high-risk category, with the Town of Round Hill having almost one-third of its acreage at high risk. Fairfax County has approximately 12% of its acreage in the high-risk category, with over 16% of the Town of Clifton's area in high risk. The Northern Virginia region is mostly low (48.97%) and medium (41%) risk, with a tenth of the region in the high-risk category.

5.10.3.1. Built Environment, Community Lifelines, and Assets

Historically, wildfires have been larger and caused more damages in areas of Loudoun and Prince William counties, not only because of increased vegetative fuel loads, but also because the areas are more sparsely settled and have lower rapid fire-response capabilities. The most at-risk properties within these areas are structures located along the wildland-urban interface, defined by the National Wildfire Coordinating Group as the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. Structures with combustible roofs and less than 30 feet of cleared defensible space are particularly at risk.

Fuels reduction projects are conducted by federal and state agencies responsible for fire response in the wildland/urban interface with a focus on high-risk communities and adjacent natural resources that are inherently important to social and/or economic stability. These projects focus on increasing public and firefighter safety, reducing risk of unwanted fire, protecting recreational opportunities on public lands, strengthening rural economies, and increasing public understanding of fire management.

The data available in the Hazus scenario model conducted for this update was utilized as the basis for determining critical and historical facilities in wildfire risk areas to determine which facilities were at an increased risk for wildfire or are located in the urban/wildland interface. Most of the region falls within areas currently classified as having low or very low potential for wildfire, with other areas classified as non-burnable.

The lack of wildfire probabilities and detailed infrastructure data led to the inability to calculate potential losses due to wildfire.

Future updates to this Plan should consider methods for quantifying annual wildfire losses, which might include defining life/safety, property, environment, and economic losses related to hydropower, tourism, and recreation, based on detailed local reports of occurrences and associated damages.

5.10.3.2. Future Population and Development Trends

Future development and the resulting population increase have the potential to elevate vulnerabilities to wildfire in the future, depending on climate change variables and jurisdictions' capabilities to manage growth appropriate to minimize fire impacts and ensure an adequate water supply. As suburban residential development continues to expand, it is reasonable to expect an increase in human/wildland interactions, resulting in more wildfires.

As climate warning progresses, precipitation is more likely to increase in the winter but decline during the summer, leading to increased drying of soils. This process, combined with less rain in the summer, could lead to more frequent, severe, and longer-lasting droughts that could result in more dry forest fuel. Increased heat waves may also increase the risk of wildfires.

5.10.3.3. Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluating, and updating of this Plan should consider the following factors related to wildfire as well as other information from the COV-SHMP:

- Have wildfire events occurred within the planning area since adoption of 2022 HMP?
- Did wildfire events take place in areas adjacent to the planning area that impacted the planning area?
- Has new scientific research or methodology changed the ability to predict wildfire events or assess risk and vulnerability?
- Has there been significant change in the population, built environment, natural environment, or economy that could affect the risk or vulnerability to wildfire, including changes in land use?
- Is there new evidence related to the impacts of wildfire that could affect the level of risk or vulnerability to wildfire?

5.11. Winter Weather

2022 HMP Update

The Winter Weather hazard was reexamined, and a new analysis performed. This new analysis included, but was not limited to:

- Reformatting the hazard section to improve flow and clarity
- Refreshing the hazard profile with updated data, maps, and imagery, where available
- Updating the assessment of risk and vulnerability by jurisdiction based on new data
- Ranking the hazard by jurisdiction using the methodology described in detail in Section 4
- Extreme Cold was separated from the Winter Weather section for the 2016 Plan update and continues to be included in the Extreme Temperatures section for the 2022 update

Based on the 2022 hazard analysis, the hazard name was changed to Severe Winter Weather to emphasize the difference between winter weather that is within the day-to-day capabilities and resources of the jurisdictions, and those that require additional mitigation to reduce the level of risk.

Table 116: Winter Weather Profile

<table>
<tr><th colspan="5">Winter Weather</th><th>Overall Vulnerability</th></tr>
<tr><td colspan="5">Definition, Key Terms, and Overview[181]</td><td rowspan="4">High</td></tr>
<tr><td colspan="5">Winter Weather: An event in which the main types of precipitation are snow, sleet or freezing rain.
Severe Winter Weather: A life-threatening winter storm for which a jurisdiction requires additional capabilities, resources, or actions.
Blizzard: A winter storm with winds of 35 miles per hour or greater, and significant snow or blowing snow with visibility of less than one-quarter mile.
Ice Storm: Ice accumulation that could cause extremely dangerous conditions and significant property or crop damage.</td></tr>
<tr><th>Frequency</th><th>Probability</th><th colspan="3">Potential Magnitude</th></tr>
<tr><td rowspan="2">Moderate</td><td rowspan="2">Highly Likely</td><th>Injuries/Deaths</th><th>Infrastructure</th><th>Environment</th></tr>
<tr><td>Moderate</td><td>High</td><td>Moderate</td></tr>
</table>

5.11.1. Hazard Profile

Winter weather may 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 impact multi-state regions. Winter storms may be accompanied by low temperatures, ice, and heavy and/or blowing snow, which can severely impair visibility.

Winter weather may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation.

[181] National Weather Service, Hazardous Weather Definitions

- **Sleet:** Raindrops that freeze into ice pellets before reaching the ground, usually bounce when hitting a surface, and do not stick to objects; however, sleet can accumulate like snow and cause a hazard to motorists.
- **Freezing rain:** Rain that falls onto a surface with a temperature below freezing, forming a glaze of ice. Even small accumulations of ice can cause a significant hazard, especially on power lines and trees.
- **Ice storm:** Occurs when freezing rain falls and freezes immediately upon impact. Communications and power can be disrupted for days, and even small accumulations of ice may cause extreme hazards to motorists and pedestrians.
- **Freeze:** Characterized by low temperatures, especially when they fall below the freezing point (zero degrees Celsius or 32 degrees Fahrenheit). House fires and carbon monoxide poisoning may occur when households use supplemental heating devices (wood, kerosene, etc.) and fuel-burning lanterns or candles for emergency heating or lighting.

Table 117: National Weather Service Winter Weather Warnings, Watches, and Advisories[182]

Term	Definition
Blizzard Warning	Issued for frequent gusts greater than or equal to 35 mph and accompanied by falling and/or blowing snow, frequently reducing visibility to less than ¼ mile for three hours or more.
Winter Storm Warning	Significant winter weather event including snow, ice, sleet, blowing snow, or a combination of these.
Wind Chill Warning	Chill values of -35°F or colder that can cause frostbite within as short a period as 10–15 minutes of exposure.
Freeze Warning	Temperatures of 32°F or colder for a significant period that could kill outdoor plants at the beginning or end of the growing season.
Winter Storm Watch	Issued when conditions are favorable for a significant winter storm event (heavy sleet, heavy snow, ice storm, heavy snow, blowing snow, or a combination of events).
Wind Chill Watch	Issued when there is the potential for a combination of extremely cold air and strong winds to create dangerously low wind chill values.
Winter Weather Advisory	A combination of winter weather conditions, such as 3 to 6 inches of snow expected within a 24-hour period; 5 to 8 inches of snow within a 24-hour period; light freezing precipitation; and/or blowing snow.
Wind Chill Advisory	Wind chill values between -25°F and -35°F that can cause frostbite within as short a period as 20–25 minutes of exposure.
Freeze Advisory	Temperatures in the mid-30s (°F) accompanied by clear skies, light winds, and high humidity near the ground that could kill outdoor plants at the beginning or end of the growing season.

[182] National Weather Service, Winter Weather Warnings, Watches, and Advisories. Retrieved at: https://www.weather.gov/safety/winter-ww

Table 118: Hazard Profile Summary

Severe Winter Weather **Assessment: High-Risk Hazard**	**Location**	Jurisdiction-wide	**Potential Cascading Effects** • Impact on critical infrastructure, including roads, bridges, utility lines, water facilities • Loss of natural resources • Economic losses if businesses must close because employers or employees are unable to reach the workplace • Long-term power outages • Significant impacts to travel on major roadways
	Extent	Moderate to Significant	
	Duration	Less than one week	
	Probability	Highly Likely	
	Seasonal Pattern	September through April	
	Speed of Onset	Slow to rapid, depending on conditions	
	Warning Time	6 to 12 hours	
	Repetitive Loss	N/A	

5.11.1.1. Location

The Northern Virginia region is in a part of the country that experiences hazardous winter weather conditions, including severe winter storms that bring heavy accumulations of snow, sleet, and freezing rain. On average, the region receives approximately 15 to 21 inches of snow annually. The region's biggest winter storms are typically associated with Nor'easters.

All jurisdictions within the planning area are susceptible to severe winter weather. During these events, winds around the storm's center can become intense, building waves that erode the Potomac shoreline and sometimes pile water inland causing extensive coastal flooding and severe erosion. These systems may also produce blinding snowfall that may accumulate to a foot or more of mixed precipitation that may leave a coating of ice. Other types of winter weather systems are more of a nuisance and generally do not cause major damage. Weather systems such as the "Alberta Clipper" (a fast-moving storm from the Alberta, Canada region), or a cold front sweeping through from the west, generally do not bring more than a few inches of snow in a narrow 50- to 60-mile-wide band.

5.11.1.2. Extent

The Regional Snowfall Index (RSI), an evolution of the Northeast Snowfall Impact Scale (NESIS)[183] seeks to rank snowstorms regionally throughout the United States based on the impacts these systems have on society. The scale is broken into five event categories ranging from 1, ("Notable") to 5 ("Extreme"). The amount of snowfall for a particular storm and the population impacted are the factors used in assigning NESIS values. This scale differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Virginia is included in the Southeast region. Researchers have calculated the scores for high-impact storms dating back to the 1900s.

[183] The Northeast Snowfall Impact Scale (NESIS) was developed by Paul Kocin and Louis Uccelline, National Weather Service, 2005.

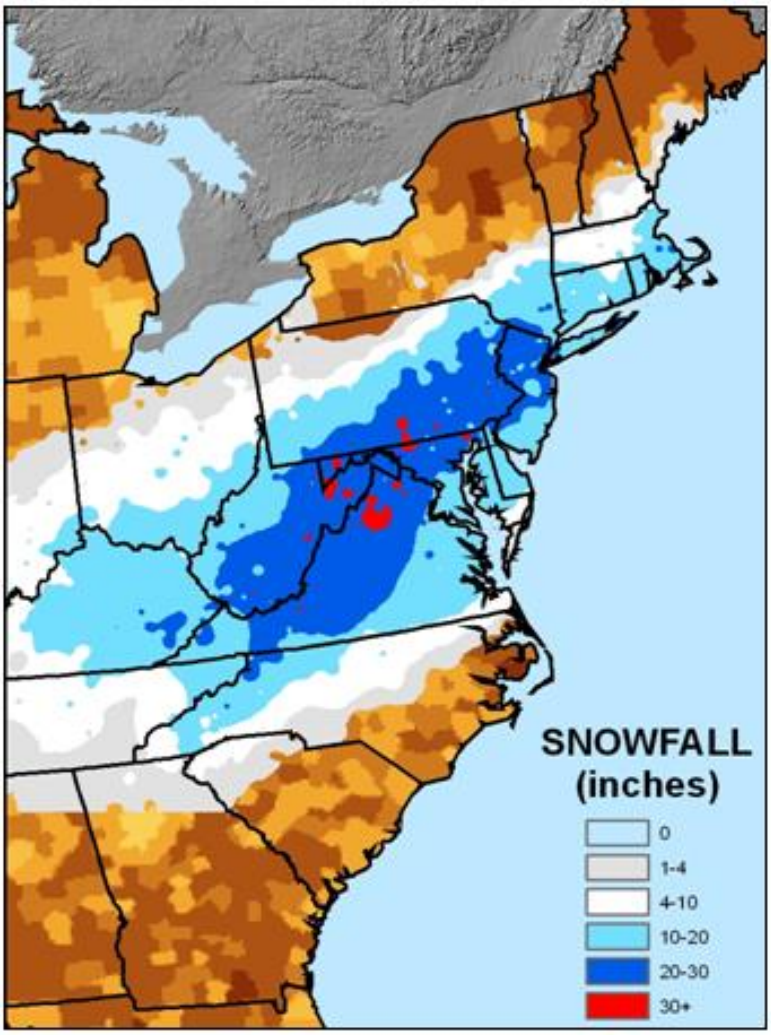


Figure 54: Example of Regional Snowfall Index (previously the Northeast Snowfall Impact Scale) with Snowfall, in Inches[184]

The NESIS image illustrates the planning area in dark blue, which relates to an event of 20 to 30 inches of snow, or a Category 4 ("Crippling").

5.11.1.3. Previous Occurrences

The National Centers for Environmental Information's Storm Events Database documents severe winter weather events (including blizzard, heavy snow, ice storm, winter storm, and winter weather) between 1996 and 2021. Within that period, there have been 503 winter storm event reports, causing an estimated $1.025 million in property damage.[185] There were five deaths and four injuries within the Northern Virginia region as a result of these events. The NCEI records winter storm events at a geographic county level;

[184] NOAA, Northeast Snowfall Impact Scale. Retrieved at: https://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis
[185] NOAA, National Centers for Environmental Information, Storm Events Database, 1950 to June 30, 2021. Most storm damages are attributable to traffic accidents and roof or other structural collapses, which are frequently insured and not reported to the National Weather Service. It is important to note that the considerable costs associated with lost wages and business opportunities, lowered productivity, and snow and ice removal are not factored into NCEI loss estimates and are therefore not accounted for here.

thus, all towns and cities within the same geographic area are included in the storm and damage estimates for that area because of the typically widespread spatial nature of winter storms.

Table 119: Winter Storm Events in Northern Virginia (1996 – 2021), by Jurisdiction[186]

Jurisdiction	Number of Winter Storm Events	Deaths	Injuries	Property and Crop Damage
Arlington County, the City of Alexandria, and the City of Falls Church	120	1	0	$440,000
Fairfax County, the City of Fairfax, & the Towns of Clifton, Herndon, and Vienna	148	3	4	$315,000
Loudoun County and the Towns of Leesburg, Lovettsville, Middleburg, Purcellville, and Round Hill	101	1	0	$235,000
Prince William County, the City of Manassas, the City of Manassas Park, & the Towns of Dumfries, Haymarket, Occoquan, and Quantico	134	0	0	$35,000
TOTAL	**503**	**5**	**4**	**$1,025,000**

[186] NOAA, National Centers for Environmental Information, Storm Events Database, 1996–June 30, 2021.

Table 120: Federal Disaster Declarations for Winter Weather, all Jurisdictions[187]

Date of Declaration	Disaster Number	Hazard Event	Arlington County	Fairfax County	Loudoun County	Prince William County	City of Alexandria	City of Fairfax	City of Falls Church	City of Manassas	City of Manassas Park
4/19/2016	DR-4262-VA	Severe Winter Storm and Snowstorm	X	X	X	X	X	X	X	X	X
4/27/2010	DR-1905-VA	Severe Winter Storms and Snowstorms	X	X	X	X	X	X	X	X	X
2/16/2010	DR-1874-VA	Severe Winter Storms and Snowstorm	X	X		X	X	X	X	X	X
3/27/2003	DR-1458-VA	Severe Winter Storm, Snowfall, Heavy Rain, Flooding, and Mudslides	X	X	X	X	X	X	X	X	X
2/28/2000	DR-1318-VA	Severe Winter Storm	X	X	X	X	X	X		X	
2/2/1996	DR-1086-VA	Blizzard of 1996 (Severe Snowstorm)	X	X	X	X	X	X	X	X	X

[187] FEMA, Disaster Declarations. Retrieved at: https://www.fema.gov/disaster/declarations

Significant Previous Occurrences

While there have been numerous instances of winter storm events occurring in the planning area, numerous jurisdictions in the region have been included in federal disaster declarations. In all but two instances, all jurisdictions in the planning area were included in the declaration. This point also shows the degree to which winter storm is a non-spatial hazard.

January 2016 – A coastal low-pressure system rapidly intensified in the Mid-Atlantic coast area and tapped into moisture from the Gulf of Mexico and Atlantic Ocean, producing heavy precipitation that resulted in snowfall due to cold air in the region. Gusty winds also accompanied the storm, creating low visibility and blizzard conditions across portions of the state. Snowfall reports between 30 and 36 inches were received across western Loudoun County, with a total of 36.3 inches near Round Hill. The storm is the fourth on the list of historic storms ranked on the NESIS scale and resulted in a federal disaster declaration (FEMA DR-4262). The storm was rated 7.66 on the southeast region RSI scale, or "Crippling."

Winter of 2014 – In January 2014, four separate storms moved through the area, each dumping ice or snow in the area. The January 21 event was particularly harsh, with most of the planning area receiving more than 5 inches of snow. The City of Manassas reported 6 to 10 inches of snow and partially activated their Emergency Operations Center for the event. February 12–13 saw the next round of snow, with more than 8 inches falling. March 3 saw yet another round of significant snowfall throughout the area, with more than 5 inches recorded; some areas, such as the City of Manassas, reported accumulations of 6 to 10 inches.

February 2010 – All of NOVA was included in DR-1905, which occurred February 5–11, 2010. This event was declared as a result of severe winter storms and snow. Record-breaking snowfall fell over Northern Virginia and much of the Mid-Atlantic area. A storm system moving through the Midwest phased with another system moving across the South, then tracked northeast and east along the Mid-Atlantic coast before heading out to sea. Snow began during the afternoon of February 5 and continued into the early evening of February 6. As much as 32.4 inches fell over the two-day period at the National Weather Service (NWS) Forecast Office in Sterling, Virginia near Dulles International Airport, with 17.8 inches at Ronald Reagan Washington National Airport. Travel by air, rail or roadway became nearly impossible, as winds gusting over 35 mph whipped snow into drifts of up to 4 feet deep. This storm was the second paralyzing snowstorm of the season for what would turn out to be (according to NWS data) Northern Virginia's snowiest winter on record. The storm was nicknamed "Snowpocalypse" and "Snowmageddon" by local media and others. The snow forced the shutdown of the federal government for four and a half consecutive days.

A dry, powdery snow accompanied by wind gusts of 40 to 50 mph caused white-out conditions across a considerable portion of Northern Virginia, particularly on the morning of February 10. Snow drifts up to four feet high leftover from the storm of February 5–6 and up to a foot of additional accumulation from this storm brought travel in the area to a standstill once again. Conditions were so fierce that at 7:00 a.m., the Virginia Department of Transportation ceased snowplow operations, citing visibility of less than 100 feet at times. Total accumulations from this storm were greatest over the eastern and northern sections of the region, where accumulations of 10 to 14 inches were common near the borders with the District of Columbia and Maryland. Lighter amounts of generally 5 to 9 inches fell over the rest of the region. The storm was rated as an 8.103 on the southeast region RSI scale, or "Major."

December 2009 – Arlington County, Fairfax County, Prince William County, the City of Alexandria, the City of Fairfax, the City of Falls Church, the City of Manassas, and the City of Manassas Park were also included in DR-1874, which occurred December 18–20, 2009. A storm system that formed over the Gulf of Mexico gathered strength as it tracked to a position off the Carolina coast and then along the Eastern Seaboard. Snow began falling over Northern Virginia during the evening of December 18 and continued into much of the following day, bringing travel to a halt as roads, railways, and runways became snow-covered and, in some cases, impassable.

The initial heavy, wet nature of the snow, combined with winds that gusted to over 35 mph at times, left thousands in the Mid-Atlantic without power. Ronald Reagan Washington National Airport recorded 15 inches of snow on December 19, for a two-day storm total of 16.4 inches. Slightly higher amounts fell just to the west and south with Dulles International Airport, totaling 19.3 inches. This event was rated a 12.776 on the southeast region RSI scale, or "Crippling."

5.11.1.4. Probability of Future Occurrences

Using the number of winter storm events documented in the NCEI database, divided by the number of years of record (24.5), a return interval of 0.216 can be determined for the region in any given year. The amount of snowfall varies slightly throughout the planning area and from month to month throughout the winter season. The western areas of Loudoun County typically receive higher levels, but these amounts are variable based on any given year and the factors related to each storm event.

Table 121: Average Monthly Snowfall (in Inches) 1991-2020[188]

October	November	December	January	February	March	April
0	0.3	2.8	6.9	7	3.9	0.1

Based on this analysis and the historical record, winter storms will remain a highly likely occurrence for the entire Northern Virginia region.

Long-range climate modeling suggests that as the planet warms, a trend of more winter precipitation taking the form of liquid precipitation (rather than snowfall) would result. Future hazard mitigation plan updates will factor the latest climate science as part of the updated hazard analysis method for determining the probability of future occurrence of winter weather.

5.11.2. Risk Assessment

The risks related to winter storms can be assessed in relation to people, property, the environment, and the economy.

5.11.2.1. People

Everyone who lives, works, and travels in the planning area are potentially at risk for impacts of severe winter storms. The hazards created by winter weather, including blizzards and ice storms create especially significant danger to life, travel, and employment conditions.

In addition, impacts to transportation may cause motorists to be stranded on area roadways for extended periods of time. Due to the transient nature of the area, there are a significant amount of people in this region who are not prepared for winter weather and know what to do which increases risk. The possibility of loss of life is significant if these jurisdictions are affected by a severe winter storm, especially if more than one weather element is present (such as heavy snowfall and ice at the same time). Storm effects can lead to accidents on icy roads, heart attacks while shoveling snow, and hypothermia due to prolonged exposure to the cold. In addition, the safety of emergency responders may be at risk during outside operations that require prolonged exposure or when icy conditions are present.

Vulnerable populations identified by the jurisdiction include people who speak limited English, the elderly, those of lower socioeconomic status, the disabled (physical and mental) and people who lack access to traditional methods of communication in order to receive preparedness messages and warnings (e.g., no TV, radio, or internet; or are vision or hearing impaired).

[188] Weather Service: https://www.weather.gov/media/lwx/climate/iadsnow.pdf

5.11.2.2. Built Environment and Community Lifelines and Assets

Property damage due to winter storms includes damage done by (and to) trees, water pipe breakage, structural failure due to snow loads, and injury to livestock and other animals.

Northern Virginia jurisdictions are a mix of residential, commercial, industrial, and governmental buildings and facilities. There are also numerous bridges, communication facilities, and utility (electricity, water, and sewer) infrastructures located in the urban as well as suburban and rural areas. The communication systems throughout the region (such as voice, internet and emergency services) are an issue if damaged. Winter weather hitting any area of the region would likely cause damage to property, especially if there is a great deal of snow.

Roof and building collapse can result from snow buildup that exceeds the load capacity of the roof. Collapse due to overloading can usually be prevented by removing excess snow as it accumulates. If damaged buildings are left unprotected, later storms can cause additional damage. Prolonged ice and snow buildup on roofs can cause ice dams, which will allow moisture to penetrate the building and damage both interior materials and structural members.

The consequences of winter storm events are the disruption of utilities and transportation systems, as well as lost hours of government and commercial business operations and decreased productivity. Vulnerability to these damages varies due in large part to specific factors, including proactive measures such as regular tree maintenance and utility system winterization, which can minimize property vulnerability. Localities accustomed to winter weather events are typically more prepared to deal with them and therefore less vulnerable than localities that rarely experience winter weather.

The frequency of structural fires tends to increase during winter weather, primarily due to utility interruptions and improper use of alternative heating sources (e.g., fireplaces, gas, or propane heaters). Fires during these events also present a greater danger because water supplies may freeze and impede firefighting efforts.

5.11.2.3. Natural Environment

The environmental vulnerabilities due to winter weather include water contamination/pollution, soil damage from chemical spills, and natural gas leaks, which can occur due to heavy snow and snow melt in the spring.

Northern Virginia has a large amount of majestic old trees, forests, and acres of open space included in federal, state, and local recreational areas. Even assets such as Arlington National Cemetery (although it is not considered a recreational site) include broad acreage and many trees. Wildlife flourishes throughout the planning area and is at risk during a severe winter storm.

5.11.2.4. Economy

The impacts of winter storms are primarily quantified in terms of the financial cost associated with preparing for, responding to, and recovering from them. The primary source of data providing some measurement of winter storm impacts is the NCEI Storm Events Database. The database includes winter event data back to 1996 but is not necessarily complete or consistent from event to event. Although a more comprehensive, labor-intensive analysis utilizing other data sources could produce a potential intensity–damage relationship between winter weather occurrences and resultant damages, such an analysis was not performed for this update. The branches of government most often affected by winter storms include the Virginia Department of Transportation and local public works and transportation departments. Roadway treatment operations often begin in advance of a winter storm and continue for as long as necessary.

The cost of snow removal, repairing damages, and loss of business could have a significant economic impact on the planning area. The effects of a winter weather would be felt on infrastructure such as

communication, transportation, and other utility interruptions which, in turn, are costly to repair and restore. In addition, the loss of services—even temporarily—could lead to indirect economic loss, based on business closures if employees are unable to reach their workplace.

Due to the significant number of federal office buildings in the region, federal government operations could be heavily impacted by a significant winter storm. In addition to government offices, a number of global businesses and industries are headquartered in the region. Significant winter weather could create severe disruption of government and commercial activity, resulting in short- to long-term economic losses (both direct and indirect) in the jurisdictions.

5.11.2.5. Hazard Risk Ranking Summary

The hazard ranking process included consideration of probability and consequences in determining an overall risk score and ranking. Information presented within this section and the hazard risk ranking process present the quantitative and qualitative summary for severe winter weather. The Hazard Identification and Risk Assessment methodology is described in **Section 4, Base Plan.**

Table 122: Hazard Risk Rankings for Severe Winter Weather, by Jurisdiction

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Ranking
Arlington County	3.3	3.8	7.1	**High**
City of Alexandria	3.3	3.5	6.8	**High**
City of Fairfax	3.7	3.5	7.2	**High**
City of Falls Church	3.7	3.5	7.2	**High**
City of Manassas	3.7	3.5	7.2	**High**
City of Manassas Park	3.7	3.5	7.2	**High**
Fairfax County	3.7	3.5	7.2	**High**
Town of Clifton	3.7	3.5	7.2	**High**
Town of Herndon	3.7	3.5	7.2	**High**
Town of Vienna	3.7	3.5	7.2	**High**
Loudoun County	3.3	3.5	6.8	**High**
Town of Leesburg	3.3	3.5	6.8	**High**
Town of Lovettsville	3.3	3.5	6.8	**High**
Town of Middleburg	3.3	3.5	6.8	**High**
Town of Purcellville	3.3	3.5	6.8	**High**
Town of Round Hill	3.3	3.5	6.8	**High**
Prince William County	3.7	4.8	8.5	**High**
Town of Dumfries	3.7	3.5	7.2	**High**
Town of Haymarket	3.7	3.5	7.2	**High**
Town of Occoquan	3.7	3.5	7.2	**High**

5.11.3. Vulnerability Assessment

Although the annual probability of winter weather conditions can be estimated, data on the total financial impact of these events is incomplete. The primary impacts of winter storms can be determined in terms of the financial cost related to preparing for, responding to, and recovering from these events; however, additional costs related to these events include traffic accidents, roof damage to homes and business, and other impacts that may be insured. For this reason, the actual economic impact is difficult to quantify. Instead, estimates of the financial impacts of severe winter storms can be developed based on NCEI winter weather event data that runs from January 1996 to June 2021. Examination of NCEI data shows that there were at least 503 winter weather events in the database, producing an estimated annualized loss of $41,837, based on total estimated losses of more than $1 million for the 24.5-year period of record.

The winter weather frequency data from the Commonwealth shows a strong trend toward more winter weather occurring in areas at higher latitudes and at higher elevations. The mountainous western portion of the state and the northern portions of the state, including Northern Virginia, experience winter weather more often and with greater severity than other portions of Virginia. Although the magnitude of damages from winter storms is perhaps not typically as great as experienced in association with extreme flooding or a severe earthquake, winter storms occur much more frequently and usually over broader areas. In addition, storm events with relatively low intensity can nevertheless cause significant impacts, especially in areas unaccustomed to such events.

Losses associated with winter storms are typically related to snow removal and business interruption, although power failure is also a significant secondary hazard commonly associated with winter storms, and particularly ice events. In addition to the impacts on transportation, power transmission, and communications, severe winter storms in the Northern Virginia region have at times caused severe property damage due to roof collapses. According to FEMA, most injuries and fatalities related to winter storms are caused by vehicle accidents and hypothermia. The entire Northern Virginia region is generally equally susceptible to winter storms and has experienced similar numbers of events and levels of damage.

5.11.3.1. Vulnerability of Community Lifelines

Quantitative assessment of community lifelines for winter storm risk was not feasible for this update. Even so, it is apparent that transportation structures are at greater risk from winter storms. In addition, building construction types—particularly roof span and construction method—are factors that determine the ability of a building to perform under severe stress weights from snow. Finally, not all critical facilities have redundant power sources, and some may not even be wired to accept a generator for auxiliary heat. Future updates should consider including a more comprehensive examination of critical facility vulnerability to winter storms.

Severe winter storms may impact critical pipelines through ground motion due to frost heave putting pressure on brittle pipelines, resulting in breakage. In addition, snow and ice may accumulate and damage control mechanisms that support pipeline operations. Regional power or telecommunication systems necessary for routine pipeline operations are also at risk for damage or loss.

5.11.3.2. Future Population and Development Trends

Because severe winter storms are not limited to geographic boundaries or population groups, it is difficult to identify development and population trends that impact this hazard. Current land use and building codes incorporate standards that address and mitigate snow accumulation.

The potential for impacts of future growth and development on severe winter storms will be monitored and evaluated in the next planning cycle to consider whether the level of risk has changed, and whether there are mitigation opportunities related to development that may reduce hazard impacts in the future.

5.11.3.3. Factors for Consideration in the Next Planning Cycle

Future monitoring, evaluation, and updating of this Plan should consider the following factors related to severe winter storms as well as other information from the *COV-HMP* updates:

- Have any severe winter storm events occurred since this Plan was adopted?
- Has any new scientific research or methodology changed the ability to predict severe winter storm events or assess risk and vulnerability?
- Has there been any significant change in the population, built environment, natural environment, or economy that could affect the risk or vulnerability to severe winter storm events?
- Is there any new evidence related to the impacts of climate change that could affect the level of risk or vulnerability to severe winter storm events?

6. Climate Change

§201.6(c)(2)(i): [The] risk assessment shall include a] description of the type, 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.

2022 HMP Update

The 2017 Northern Virginia (NOVA) Hazard Mitigation Plan (HMP) had *global warming* as a discussion point in relation to climate change in Section 3(B)(3) and other specific hazard sections, such as Section 4(VI) Flood. For this update, the topic is addressed as "climate change" to help convey that there are other changes besides rising temperatures. Elements of climate change are treated separately from individual hazards to emphasize the potential impacts on multiple sectors by various hazards. In addition, this section includes information on climate change mitigation and adaptation strategies in development by the Commonwealth of Virginia and HMP participants.

To profile climate change for the 2022 NOVA HMP update, the hazards impacted by this trend and/or its consequences are addressed in this section.

This section is not intended to provide a comprehensive review of current scientific evidence and data on climate change on either a global or jurisdictional scale. Nor does it propose or advocate for specific policy-making or regulatory initiatives related to climate change. It is intended to serve as a guide for identifying potential mitigation initiatives and actions for HMP participants and to link these activities to the strategies, goals, and objectives aimed at mitigating the potential impacts and consequences of climate change.

While this Plan carefully outlines all hazards that threaten the region, it is recommended that elected officials, planners, and the emergency management community recognize the potential for the changing nature of the climate and its future impacts.

Since the 2017 Plan, there has been increasing confidence that certain changes in multiple atmospheric and meteorological conditions may be attributed to climate change. New climate information and data are included in this update discuss in the following areas:

- Characteristics
- Impacts and consequences
- Vulnerabilities
- Changes in development in hazard prone areas
- Climate change initiatives

Specific data sources and key documents are provided as footnotes in this section.

Climate Change: Definition and Key Terms

- A sustained increase in the average temperature of the Earth that is sufficient to cause climate change.
- A change in the usual weather found in a place, such as the amount of rain a place receives in a year, the usual temperature for a month or a season, or a change in the location and amount of snowfall.

Climate change is both a present threat and a slow-onset disaster because it amplifies existing hazards. Extreme weather events have become more frequent over the past 40 to 50 years, and this trend is projected to continue. Rising sea levels, coupled with potentially higher hurricane wind speeds, rainfall intensity, and storm surge, are expected to have a significant impact on coastal communities, including those in Northern Virginia. More intense heat waves may mean more heat-related illnesses, droughts, and wildfires. As climate science evolves and improves, future updates to this Plan might consider including climate change as a parameter in the ranking or scoring of natural hazards.[189]

6.1. Characteristics

Climate change is a worldwide concern because of its potential to significantly impact people, natural resources, property, and economic conditions. While the magnitude of these changes is difficult to predict, there is broad agreement in the scientific community that they will continue to occur and will dramatically affect many aspects of peoples' daily lives.

Climate change, in and of itself, is not an individual hazard, and it is not required to be addressed by federal mitigation planning criteria. However, analyzing the conditions brought on by climate change can provide a better understanding of its risk and how the population, the environment, property, and the economy may be affected by it. In addition, changing climatic conditions may exacerbate the impacts of other hazards currently affecting the Northern Virginia region.

The effects of climate change are already impacting the communities in the planning area, and they are projected to increase in coming years. At the same time, this presents the opportunity to identify, through research and its application, appropriate mitigative and adaptive strategies and activities that can lessen the effects of climate change on the environment and future populations.

6.1.1. What Might Happen to the Earth's Climate?[190]

Scientists think the Earth's temperature will keep increasing for the next 100 years, causing:

- More snow and ice to melt
- Ocean levels to rise
- Some places to become hotter; other places to experience colder winters with more snow
- Some places to receive more rain; other places to receive less rain
- Some places to be exposed to stronger hurricanes

[189] *2017 Northern Virginia Hazard Mitigation Plan*. (2017). http://arlington.granicus.com/MetaViewer.php?view_id=2&event_id=1101&meta_id=163110
[190] National Aeronautics and Space Administration (NASA). (2017, May 14). *What is Climate Change?* https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-climate-change-k4.html

- Changes in the usual weather found in a given place, such as the annual amount of rain, the usual temperature for a month or a season, or a change in the locations and amounts of snowfall.

The Fourth Assessment Report[191] from the Intergovernmental Panel on Climate Change (IPCC) is a global reference point on the science of climate change. It states that between 1880 and 2012 there was an increase in global average temperature of approximately 1.5 °F. In addition, between 1901 and 2010, there was an increase in the global average sea level of about 7.5 to 8.3 inches. The report predicted that under current climate models, the global mean warming at the end of the twenty-first century will range from 0.5 °F to 8.6 °F, and sea levels could rise between 10.2 and 32.3 inches relative to the 1986–2005 average.

Scientists from George Mason University and the Center for Ocean-Land-Atmosphere Studies in Maryland have examined the original data for the moderate scenario presented in the Fourth Assessment Report, and they have calculated that the average warming for Virginia and the adjoining areas from 2000 to 2099 will be 5.6 °F, and that precipitation will increase by 11 percent.

The Fifth Assessment Report from the IPCC[192] notes that changes in extreme events have been observed since about 1950. It notes that "some of these changes have been linked to human influences, including a decrease in low temperature extremes, an increase in high temperature extremes, an increase in extreme high sea levels and an increase in the number of heavy precipitation events in a number of regions."[193]

Climate change is impacting the United States in the following ways:

- Rising air and water temperatures and changes in precipitation are intensifying droughts, increasing heavy downpours, reducing snowpack, and causing declines in surface water quality, with varying impacts across regions.
- Sea level rise threatens coastal areas with flooding and saltwater contamination, impacting sensitive coastal ecosystems and public and private property and potentially impacting power plants and energy availability.

6.1.2. Climate Change and Rising Temperatures

The average surface temperatures of the world's oceans have risen 2 °F since the pre-industrial era of 1880 to 1900.[194] This increase may seem minimal, but it has a significant impact on the heat capacity of the world's oceans. The extra accumulated heat drives regional and seasonal temperature extremes, reduces snow cover and sea ice, intensifies heavy rainfall, and changes habitat ranges for plants and animals.

Figure 55 tracks the trend in average annual global temperatures since 1880 compared to the long-term average from 1901 to 2000. The "zero" line represents the long-term average temperature for the entire planet; blue and red bars show the difference above and below average for each year. The overall trend since 1980 has been a steady rise in the average annual temperature of ocean surface waters. The 10 warmest years on record have all occurred since 2005, with seven of the 10 occurring since 2014. In perspective, as each new year is added to the historical record, it has become one of the 10 warmest on record at that time, but it is ultimately replaced as the "top ten" window shifts forward in time.

[191] Intergovernmental Panel on Climate Change. (2012). *Climate Change 2012: Synthesis Report. A*s noted in the 2017 Northern Virginia Hazard Mitigation Plan.
[192] Intergovernmental Panel on Climate Change. (2014). *Climate Change 2014: Synthesis Report.* https://www.ipcc.ch/report/ar5/syr/
[193] Ibid., page 7.
[194] Dahlman, L. & Lindsey, R. (2021). *Climate Change: Global Temperature*. National Oceanic and Atmospheric Association. National Oceanic and Atmospheric Administration. https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature

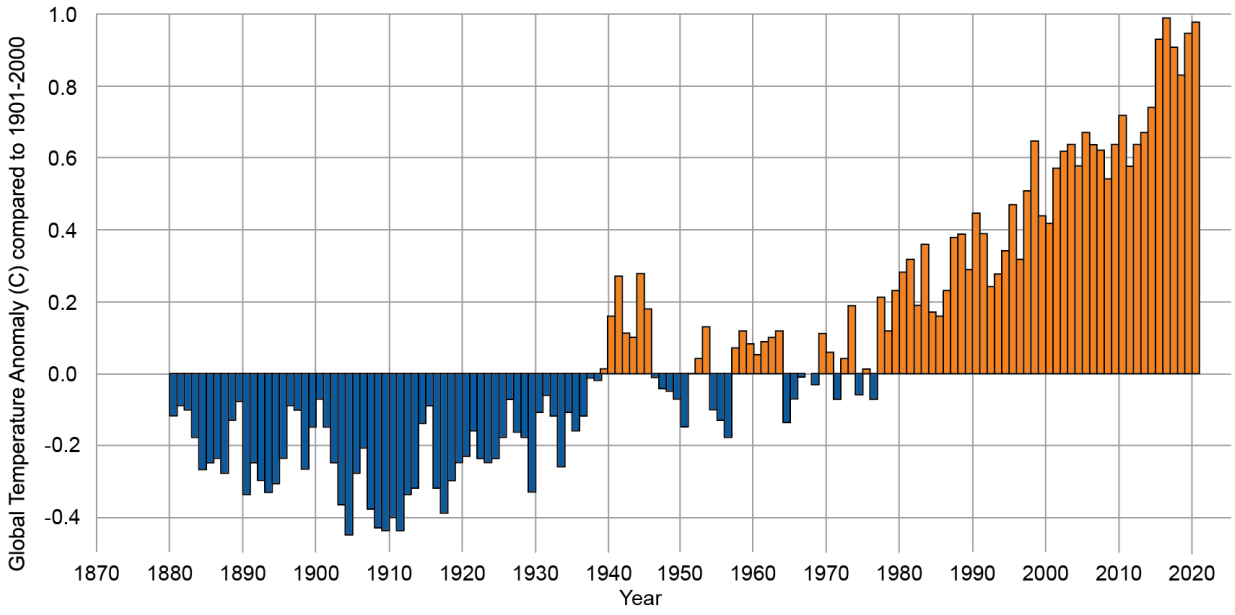


Figure 55: History of Global Ocean Surface Temperature Since 1880[195]

6.1.3. The Significance of Global Average Temperatures for Northern Virginia

While the Northern Virginia region is not seeing the highest increase in average temperatures compared to other parts of the world, it is experiencing some of the effects of this phenomenon in different ways. Most importantly, increases in extreme heat events bring an increased risk to public health and the environment. In addition, some areas might experience longer periods of drought or more frequent excessive rainfall events as a result of higher levels of moisture absorbed into the atmosphere.

The Commonwealth's diverse geographic elements, including the Appalachian and Blue Ridge Mountains in the west and the Atlantic coastal region in the east, highly influence the temperature and precipitation patterns in Northern Virginia, with the west and north being cooler and drier than the eastern coastal region. Since the beginning of the twentieth century, temperatures have risen approximately 1.5 °F in the region, with the average annual temperatures since 2000 exceeding previous highs in the 1930s. The below-average number of very cold nights since 1990 indicates a warming trend in winters, and average summer temperatures between 2005 and 2014 exceeded those in the early 1930s.

[195] Dahlman, L. & Lindsey, R. (2021). *Climate Change: Global Temperature*. National Oceanic and Atmospheric Association. National Oceanic and Atmospheric Administration. https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature

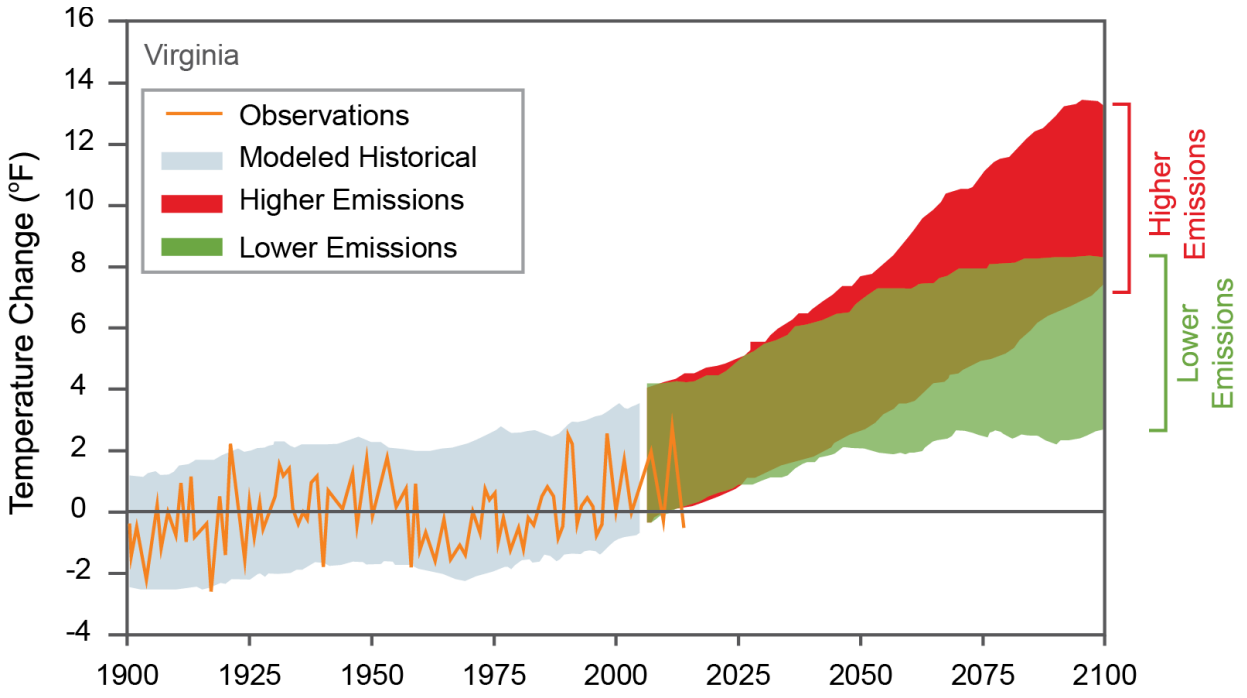


Figure 56: Observed and Projected Temperature Change in Virginia, 1900–2100[196]

6.1.4. Climate Extremes Index

A relatively new index developed by the National Oceanic and Atmospheric Association (NOAA) provides an assessment of climate extremes based on previous events distributed through a long-term record. Figure 57 shows the annual index for 2018, indicating that the entire southeast United States, including Virginia, was ranked in the top tenth percentile, with a Climate Extremes Index of 44.60 percent.

6.1.5. Precipitation

Over the previous two decades, annual precipitation has generally been above the long-term average, and there has been an upward trend in the annual number of extreme precipitation events. The average annual summer precipitation has been below or near the long-term average in the most recent decade.

[196] Runkle, J., K. Kunkel, L. Stevens, S. Champion, B. Stewart, R. Frankson, and W. Sweet. (2017). *State Climate Summary – Virginia, 2017*. National Oceanic and Atmospheric Association (NOAA) National Center for Environmental Information (NCEI). https://statesummaries.ncics.org/chapter/va/

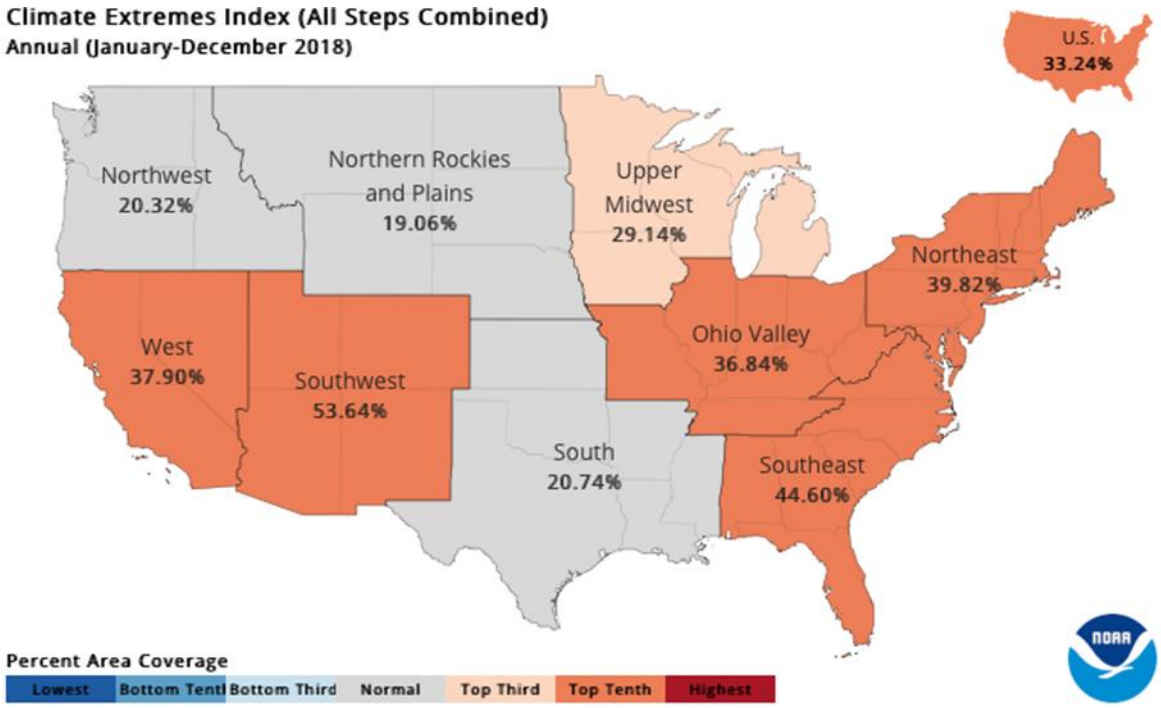


Figure 57: Example of Climate Extremes Index, 2018[197]

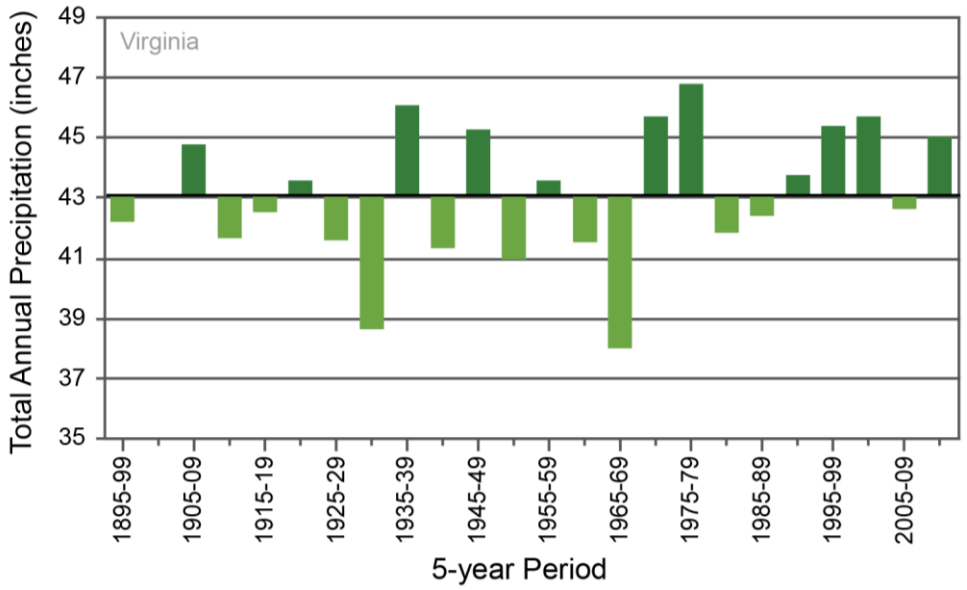


Figure 58: Extreme Precipitation Events in Virginia in Five-Year Periods, 1895–2009[198]

[197] Gleason, K. & National Center for Atmospheric Research Staff (Eds). (2019, December 12). *The Climate Data Guide: U.S. Climate Extremes Index (CEI).* https://climatedataguide.ucar.edu/climate-data/us-climate-extremes-index-cei

[198] Runkle, J., K. Kunkel, L. Stevens, S. Champion, B. Stewart, R. Frankson, and W. Sweet. (2017). *State Climate Summary – Virginia, 2017*. National Oceanic and Atmospheric Association (NOAA) National Center for Environmental Information (NCEI). https://statesummaries.ncics.org/chapter/va/

6.1.6. Climate Change and Increasing Flood Risk

The general description of current flood characteristics, risks, and vulnerabilities is provided in **Section 5.5, Flood**, with specific local impacts described in the Jurisdiction Annexes.

Future flood risk—coastal, riverine, and flash—due to climate change has been studied at great length by the scientific community with several key messages relevant to hazard mitigation planning:

- The climate change trend will change ocean levels.
- These changes will vary by location and magnitude.
- Meteorological factors that drive the development of weather patterns contribute to higher precipitation events.

The Fourth National Climate Assessment[199] notes that global sea level is very likely to rise by 0.3–0.6 feet by 2030, 0.5–1.2 feet by 2050, and 1.0–4.3 feet by 2100 under a range of emission scenarios from very low to high. This would increase both the depth and frequency of coastal flooding. Under higher emissions scenarios, the sea level around the Southeast United States could rise over eight feet by 2100. By 2050, several Southeast United States cities are projected to experience more than 30 days of high tide flooding regardless of scenario, and more extreme coastal flood events are projected to increase in frequency and duration. For example, water levels that currently have a one percent chance of occurring each year—known as a 100-year event—will be more frequent with sea level rise. This increase in flood frequency suggests the need to consider revising flood study techniques and standards that are currently used to design and build coastal and urban infrastructure.

Specific conclusions regarding flooding are highlighted in the assessment:[200]

- Higher sea levels will cause storm surges from tropical storms to travel farther inland than in the past, impacting more coastal properties. The combined impacts of sea level rise and storm surge in the Southeast United States have the potential to cost up to $56–60 billion (in 2015 dollars) each year up to 2050 and up to $79–99 billion up to 2090 under low to higher scenarios.
- Extreme rainfall events have already increased in frequency and intensity in the Southeast, and there is high confidence they will continue to increase. The region has experienced increases in the number of days with more than three inches of precipitation and a 16 percent increase in observed five-year maximum daily precipitation. This is defined as the amount falling in an event expected to occur only once every five years. The frequency and severity of extreme precipitation events are projected to continue to increase in the region under both lower and higher emissions scenarios.
- By the end of the century, under a higher emissions scenario, projections indicate approximately twice as many heavy rainfall events, defined as two-day precipitation events with a five-year return period, and a 21 percent increase in the amount of rain falling on the heaviest precipitation days, defined as days with a 20-year return period. These projected increases would directly affect the vulnerability of the Southeast's coastal and low-lying areas.
- Natural resources, industry, the local economy, and the population of the Southeast United States are at increasing risk of these extreme events.
- Existing flood map boundaries do not account for future flood risk due to the increasing frequency and intensity of precipitation events, as well as new development that would reduce the floodplain's ability to manage stormwater. As building and rebuilding in flood-prone areas continue, the risk of higher losses will continue to grow.

[199] Carter, L., Terando, A., Dow, K., Hiers, K., Kunkel, K.E., Lascurain, A., Marcy, D., Osland, M., & Schramm, P. (2018). *Fourth National Climate Assessment, Chapter 19: Southeast*. United States Global Change Research Program. https://nca2018.globalchange.gov/chapter/19/
[200] Ibid.

- Increases in the number of extreme rainfall events stress deteriorating infrastructure, such as transportation and stormwater systems that have not been designed to withstand these extreme events.

The message is clear: The combined effects of rising numbers of high tide flooding and extreme rainfall events, along with deteriorating storm water infrastructure, are increasing the frequency and magnitude of coastal and lowland flood events.

6.1.7. Sea Level Rise

An additional consideration for future flood events is sea level rise, for which jurisdictions bordering the Potomac River and other tidal-influenced waterways are susceptible.

Sea level rise is expected to continue and possibly accelerate as the Earth warms. The global mean sea level has risen approximately eight to nine inches since 1880, with most of that rise occurring in the past 25 years. The global mean sea level in 2019 was 3.4 inches higher than the 1993 average, the highest annual average in the satellite record during that time. In one year, 2018–2019, the global sea level rose 0.24 inches. In the United States, the mid-Atlantic region is experiencing the second fastest rate of sea level rise after the Gulf of Mexico.[201]

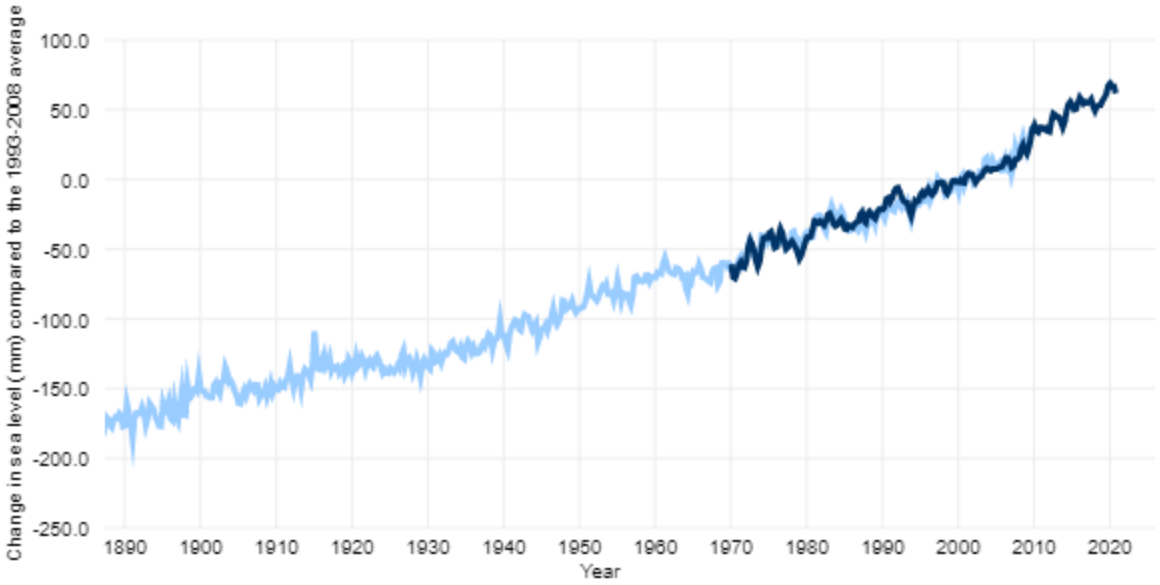


Figure 59: Global Changes to Sea Level, 1880–2020[202]

Based on multiple computer models, the lower possible scenario of global mean sea level rise by 2100 is at least 12 inches above the 2000 levels. With higher rates of emissions, sea level rise could reach 8.2 feet above 2000 levels by 2100. Neither scenario calculates changes in the melting of ice sheets, which contributes to sea level rise. Some scientists suggest that should the Greenland and West Antarctic ice sheets collapse, the sea level rise will be several feet higher than the high scenario indicates.[203]

[201] Dahlman, L. & Lindsey, R. (2021). *Climate Change: Global Temperature.* National Oceanic and Atmospheric Association (NOAA). https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature
[202] Dahlman, L. & Lindsey, R. (2021). *Climate Change: Global Temperature.* National Oceanic and Atmospheric Association (NOAA). https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature
[203] Ibid.

6.1.7.1. Specific Areas at Risk from Sea Level Rise

The Northern Virginia Regional Commission (NVRC), in a study of sustainable shorelines and community management,[204] found that Northern Virginia will not experience wide-scale inundation from sea level rise. However, there are four area "hot spots" that will see impacts to their social, economic, and environmental assets. They are as follows:

Arlington County

- Ronald Reagan Washington National Airport
- Four Mile Run corridor

City of Alexandria

- Four Mile Run Corridor
- Daingerfield Island
- Old Town
- Jones Point

Fairfax County

- Huntington
- Belle Haven/New Alexandria
- Dyke Marsh
- Tidal embayment's
- Hallowing Point

Prince William County

- Occoquan River
- Occoquan National Wildlife Refuge
- Tidal embayment's
- Town of Quantico

Looking more closely at one of the "hot spots"—the Ronald Reagan Washington National Airport – illustrates the potential impacts. The airport is situated along the banks of the Potomac River, in an area that had been mostly underwater and was built up by sand and gravel fill. Approximately 200 acres of the airport are in the 100-year floodplain, which is 11.4 feet above mean sea level. Under the high-emissions scenario, permanent inundation of portions of taxiways and access roadways is possible.

In addition to mapping high-resolution sea level rise and storm surge inundation for Northern Virginia, the NVRC study also quantified specific elements threatening to both the built and natural environments, and it developed strategies to protect, adapt, or retreat communities located in areas at risk. It emphasized that protection strategies should be considered for critical infrastructure and areas of erosion along the Potomac River. Detailed studies in several areas were conducted as part of the report to identify specific vulnerabilities under the following five scenarios:

[204] Sustainable Shorelines and Community Management in Northern Virginia Phase III, September 30, 2013, Northern Virginia Regional Commission. (2013). *Sustainable Shorelines and Community Management in Northern Virginia Phase III*. https://www.novaregion.org/DocumentCenter/View/10838/FY10-Phase-III-Report-Sustainable-Shorelines-Community-Management?bidId=

- Mean High Water (MHW): the area that inundates currently at an average high tide
- Mean High Water (MHHW): the area that inundates at the average of the highest tides each tidal day, as observed over a 19-year period
- Steady State: MHHW + 1-foot projected sea level rise
- Average Accelerated: MHHW + 3 feet projected sea level rise
- Worst Case: MHHW + 5 feet projected sea level rise

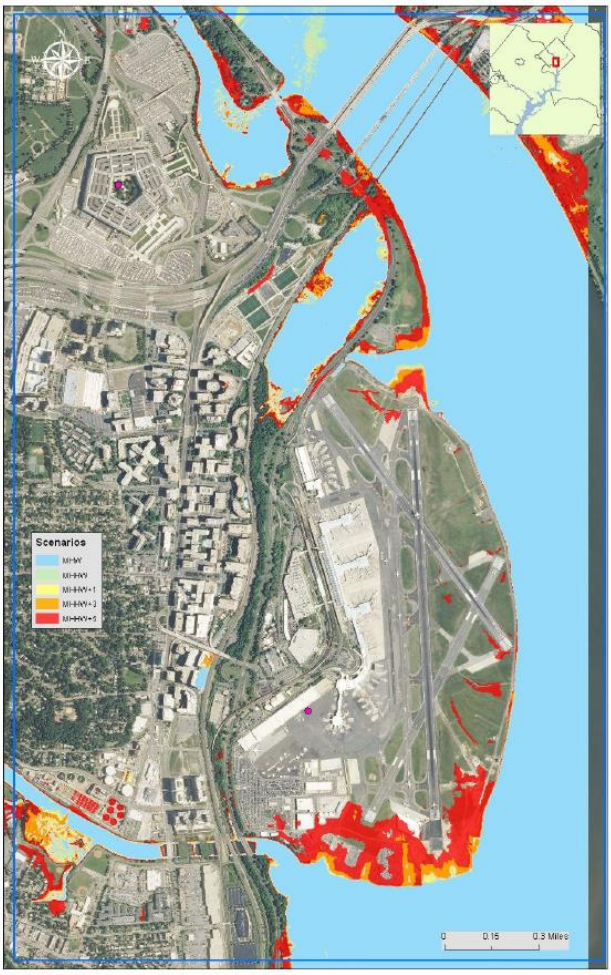


Figure 60: Projected Mean High-Water Scenario, Sea Level Rise for Ronald Reagan Washington National Airport, 2100[205]

6.1.8. Case Study – City of Alexandria Climate Adaption Planning

The City of Alexandria's vulnerability to sea level rise is highlighted in the NVRC report. Although it is not expected that the planning area will experience extensive sea level inundation, some of the areas in the city are vulnerable to flooding from sea level rise and storm surge on a small scale. They are the Four Mile Run corridor (Figure 61), Old Town (Figure **62**), and Jones Point (Figure **63**).

[205] Sustainable Shorelines and Community Management in Northern Virginia Phase III.

In addition, the city has undertaken a variety of climate initiatives to address its vulnerability to sea level rise, including the following:

- Strategic policy initiatives, such as Eco-City Alexandria, a Climate Emergency Declaration, and a Green Building Policy
- Climate planning partnerships
- Emissions inventory updates to track reduction
- Energy and Climate Change Action Plan 2012
- Environmental Action Plan 2040

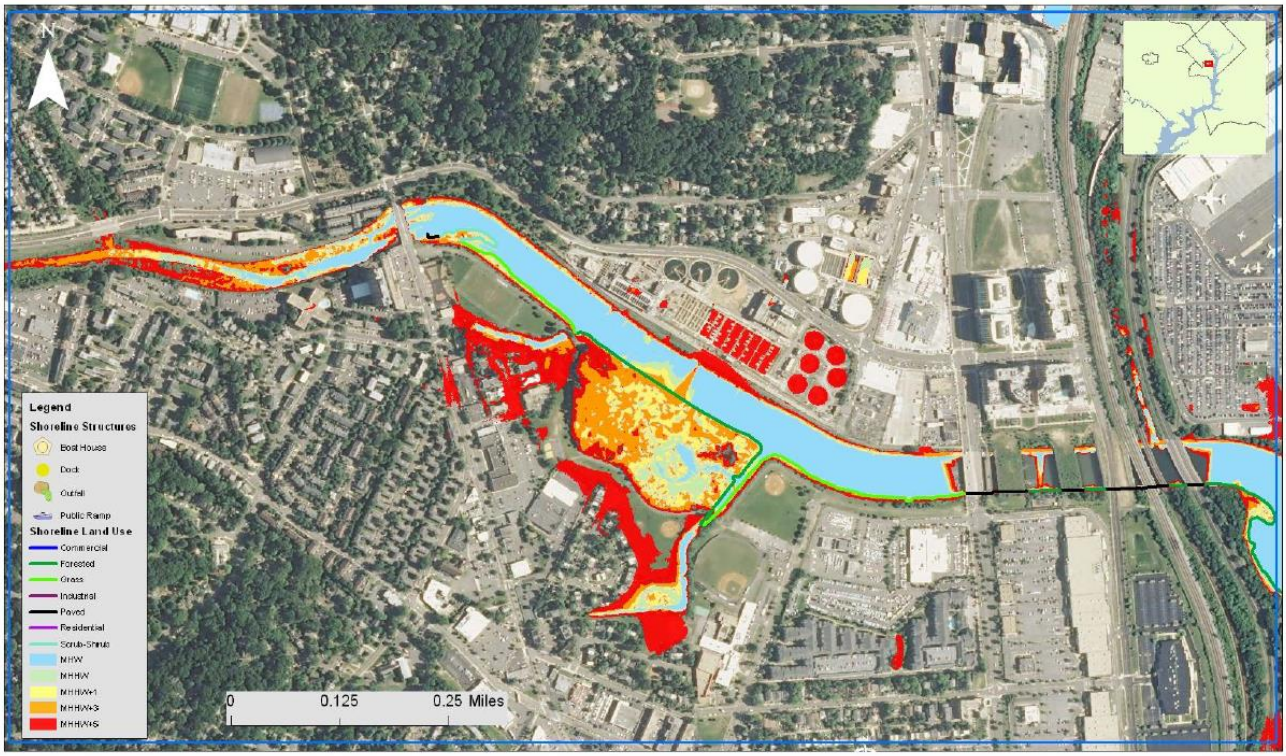


Figure 61: Four Mile Run Corridor Shoreline Land Use and Shoreline Structures, City of Alexandria Side Only[206]

[206] Sustainable Shorelines and Community Management in Northern Virginia Phase III.

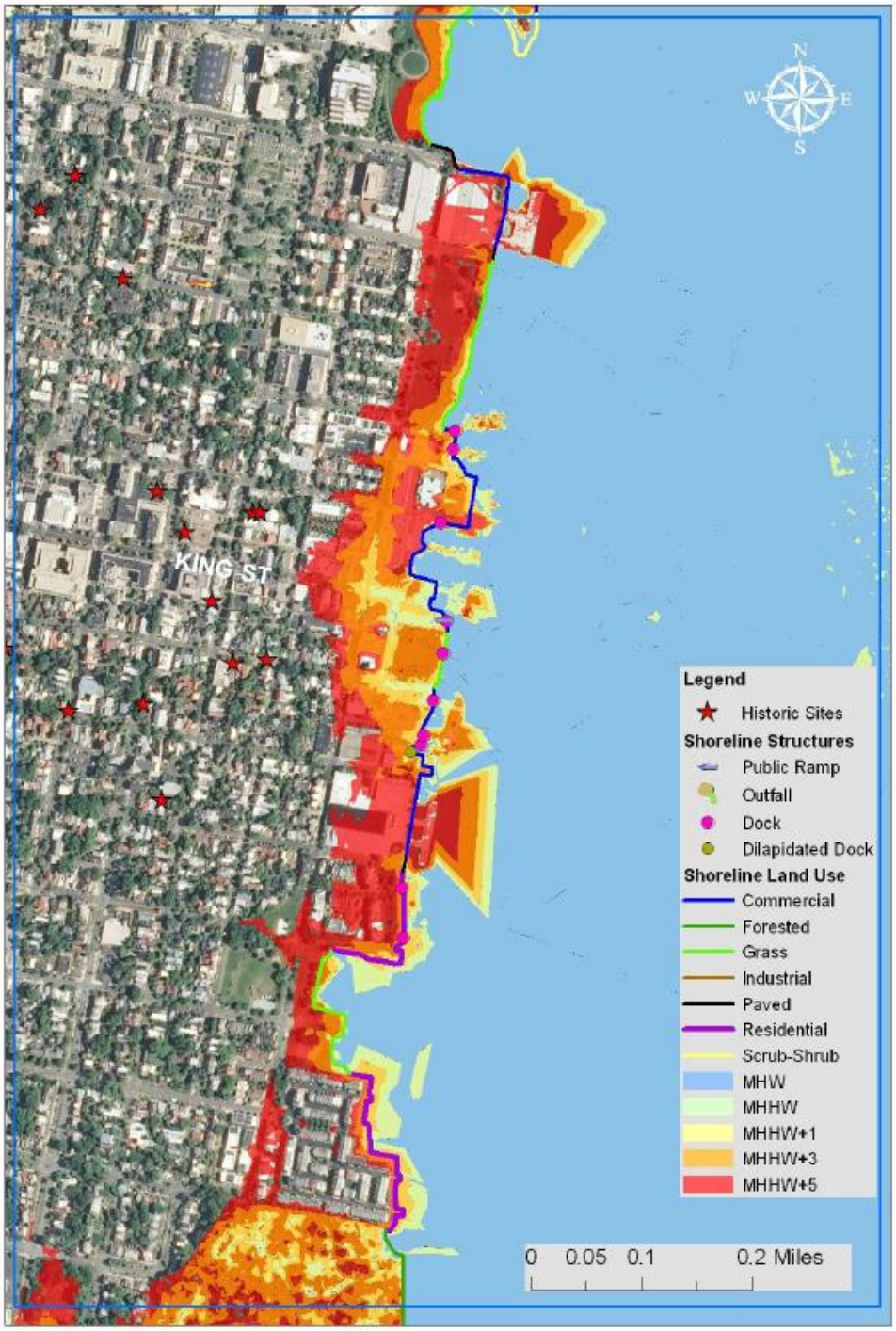


Figure 62: Old Town Shoreline Land Use – City of Alexandria[207]

[207] Sustainable Shorelines and Community Management in Northern Virginia Phase III.

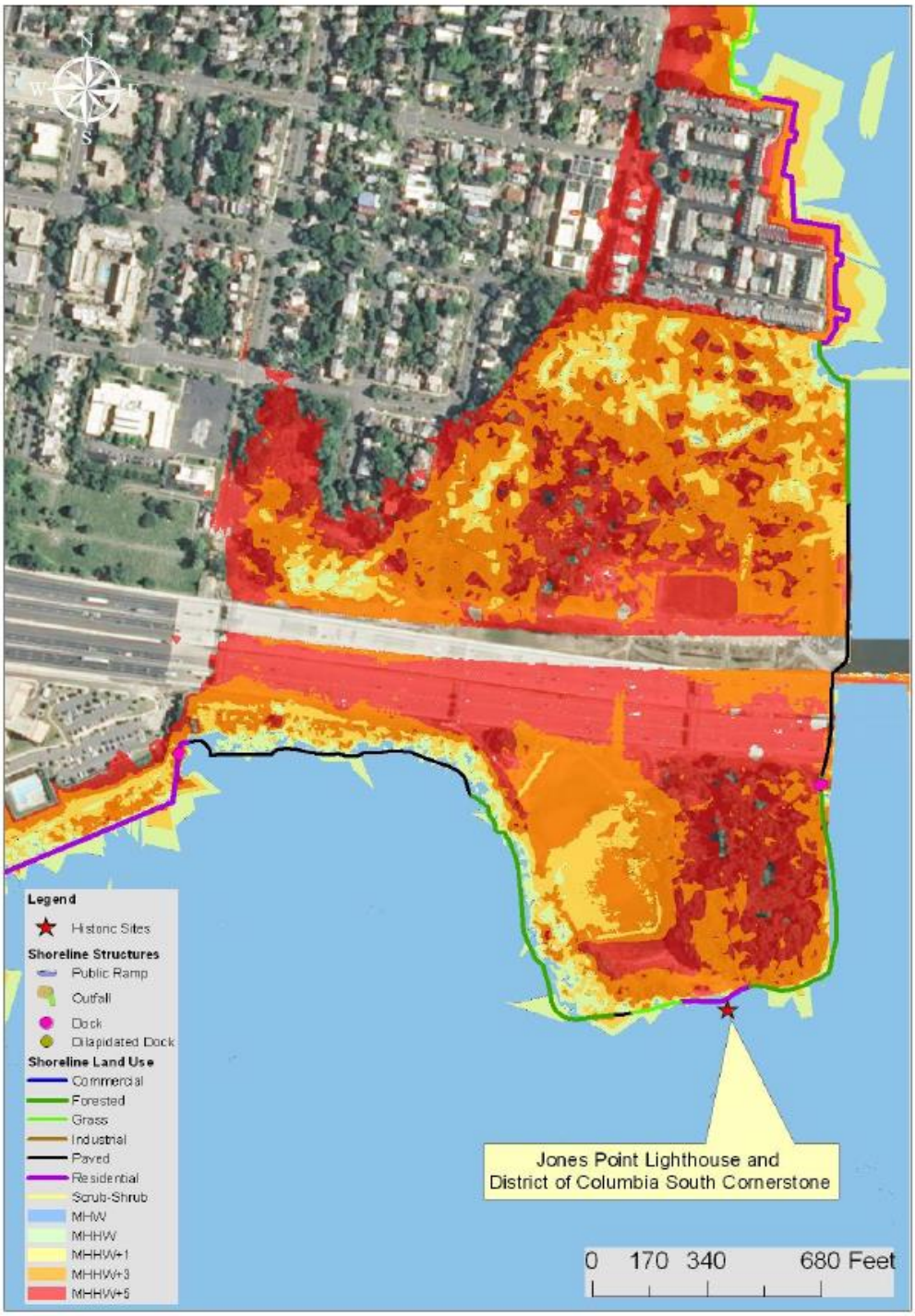


Figure 63: Jones Point Shoreline Land Use – City of Alexandria[208]

[208] Sustainable Shorelines and Community Management in Northern Virginia Phase III.

6.1.9. Summary of Climate Change Projections for the Twenty-First Century

Projections for changes in climate generally follow scenarios based on higher or lower emissions. The high emissions scenario projects the current “worst case” picture that should be considered for mitigation planning purposes:

- Unprecedented warming with more intense heat waves posing health risks to people, animals, environments, and infrastructure
- Less intense cold waves
- Increasing annual precipitation rates
- Increasing number of heavy precipitation events
- Periodic droughts become more intense because higher temperatures increase the rate at which the soil loses moisture during dry spells
- Sea level rise in coastal areas because of increasing ocean surface temperatures

6.2. Impacts and Consequences of Climate Change

The United States Climate Resilience Toolkit classifies the potential impacts and consequences of climate change in the Southeast United States, including Virginia, by population circumstances (urban or rural) and environment (coastal or ecosystem) (see. The impacts and consequences described potentially affect the population, built environment, natural environment, and economy.

Table 123: Potential Impacts from Climate Change in the Southeast United States, Including Virginia[209]

Impact Category	Description
Urban	• Increase in the number of days when nighttime temperatures stay above 75 °F • Greater increases in timing, frequency, intensity, and duration of heat waves—defined as prolonged periods of temperature and humidity—than the national average • Elevated utility costs to cool homes and businesses • Increased heat-related illnesses • Decline in labor productivity • Rapid population shifts • Socioeconomic inequalities leading to disproportionate impacts on vulnerable populations in relation to health risks • Increased days of lower air quality because of carbon dioxide, allergens, dust-raising activities, and particulate matter in the air • Increased vector-borne disease from standing water that breeds mosquitoes
Rural	• Food production impacts: ▪ Changes in agricultural crops, seasons, and quality ▪ Impacts from decreased water availability for livestock • Unreliable energy production if dependent on water availability, such as for natural gas and nuclear power plants • Increased ocean and freshwater temperatures that impact fishing • Decline in labor productivity • Health risk to workers with outdoor jobs • Increased vulnerability because of demographics, occupations, earnings, literacy, poverty incidence, and lack of access to healthcare and community services • Limited government capacity and resources to respond to events
Coastal	• Significant critical infrastructure vulnerable to rising sea level and coastal flooding • More frequent high tide flooding, perhaps occurring daily by 2100 • Increased saltwater intrusion, affecting surface and groundwater supplies, habitats, agricultural lands, and water management infrastructure • Decline in coastal economies dependent on tourism • Rapidly growing population • Increased economic investment in coastal areas • Transportation infrastructure and connection points vulnerable to high water levels: ▪ Impacts on supply chains (imports and exports) • Threats to vital coastal ecosystems
Ecosystems	• Rising sea levels, fresh water being invaded with saltwater, and the death of deciduous trees • Redistribution of species • Changes in species' ranges and behavior • Transformation of temperate ecosystems by poleward-moving tropical organisms, plants, and crops in response to rising temperatures

[209] U.S. Climate Resilience Toolkit. (2018). *Ecosystem Impacts: Natural Ecosystems are Responding to Climate Change.* https://toolkit.climate.gov/regions/southeast/ecosystems-impacts

Impact Category	Description
	• Spread of disease-carrying vectors, such as mosquitoes • Warmer winters that allow northward expansion of tropical and subtropical species • Less southern migration of bird species, reducing plant pollination and the control of certain pests • Increased northern migration of fish populations • Increased tree mortality, which allows new species to intrude • Increased dieback of critical plant species from prolonged rainfall inundation • Changing patterns of wildfire, such as frequency, intensity, size, pattern, season, and severity

6.3. Vulnerabilities

6.3.1. People

Hazards linked to climate change can instigate both direct and indirect vulnerabilities that affect the health and well-being of the population, including the following:

- Contaminated water
- Decreased water quantity
- Failure of sanitation systems
- Outbreaks of Infectious disease
- Loss of health and medical services, including mental health care
- Separation from social and/or community cultural systems
- Job loss
- Economic decline

Additional indirect impacts could result in long-term consequences that prohibit or delay the onset of conditions leading to public health issues. Extreme weather events encourage outbreaks of disease and infestation, flooding leads to an increase in fungal growth and nematodes, while drought leads to increases in locust and white fly populations. Changes in ecosystems, agriculture, and water supplies can have extreme impacts on human health.

In addition to more intense heat, the related deterioration of air quality could increase the occurrence of many health problems, especially cardiovascular and respiratory problems.

Other populations that may be considered vulnerable in relation to health and medical systems and services include:

- Those with physical and/or mental disabilities
- Those with visual impairments
- Those who are dependent on electricity, such as those on oxygen, ventilators, and other medical equipment required for life-support
- Older adults

- Those experiencing socioeconomic disadvantages
- Those without housing
- Those without sufficient access to healthcare

Projections for warmer winters and hotter summers also increase the frequency of outbreaks of vector-borne diseases, such as West Nile virus and Lyme disease from mosquitos and ticks, respectively. Seasonal pollen production also will accelerate, extending the allergy season and increasing risks for asthma.

Emergency responders may also be affected by climate change, such as increased service demands and stress-related and other personal vulnerabilities.

6.3.2. Built Environment and Critical Infrastructure

Projected changes in climate-related hazards will impact the built environment in a variety of ways. Severe weather events that produce high winds, such as hurricanes and tropical storms, will be more likely to damage or destroy residences, businesses, and Community Lifeline infrastructure.

Coastal areas and properties will be especially vulnerable to sea level rise. Much of the critical infrastructure in coastal areas, such as electric, water, sanitary, communications, and transportation systems, could be negatively impacted by multiple hazard effects. For example, although power failures occur periodically from a variety of causes, the probability of failure of the energy system increases as the intensity of extreme events increases. This type of cascading incident, depending on severity, could pose significant health and safety risks, and it would normally require the involvement of local emergency management organizations to coordinate provisions for food, shelter, water, heating and cooling, and other support services.

Hazard-specific consequences for critical infrastructure are related to specific hazard impacts.

Temperature-related impacts may include:

- Increased strain on building and industrial materials
- Increased peak electricity loads in summer and reduced or increased heating requirements in winter

Precipitation-related impacts may include:

- Increased street, basement, and sewer flooding
- Reduction of water quality

Sea level rise-related impacts may include:

- Inundation of low-lying areas and wetlands
- Increased structural damage and impaired operations of Community Lifelines such as power, water, sewer, drainage, transportation, communication, and health and medical

The impacts of climate change have the potential to affect military installations in low-lying areas susceptible to sea level rise and storm surge, also creating a threat to national security. Coordination between federal agencies, the military, and local jurisdictions in the planning area is critical to addressing these risks.

The NVRC uses NOAA data and local parcel information on its Climate Resilience Dashboard to show the impact sea level rise could have on jurisdictions in Northern Virginia. Based on these technical data, the following could be impacted:[210]

- Parcels impacted: 1,015
- Acres impacted: 2,135
- Property value impacted: $262,127,733

Depending on the approach and conditions of the sites being addressed for sea level rise, there could be unintended consequences of shoreline protection, such as armoring, which ignores the surge-reducing benefits of areas such as wetlands. Protecting one area could increase flood impacts in another. Other options include a mix of approaches that might have additional benefits. The NVRC's Sustainable Shorelines and Community Management in Northern Virginia report notes, "living shorelines combined with zoning measures and in some cases structural measures, can be combined to provide an integrated, redundant, and flexible approach to planning a climate change adaptation strategy on a site-specific basis."[211] Generally, the three broadly defined categories of shoreline adaptation strategies are retreat, accommodate, and protect. Adaptation strategies should be appropriately tailored to the unique circumstances of a specific area. Descriptions of specific actions that could address sea level rise are presented in the NVRC report.

Virginia Code now requires that living shoreline approaches be used unless it is proven that they are unfeasible for a specific site. Please refer to the Virginia Law website for more details.

Although numerous studies and plans have been or are being developed, there is no conclusive optimal approach to reducing coastal threats to property.

Table 124: Approaches and Benefits of Shoreline Protection to Address Sea Level Rise[212]

Approach	Potential Benefits
Armor the shore with seawalls, dikes, revetments, bulkheads, and other structures.	Preserves existing land uses, but wetlands and beaches are squeezed between development and the rising sea.
Elevate the land, and possibly wetlands and beaches, as well.	Preserves the natural shores and existing land uses, but often costs more than shoreline armoring and may encourage coastal development.
Retreat by allowing the wetlands and beaches to take over land that is dry today.	Preserves natural shores, but existing land uses are lost.

Detailed estimates of potential exposure of property and critical infrastructure is presented in relation to flood in **Section 5.5**.

[210] Northern Virginia Regional Commission. (2019). Climate Resilience Dashboard: Sea Level Rise Impact on Northern Virginia [GIS map]. Retrieved December 10, 2021, from https://www.arcgis.com/apps/opsdashboard/index.html#/43b6ba6a06994711b8da848f31eb18d1
[211] Northern Virginia Sustainable Shoreline Community Management Project. (2013). *Sustainable Shorelines and Community Management in Northern Virginia, Phase III*. p. 11 https://www.novaregion.org/DocumentCenter/View/10838/FY10-Phase-III-Report-Sustainable-Shorelines-Community-Management?bidId=
[212] U.S. Climate Change Science Program (2009). *Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region*, *Synthesis and Assessment Product 4.1*. https://nepis.epa.gov/Exe/ZyPDF.cgi/P100483V.PDF?Dockey=P100483V.PDF

6.3.3. Natural Environment

Environmental impacts from various climate change conditions, such as extreme heat, drought, and sea level rise, increase vulnerability of ecosystems, crops, livestock, and, ultimately, food supplies.

Especially vulnerable to environmental impacts are the jurisdictions through which the Potomac River flows, including the City of Alexandria and the counties of Northern Virginia. A 2018 study conducted by the National Academy of Sciences found that 37 percent of the waterways in the United States, including the Potomac River, have become saltier over time, impacting water treatment systems and quality. Salt intrusion into the water supply occurs from rising sea water and run-off from road salt in the winter.

Water supplies and quality will also be impacted by extreme heat and drought. Rising sea levels and intense flooding will affect sensitive natural protective barriers along shorelines and inland waterways. Ultimately, changes in the natural environment will lead to a higher incidence of public health issues.

As climate and weather patterns shift, the resulting environmental issues may be leveraged as a tool for terror and political violence. This emerging threat is not related to "eco-terrorism." Rather, it is related to a growing potential for vulnerable ecosystems to be exploited or destroyed as a means to "intimidate or provoke a state of terror in the general public for a political, ideological, or philosophical agenda.[213]

Although incidents of terrorism related to climate change have not been felt in the United States, the potential for incidents of this type does exist, and they have occurred in other countries. One study theorizes that "detrimental climate change implications that particularly affect natural resources, such as floods and droughts, create civil unrest and eventually a vacuum for terrorist events to occur. This would most likely occur in conjunction with poor governance and/or political terror, which would result in a poor distribution of resources for the population."[214] This specific study found a relationship between climate trends and agriculture in Nigeria as a threat multiplier for conflict. For example, severe drought from climatic weather shifts raises the vulnerability of water systems, restricting water supplies. In this situation, extremist groups have stepped up attacks as a strategic tactic of coercion to manipulate the water supply, especially in countries under extreme, long-term drought conditions.

By focusing on sound scientific data, delivered with consistent messaging across multiple government agencies, the potential for violent and/or criminal acts related to climate change appropriate to prevent or mitigate actions could be identified.

6.3.4. Economy

The economic costs of climate change can be extraordinary. Impacts from conditions linked to climate change can affect the region's economy in relation to jobs, the prices of goods and services, and costs of development and construction.

The Northern Virginia jurisdictions, as part of the National Capital Region, have a significant portion of their economies focused on government facilities and workers and major commercial and industrial employers. Threats to Community Lifelines in the region could bring catastrophic losses to the economy.

Highly commercialized areas of Northern Virginia line the Potomac River, which has some tidal influence from the Chesapeake Bay and the Atlantic Ocean. Many of these areas are the sites of federal agency headquarters, large employers, and multifamily residences. Increasing tidal action combined with flooding from more frequent excessive rainfall events and sea level rise can cause direct and indirect economic losses through building damage, business closures, and loss of infrastructure in the coming decades.

[213] Somers, S. (2019, September 9). *How Terrorists Leverage Climate Change.* New Security Beat. https://www.newsecuritybeat.org/2019/09/terrorists-leverage-climate-change/

[214] Lytle, N. *Climate Change as a Contributor to Terrorism: A Case Study in Nigeria and Pakistan*. (2017). Senior Theses. 207. https://scholarcommons.sc.edu/senior_theses/207

6.3.5. Continuity of Services and Program Operations

Government services and emergency operations can be disrupted by the impacts and consequences of hazards related to climate change. Extreme temperatures may increase the demand for emergency medical calls and heating and cooling centers for a larger population. Issues related to addressing sea level rise appropriately may lead to controversial approaches and disagreements among elected leadership. Flooding and severe storms may impact government facilities and limited resources. In addition, the consequences of events that impact a greater population will strain the capabilities and capacity of multiple sectors of government operations and services.

6.3.6. The Interconnectivity of Critical Systems

The impacts of climate change exacerbate the risks to interconnected systems, many of which span regional and national boundaries. They are already exposed to a range of stressors, such as aging and deteriorating infrastructure, changes in land use, and population growth. As the IPCC noted in its Fourth National Climate Assessment, "Extreme weather and climate-related impacts on one system can result in increased risks or failure in other critical systems, including water resources; food production and distribution; energy and transportation; public health; international trade; and national security."[215]

One example of economic impact caused by the interconnectivity of critical systems that occurred in May of 2021 was a ransomware attack on the Colonial Pipeline system. The system feeds refined gasoline, diesel, and jet fuel supplies from Texas throughout the southeastern United States and mid-Atlantic region, including major airports and New York. This system is the primary fuel source for many Virginia fuel retailers, and it delivers approximately 45 percent of the fuel consumed on the East Coast.[216] The entire system was shut down for five days to contain the threat. Fuel resources for suppliers and users came dangerously close to being unavailable before the crisis was averted. Had the event continued beyond this time, user's systems would have experienced shutdowns, impacting power companies and major government services and businesses. Even though catastrophic impacts were avoided, the short-term shutdown led to limited fuel availability and a rise in gas prices throughout the supply area within four days. Virginia Governor Ralph Northam declared a state of emergency, Executive Order 78, to address gasoline supply disruptions throughout the Commonwealth.[217]

Although the cause of this incident was attributed to a cyberattack rather than climate change, it demonstrates the interconnectivity of lifeline systems and how impacts at one critical location can affect the entire Northern Virginia region and other parts of the United States simultaneously. Future incidents related to climate change have the potential to create similar, if not wider-scale, impacts. Much of the country's oil and gas resources are linked to seaports that could be vulnerable to sea level rise, impacting their operations.

The interconnectivity of critical systems is acutely obvious in the use of fuels and in efforts at federal, state, and local levels to reduce emissions by reducing the levels of greenhouse gases (GHGs). States have policy authority to enact laws for the good of the public, the economy, and the environment. Local governments have authority for land use, decisions on zoning and development, maintenance and operation of local infrastructure and vehicle fleets, and the enforcement of building codes. Mechanisms that control GHG emissions will be most effective if they are coordinated across multiple levels of government.

[215] Carter, L., Terando, A., Dow, K., Hiers, K., Kunkel, K.E., Lascurain, A., Marcy, D., Osland, M., & Schramm, P. (2018). *Fourth National Climate Assessment, Chapter 19: Southeast. United States*. Global Change Research Program, p 26. https://nca2018.globalchange.gov/chapter/19/
[216] Dempsey, T., & Franklin, J. (2021, May 11). *Northman: Virginia Under State-of-Emergency After Colonial Pipeline Ransomware Cyberattack*. WUSA9. https://www.wusa9.com/article/news/local/virginia/virginia-state-of-emergency-colonial-pipeline-ransomware-cyberattack/65-bd86b798-d278-4da2-9c19-94d887c0d965
[217] Ibid.

6.3.7. Sector Vulnerability

Vulnerabilities related to the multiple hazard characteristics of climate change can be classified in specific sectors.

Table 125: Climate Change Vulnerabilities, by Sector

Sector	Vulnerabilities
Water Climate changes that affect the quality and quantity of water available for use by people and ecosystems increase risks and costs to agriculture, energy production, industry, recreation, and the environment through:	• Groundwater depletion • Sea level rise that results in flooding and saltwater contamination of water systems • Aging and deteriorating water infrastructure • Reduced reliability of hydropower production
Health and Safety Impacts from increasingly extreme weather events can result in:	• Poorer air quality and health risks from wildfire and ground-level ozone pollution • Food and water contamination • Increases in vector-borne diseases and heat-related deaths • Increase in frequency and severity of allergic illnesses, including asthma and hay fever • Long-term mental health consequences • Increase in impacts on vulnerable populations such as the elderly, children, those with low income, and communities of color
Economy Changing temperatures, sea level rise, and more frequent extreme events are expected to increasingly disrupt and damage critical infrastructure and property and reduce labor productivity and community vitality; including:	• Regional economies that depend on natural resources and favorable climate conditions, such as agriculture, tourism, and fisheries • Reduced efficiency of power generation, which, combined with increasing demand, leads to higher costs • Global impacts that affect trade and economy, including import and export prices and United States businesses with overseas operations and supply chains
Natural Environment, Ecosystems, and Services Changing temperatures, sea level rise, and more frequent extreme events are expected to increasingly disrupt and damage critical ecosystems that protect the environment, health, and property, including:	• Increasing wildfire frequency Although NOVA does not have a high risk of wildfire, the number of events in the region could increase, as could wildfire incidents outside the region. The region could experience impacts from these out-of-area fires, such as smoke and smog, which can negatively impact natural environments and ecosystems. • Changes in insect outbreaks • Migration of native species • Degradation of regional heritage and quality of life tied to ecosystems and outdoor recreation

Sector	Vulnerabilities
Agriculture* and Food Changing temperatures, extreme heat, drought, wildfire, and heavy downpours can increasingly disrupt agricultural productivity, and impact: **Although the NOVA region does not have a significant agricultural base, it could be impacted by food shortages caused by impacts on agriculture.*	• Poorer livestock health • Declines in crop yields and quality • Threats to rural livelihoods • Threats to sustainable food security • Threats to price stability
Infrastructure Rising sea levels and excessive rainfall events can increasingly disrupt or inundate Community Lifelines, including:	• Impact on entrances to bridges, tunnels, and highway segments • Increased salinity of water and wastewater plants and sewer outfall systems • Coastal lifeline systems permanently under water • Utility system disruption or failure • Increased wear and tear on equipment not designed for saltwater exposure • More frequent delays and service interruptions on transportation systems • Economic impact related to the failure of systems • Potential loss of life

6.4. Changes in Development in Hazard-Prone Areas

It is expected that coastal communities and habitats will be increasingly stressed by climate change impacts interacting with development and pollution during the twenty-first century. Population growth and the rising value of infrastructure in coastal areas increases the vulnerability to climate variability, with losses projected to rise even more if the intensity of tropical systems, severe storms, and related conditions increases.

As noted earlier in this section, current flood map boundaries do not account for future flood risk from increasing frequency and intensity of precipitation events, as well as new development that would reduce the floodplain's ability to manage stormwater. As building and rebuilding in flood-prone areas continue, the risk of higher losses will continue to grow.

6.4.1. Future Development in Hazard-Prone Areas

Currently, there is no consistent quantitative method to assess the impact of future development in relation to climate change. This is primarily because of the multiple complex hazard characteristics and conditions, multiple infrastructure systems, and limits to local government authority. Readiness for increased exposure will be low unless measures for adaptation are implemented. Mapping storm surge and flood zones is one tool to assess potential vulnerabilities in development-prone coastal and waterfront areas. Modeling, such as that conducted for the city of Alexandria, can help guide future development and adaptive approaches for existing infrastructure. In addition, policy changes that limit the siting of new development or infrastructure, including transportation corridors, in high-risk areas may reduce future vulnerability. Land use restrictions, such as setbacks and design elevations and

modifications to building codes for structural elements and corrosion-resistant equipment may also help to lower the risk of multiple hazards.

6.5. Climate Change Initiatives

The impacts and consequences of hazard conditions related to climate change are at the forefront of government policy and planning. Several jurisdictions in the planning area have already adopted policies, initiated and completed plans, and undertaken various initiatives and actions to address the effects of climate change. Others are in the initial phases of developing policies and plans, with a focus on reducing emissions of GHGs.

6.5.1. Mitigation versus Adaptation

Climate change is inevitable, and some degree of change will affect the population and environment regardless of future mitigation. Climate change mitigation is avoiding and reducing emissions of heat-trapping greenhouse gases into the atmosphere to reduce warming and further climate change.

Climate change adaptation is altering human behavior, systems, and, if possible, ways of life to reduce the impacts of climate change. Some actions should be taken to minimize climate-induced risks to the environment, human health, society, and economics. These actions are classified as "adaptation," defined as "adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities."[218]

6.5.2. Efforts to Address Climate Change

In recent years, jurisdictions in the Northern Virginia region have implemented multiple initiatives intended to address climate change through policy, research, and adaptive measures.

Table 126: Climate Change Initiatives in the Commonwealth of Virginia and Northern Virginia Jurisdictions

Type of Initiative	Measure	Date Implemented/ Updated
Commonwealth of Virginia		
Executive Order 24	Issued to increase Virginia's resilience to recurrent flooding, sea level rise, and other natural hazards applied equally to all individuals	2018
Executive Order 29	Established the Virginia Council on Environmental Justice for the protection of natural resources	2019
Executive Order 59	Established the Governor's Commission on Climate Change to create a Climate Change Action Plan to evaluate expected impacts on the Commonwealth's natural resources, public health, and economy; identify what Virginia needs to do to prepare for the likely consequences of climate change; and identify approaches being pursued by other states, regions, and the federal government. The Final Report: A Climate Change Action	2007

[218] Intergovernmental Panel on Climate Change. (2014). *Climate Change 2014: Synthesis Report.* https://www.ipcc.ch/report/ar5/syr/

Type of Initiative	Measure	Date Implemented/ Updated
	Plan, dated December 15, 2008, was the product of this effort.	
Virginia Carbon Rule	Allowed the Commonwealth to join the Regional Greenhouse Gas Initiative. Funds generated from legislation go toward community flood preparedness, coastal resilience, climate planning efforts, and energy efficiency programs	June 2020
Virginia Coastal Resilience Master Planning Framework	Identified core principles of the Commonwealth's approach to coastal protection and adaptation to serve as a blueprint for implementing the first project-driven Coastal Resilience Master Plan by the end of 2021	October 2021
Living shorelines; development of general permit; guidance	"Living shoreline" means a shoreline management practice that provides erosion control and water quality benefits; protects, restores, or enhances natural shoreline habitat; and maintains coastal processes through the strategic placement of plants, stone, sand fill, and other structural and organic materials. When practicable, a living shoreline may enhance coastal resilience and attenuation of wave energy and storm surge.[219]	May 2022
Metropolitan Washington Council of Governments (COG)		
National Capital Region Climate Change Report	Multiple jurisdictions in Northern Virginia have adopted the COG's climate goals on climate change established in Resolution R31-07, which created a regional climate change initiative. The report highlights actions to address energy consumption, transportation, and land use and promote green economic development.	November 2008
Arlington County		
Climate Action Resolution	Confirmed commitment to climate action by implementing the Community Energy Plan	2017
Community Energy Plan, Comprehensive Plan	Long-term vision for transforming how the county generates, uses, and distributes energy, with a goal of becoming a carbon neutral community by 2050	2019
Climate Change, Energy and Environment Commission	Advisory commission to the County Board created to focus on climate change-related and sustainability actions. One objective is to liaise with various commissions in related areas, including emergency preparedness.	December 2020
City of Alexandria		
Energy and Climate Change Action Plan (2012–2020)	The Plan builds on the Environmental Action Plan 2030 and further defines the city's path to significant reduction of greenhouse gas (GHG) emissions. It describes the potential local impacts (as of 2011), lists the steps the city had already taken, and presents steps to mitigate and adapt to future climate change. Chapter 5 addresses potential impacts and risks and related adaptation and preparedness measures.	March 2011

[219] https://law.lis.virginia.gov/vacode/title28.2/chapter1/section28.2-104.1/

Type of Initiative	Measure	Date Implemented/ Updated
Environmental Action Plan 2040	Established a citywide environmental plan to address climate change as indicated by changing conditions in the atmosphere, extreme weather events, rising coastal water, and record-breaking rainfall and high temperatures	July 2019
Climate Initiatives	Partnerships and supporting pledges through the COG to develop a region wide GHG emissions inventory and support the 2015 Paris Agreement; supported of the United States Conference of Mayors' Climate Protection Agreement (2005)	Various dates
City of Falls Church		
Environmental Sustainability Council	Addressed a wide range of environmental and sustainability issues related to the quality of life in the community, including stormwater, streams and natural springs, urban forest, and climate, air, and energy.	Est. 1989
City of Fairfax		
Climate Change Planning	The city is working to plan for and mitigate the impacts of climate change in the community.	September 2021
Climate Change Initiatives	Participating in the COG GHG inventories	2005-2018
Environmental Sustainability Committee	Created to guide the city to become an environmentally sustainable "green city" by recommending programs and policies and undertaking actions to engage residents and businesses.	2016
Fairfax County		
Community-Wide Energy and Climate Action Plan – Final Report	The county's first GHG reduction plan toward carbon neutrality by 2050. Develops strategies and actions for buildings and energy efficiency, energy supply, transportation, waste, and natural resources.	September 14, 2021
Resilient Fairfax – Climate Adaptation and Resilience Plan	Resilient Fairfax, led by the Office of Environmental and Energy Coordination (OEEC), is a program to strengthen the county's resilience to changing climate conditions. The first Resilient Fairfax Climate Adaptation and Resilience Plan is scheduled for completion in fall 2022. The Plan includes detailed analyses and strategies to help the county better prepare for changing climatic conditions and hazards, such as increasing temperatures, severe storms, and flooding.[220]	2022
Loudoun County		
Loudoun County Energy Strategy	Developed to support the county's economic competitiveness and respond to the impact of the county's energy use on the environment	December 2009; amended 2010
Loudoun Climate Project	Advocacy group formed to increase understanding of climate change and how it influences personal choices and public policy	2021

[220] https://www.fairfaxcounty.gov/environment-energy-coordination/resilient-fairfax

Type of Initiative	Measure	Date Implemented/ Updated
Resolution of the Loudoun County School Board	Resolution committing the school board to the support of climate change initiatives and opportunities to reduce carbon consumption by facilities and transportation	June 2020
Prince William County		
Climate Resolution	Commits the county to a 100% renewable energy grid by 2035 and 100 percent carbon neutrality by 2050; incorporates equity principles and environmental justice into the Community Energy Master Plan	November 2020
Community Energy and Sustainability Master Plan	PWC's Office of Environmental & Energy Sustainability is leading the development of the first event Community Energy and Sustainability Master Plan and is scheduled for completion in 2023.	2023
Sustainability Commission	On November 17, 2020, the PWC Board of Supervisors authorized the creation of a Sustainability Commission, a public advisory board charged with advising on potential enhancements to the CESMP and other related program areas.	November 2020

6.5.3. Actions to Reduce Risks and Increase Resilience

Climate change scientists agree that the reduction of future risks from climate change depends primarily on decisions made now. Since we are already committed to some level of climate change, responding to climate change involves a two-pronged approach: 1) emissions reduction (also referred to as "climate mitigation") seeks to reduce greenhouse gas (GHG) emissions to slow down climate change itself, and 2) "climate resilience/adaptation," which is also necessary to ensure communities are prepared for and adapting to hazards such as severe storms, flooding, and extreme temperatures.

Table 127: Suggested Actions to Reduce Risk and Build Resilience Against Climate Change[221]

Hazard	Suggested Actions
Extreme Heat	• Increase urban tree cover. • Install cool roofs to reduce the negative health impacts of heat. • Implement urban designs that facilitate air movement and alleviate heat. • Increase standards for insulation of buildings and homes. • Increase preparedness education about heat-related health issues for healthcare providers and the public.
Increased Precipitation and Flood	• Increase capacities of stormwater systems. • Identify infrastructure that should be elevated or relocated to avoid future inundation. • Continue acquisition, elevation, and relocation projects for property owners.

[221] Liao, K. J. (2011, January 26). Impacts of Climate Change on the Environment: Mitigation and Adaptation [PowerPoint slides]. Department of Environmental Engineering, Texas A&M University-Kingsville. https://www.tamuk.edu/engineering/_docs_CoE/research/interdisciplinary-seminar-series/impacts-of-climate-change-on-the-environment.pdf

Hazard	Suggested Actions
	• "Flood-proof" mechanical systems and/or components of industrial and commercial structures. • Update flood hazard mapping.
Drought	• Develop water usage and/or restriction plans for governments, homes, and businesses. • Identify alternate water sources. • Develop new drought- and heat-resistant varieties of crops. • Develop new or improve existing irrigation systems to reduce water leakage. • Conserve soil moisture through mulching. • Implement drought-resistant landscaping. • Educate the public on water-saving measures.
Sea Level Rise	• Preserve estuaries and wetlands to accommodate rising levels of saltwater. • Develop long-term plans to address sea level rise for at-risk public and private property. • Conduct feasibility studies to determine potential shoreline protection measures against erosion and flood. • Change land use in high-risk areas.
Increased Severe Storms	• Enhance emergency preparedness messaging. • Expand or enhance early warning systems. • Update or increase resilience of infrastructure, including roads, power grids, and stormwater systems. • Identify options for effective post-event emergency relief.

6.5.4. Cost Effectiveness of Climate Change Mitigation

The *Governor's Commission on Climate Change, Final Report* notes the difficulty of quantifying actual steps to mitigate climate change regarding costs and benefits, but it provides guidance related to the cost effectiveness of specific GHG measures. Figure 64 illustrates strategies to reduce GHGs reduction strategies for nine sets of actions and the savings attributable to each of these actions. The Final Report also provides estimates of the savings in relation to metric tons of emissions attributable to each set of actions.

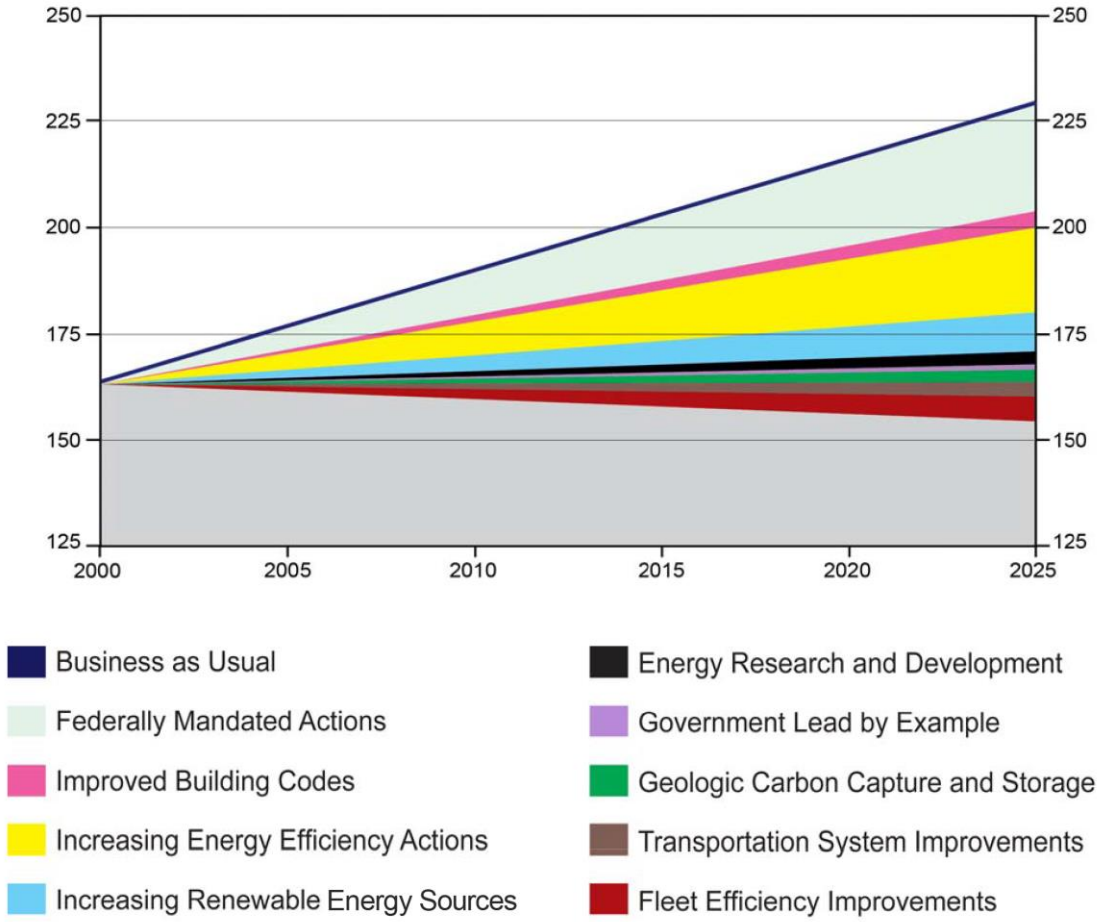


Figure 64: Strategies to Reduce the Emissions of Greenhouse Gasses (MMt CO_2e)[222]

Various methods have been developed for conducting benefit cost analysis applied to climate change, based on metrics structured on the total GHGs reduced during a project's lifetime. However, not all projects can be calculated or are applicable to this method.

6.5.5. Summary

Early in 2021, the governor released a plan to address climate change in Virginia. It aligned with current federal climate and infrastructure policies and focused on future clean energy goals. While efforts to reduce GHGs are targeted at an identified cause of climate change, there is no commonwealth-level institutional infrastructure to monitor the widespread impacts of the various conditions resulting from climate change or to coordinate climate change analysis and initiatives with local jurisdictions. Additional data and progress in documenting the impacts of climate change will be monitored and addressed in the next Plan update.

[222] MMt: Methylcyclopentadienyl manganese tricarbonyl, an additive used in leaded gasoline to increase octane rating. CO_2e: Carbon dioxide equivalent. CO_2 measures only carbon dioxide, whereas CO_2e includes all greenhouse gases.

Governor's Commission on Climate Change. (2008). *Final Report: A Climate Change Action Plan.* https://www.naturalresources.virginia.gov/media/governorvirginiagov/secretary-of-natural-resources/pdf/ccc_final_report-final_12152008.pdf

7. Capability Assessment

Requirements

- **§201.6(c)(3)** – [The plan shall include the following:] A *mitigation strategy* that improves these existing tools. policies, programs, and resources, and its ability to expand on and identified in the risk assessment, based on existing authorities, provides the jurisdiction's blueprint for reducing the potential losses.

2022 HMP Update

- Updated capability assessments were conducted for all jurisdictions.

7.1. Overview

The mitigation strategy serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The Stafford Act directs hazard mitigation plans to describe hazard mitigation actions and establish a strategy to implement those actions. Therefore, all other requirements for a hazard mitigation plan lead to and support the mitigation strategy.

Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk to life and property from hazard events. It is an ongoing process that occurs before, during, and after disasters and serves to break the cycle of damage and societal impacts in hazardous areas. An aim of the mitigation planning process is to incorporate mitigation into a community's existing authorities, policies, procedures, and programs to reduce or avoid long-term vulnerabilities to the identified hazards.

This section provides an analysis of the current mitigation capabilities, including an assessment of National Flood Insurance Program participation and compliance. Strong mitigation capabilities are highlighted and areas for improvement are identified. A ranking summary table displays the capabilities of jurisdictions, providing a comprehensive view of the region's capabilities.

7.2. Capability Assessment Summary

Assessing mitigation capabilities is an integral part of the mitigation planning process in which jurisdictions identify, review, and analyze the resources currently available to them that can be used for reducing the impact of hazards on their communities.[223] This assessment of capabilities identifies the framework that is in place, or should be in place, for the implementation of mitigation actions[1].
During the planning process, jurisdictions examined planning and regulatory, administrative and technical, safe growth for future development, financial, education and outreach, and National Flood Insurance Program capabilities. The capability assessment incorporated any new capabilities that have emerged in the past five years. This section provides a summary of the capabilities of NOVA planning participants. Detailed jurisdiction-specific assessments are provided in the Jurisdiction Annexes.

[223] Federal Emergency Management Agency. (2016, September) *State Hazard Mitigation Planning Key Topics Bulletins: Mitigation Capabilities*. https://www.fema.gov/sites/default/files/2020-06/fema-state-mitigation-capabilities-planning-bulletin_09-26-2016.pdf#:~:text=An%20assessment%20of%20state%20mitigation%20capabilities%20is%20essential,efforts%20targeted%20for%20state-level%20and%20%20local%20planning.

7.2.1. Capabilities Assessment Summary Ranking and Gap Analysis

7.2.1.1. Mitigation Capabilities and Capacity Building

Capacity building: increasing resilience by assessing and growing mitigation capabilities

Resilience is the capacity of communities to survive, adapt, grow, and even transform – when conditions require it – in the face of stresses and shocks. Building resilience is about making communities better prepared to withstand hazard events and better able to bounce back quickly and emerge stronger from these events. The assessment of mitigation capabilities is an essential step toward resilience. Building resilience cannot effectively occur unless there has been an honest assessment of a jurisdiction's capabilities to plan, manage, and assign resources to facilitate long-term hazard risk reduction (FEMA). Mitigation capacity building is becoming more prominent and realistically achieved with the implementation of FEMA's Building Resilient Infrastructure and Communities (BRIC) program, which began in fiscal year 2020. This program, which replaced the Pre-Disaster Mitigation (PDM) program, supports communities through capability and capacity building, encouraging and enabling innovation, promoting partnerships, enabling large projects, maintaining flexibility, and providing consistency.

Mitigation Capabilities

To complete the assessment, jurisdictions reviewed legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the jurisdictions documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy.

The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Planning and regulatory capabilities are based on the implementation of plans, ordinances, and programs that demonstrate a jurisdiction's commitment to guiding and managing growth, development, and redevelopment in a responsible manner while maintaining the general welfare of the community. Although some conflicts can arise, these planning initiatives generally present significant opportunities to integrate hazard mitigation principles and practices into the local decision-making process.
- Administrative and technical
  - Administrative capabilities encompass the ability of a jurisdiction to develop and implement mitigation projects, policies, and programs and are directly tied to its ability to direct staff time and resources for that purpose.
  - These capabilities can be evaluated by determining how mitigation-related activities are assigned to local departments and if there are adequate personnel resources to complete these activities in a jurisdiction. The degree of coordination among departments will also affect administrative capability for the implementation and success of proposed mitigation activities.
  - Technical capabilities can generally be assessed by looking at the level of knowledge and technical expertise of jurisdictional employees, such as personnel skilled in using Geographic Information Systems (GIS) to analyze and assess community hazard vulnerability.
- Safe Growth Assessment
  - Using the American Planning Association's Basic Safe Growth Audit Questions, jurisdictions evaluate the extent to which hazard mitigation principles or practices are successfully integrated into existing actions that influence the long-term risk to people and property from hazards and promotes internal consistency. This process also identifies gaps or conflicts regarding community development and future hazard vulnerability, provides an important

connection between community development, public safety, and risk management, and identifies opportunities for further integration.

- Financial
  - This capability was assessed by reviewing a jurisdiction's access to or eligibility to utilize routine government funding resources such as capital improvement funding, taxes, fees, and Commonwealth and federal funding sources to fund past and future mitigation actions.
- Education and outreach
  - This capability was assessed by analyzing the education and outreach programs and methods already in place in a jurisdiction that could be used to implement mitigation activities and communicate hazard-related information.

After the assessment was completed, each capability category was ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** the jurisdiction has limited capabilities within this category and is generally unable to implement most mitigation actions.
- **Low:** the jurisdiction has some capabilities within this category and can implement a few mitigation actions.
- **Moderate:** the jurisdiction has some capabilities within this category, but improvement is needed in order to implement some mitigation actions.
- **High:** the jurisdiction has significant capabilities within this category as demonstrated by its authorities, programs, plans and/or resources, and can implement most mitigation actions.

A summary of the NOVA region's mitigation capability rankings is presented in Table 3.1. Thorough assessments of each jurisdiction's capabilities and gap analyses showing areas of improvement are provided in the Jurisdiction Annexes. Highlights of NOVA's mitigation capabilities include:

- High planning and regulatory capabilities across participants. The participating towns that have moderate capabilities in this category have strong relationships with their county partners and can collaborate and share resources to fill any gaps that may exist.
- Almost all participants had high to moderate administrative and technical capabilities. Again, because of the overall strength of these capabilities in the planning area, those with moderate or low capabilities can share resources to fill any gaps that may be present.

No matter the strength of mitigation capabilities, there is always room for improvement due to constantly changing factors such as population, staffing, finances, and different types and magnitudes of hazards. During the assessment, a gap analysis was performed to identify ways in which capabilities could be expanded and improved to reduce risk. Key areas for improvement include:

- Increases in financial capabilities are necessary to complete a broad range of mitigation actions that will protect life, property, and the environment.
- An increase in public education about natural and human-caused hazards is necessary to better prepare the population—especially vulnerable populations—about hazards, including the increasing severity and frequency of hazards such as flooding.
- Many participants had low or moderate safe growth capabilities, making this an area that can be expanded and improved to reduce risk. Integrating mitigation into safe growth focuses such as land use, environmental management, ordinances and regulations, and local programs and policies can increase a community's safety as it grows.

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Table 128: Mitigation Capability Assessment Ranking Summary

Jurisdiction	Capability				
	Planning and Regulatory	Administrative and Technical	Safe Growth	Financial	Education and Outreach
Arlington County	High	High	High	Moderate	High
City of Alexandria	High	High	Moderate	Moderate	Moderate
City of Fairfax	High	High	High	Moderate	Moderate
City of Falls Church	High	High	Moderate	Moderate	Moderate
City of Manassas	High	High	Moderate	Moderate	Moderate
City of Manassas Park	High	Moderate	High	Moderate	Moderate
Fairfax County	High	High	High	Moderate	Moderate
Town of Clifton	Moderate	Low	Low	Low	Moderate
Town of Herndon	High	Moderate	High	Moderate	Moderate
Town of Vienna	Moderate	Moderate	Moderate	Moderate	Moderate
Loudoun County	High	High	High	Moderate	Moderate
Town of Leesburg	High	High	Low	Moderate	Low
Town of Lovettsville	High	High	High	Moderate	Low
Town of Middleburg	Moderate	Moderate	Moderate	Moderate	Moderate
Town of Purcellville	Moderate	High	Moderate	Moderate	Low
Town of Round Hill	High	High	High	Moderate	Moderate
Prince William County	Moderate	Moderate	Moderate	Moderate	Moderate
Town of Dumfries	Low	Moderate	Moderate	Moderate	Low
Town of Haymarket	Moderate	Moderate	Moderate	Moderate	Moderate
Town of Occoquan	Moderate	Moderate	Moderate	Low	Moderate

NFIP Assessment and Continued Compliance

The administration of the National Flood Insurance Program (NFIP) is a key component of jurisdictional hazard management capabilities.[224]

The United States Congress established the NFIP with the passage of the National Flood Insurance Act of 1968. Some planning participants partake in the Community Rating System (CRS), which is a part of the NFIP. The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. This is done by providing flood insurance premium discounts to property owners in communities participating in the CRS program. Credit points are earned for a wide range of local floodplain management activities; the total number of points determines the amount of flood insurance premium discounts provided to policyholders.[225]

A summary of participant NFIP information is presented in Table 129. All jurisdictions included in the planning process participate in the NFIP. The table also provides the date of the Flood Insurance Rate Map (FIRM) in effect in each community.

These maps were developed by FEMA or its predecessor and show the boundaries of the 100-year and 500-year floods. Nine of the maps are over 15 years old. Some plan participants have experienced dramatic growth since the effective date of their most recent FIRM and this change is not reflected in the FIRM. This difference may mean that the actual floodplain varies from that depicted on the map.

Fairfax County, the towns of Clifton, Herndon, Vienna, the City of Alexandria, the City of Fairfax, and the City of Falls Church are currently working with FEMA to update FIRMs for their communities. Additionally, Prince William County is currently undergoing a CRS recertification process which includes evaluating the county's flood preparedness, flood damage reduction efforts, mapping and regulations, and public information activities.

Repetitive and Severe Repetitive Loss Strategy

Plan participants employ a number of strategies to reduce the number of repetitive loss and severe repetitive loss properties in their jurisdictions, including regulatory requirements such as building code enforcement and floodplain and zoning ordinances, comprehensive planning activities including land use planning, and environmental management activities such as open space and natural environment preservation.

These strategies serve to make local jurisdictions eligible for increased federal cost share for FEMA Flood Mitigation Assistance (FMA) grants. The strategy adheres to the requirements from 44 C.F.R. $201.4 (c)(3)(v).

Definitions

For properties to be eligible for an increased federal cost share in FMA grants, the definitions below must apply, as stipulated in the Biggert-Waters Flood Insurance Reform Act of 2012:

[224] Federal Emergency Management Agency. (2013, March 1). *Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials*. https://www.fema.gov/sites/default/files/2020-10/fema_integrating-hazard-mitigation_case-studies_tools-community-officials.pdf

[225] Federal Emergency Management Agency. (2016, September) *State Hazard Mitigation Planning Key Topics Bulletins: Mitigation Capabilities*. https://www.fema.gov/sites/default/files/2020-06/fema-state-mitigation-capabilities-planning-bulletin_09-26-2016.pdf#:~:text=An%20assessment%20of%20state%20mitigation%20capabilities%20is%20essential,efforts%20targeted%20for%20state-level%20and%20%20local%20planning.

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

1. Has incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event; and
2. At the time of the second incidence of flood-related damage, was covered under a contract for flood insurance which contained an increased cost of compliance coverage.

A **severe repetitive loss property** is a structure that:

1. Is covered under a contract for flood insurance made available under the NFIP; and,
2. Has incurred flood-related damage:
    a. For which four or more separate claims payments have been made under flood insurance coverage with the amount of each such claim exceeding $5,000 and with the cumulative amount of such claim payments exceeding $20,000; or
    b. For which at least two separate claims payments have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

The NFIP's Flood Insurance Manual provides the following definitions for NFIP and CRS purposes:

A repetitive loss structure is an NFIP-insured structure that has had at least two paid flood losses of more than $1,000 each in any 10-year period since 1978.

The severe repetitive loss group consists of any NFIP-insured property that has met at least one of the following paid flood loss criteria since 1978, regardless of ownership, with two of the claim payments occurring within ten years of each other:

1. Four or more separate claim payments of more than $5,000 each (including building and content payments); or
2. Two or more separate claim payments (building payments only) where the total of the payments exceeds the current value of the property.

Specific information about NFIP compliance, CRS participation, and NFIP-insured structures that have been categorized as repetitive loss (RL) and severe repetitive loss (SRL) properties are included in the jurisdiction annexes.

Table 129: NFIP Participation Summary[226]

Jurisdiction and Community Identification Number (CID)	Initial Flood Hazard Boundary Map (FHBM) Identified	Initial Flood Insurance Rate Map (FIRM) Identified	Current Effective Map Date	Regular-Emergency Date	Digital Flood Insurance Rate Map (DFIRM)/ (Q3)
Arlington County 515520#	-	10/1/1969	8/19/2013	12/31/1976	DFIRM
City of Alexandria 515519#	8/22/1969	8/22/1969	6/16/2011	5/8/1970	DFIRM
City of Fairfax 515524#	5/5/1970	12/23/1971	6/2/2006	12/17/1971	DFIRM
City of Falls Church 510054#	9/6/1974	2/3/1982	7/16/2004	2/3/1982	DFIRM
City of Manassas 510122#	5/31/1974	1/3/1979	1/5/1995	1/3/1979	DFIRM
City of Manassas Park 510123#	3/11/1977	9/29/1978	1/5/1995	9/29/1978	DFIRM
Fairfax County 515525#	5/5/1970	3/5/1990	9/17/2010	1/7/1972	DFIRM
Town of Clifton 510186#	3/28/1975	5/2/1977	9/17/2010	5/2/1977	DFIRM
Town of Herndon 510052#	6/14/1974	8/1/1979	9/17/2010	8/1/1979	DFIRM
Town of Vienna 510053#	8/2/1974	2/3/1982	9/17/2010	2/3/1982	DFIRM
Loudoun County 510090A	4/25/1975	1/5/1978	7/5/2001	1/5/1978	DFIRM

[226] Federal Emergency Management Agency. (n.d.). *Community Status Book Report Virginia: Community Participating in the National Flood Program*. https://www.fema.gov/cis/VA.pdf

Jurisdiction and Community Identification Number (CID)	Initial Flood Hazard Boundary Map (FHBM) Identified	Initial Flood Insurance Rate Map (FIRM) Identified	Current Effective Map Date	Regular-Emergency Date	Digital Flood Insurance Rate Map (DFIRM)/ (Q3)
Town of Leesburg 510091A	8/30/1974	9/30/1982	7/5/2001	9/30/1982	DFIRM
Town of Lovettsville 510259A	4/15/1977	7/5/2001	2/17/2017	10/22/2013	DFIRM
Town of Middleburg 51036DA	-	7/5/2001	7/5/2001	7/31/2001	DFIRM
Town of Purcellville 510231A	7/11/1975	11/15/1989	7/5/2001	11/15/1989	DFIRM
Town of Round Hill 510279A	5/13/1977	7/5/2001	7/5/2001	1/10/2006	DFIRM
Prince William County 510119A	1/10/1975	12/1/1981	8/3/2015	12/1/1981	DFIRM
Town of Dumfries 510120A	6/18/1976	5/15/1980	8/3/2015	5/15/1980	DFIRM
Town of Haymarket 510121#	8/9/1974	1/17/1990	1/5/1995	1/31/1990	DFIRM
Town of Occoquan 510124#	11/1/1974	8/15/1978	8/3/2015	8/15/1978	DFIRM

Table 130: CRS Participation Summary[227]

Jurisdiction	CRS Entry Date	Current Effective Date	Current Class	Percent Discount SFHA	Percent Discount Non-SFHA
Arlington County	10/1/1992	10/1/2008	8	10	5
City of Alexandria	10/1/1992	10/1/2013	6	20	10
City of Falls Church	5/1/2007	10/1/2016	6	20	10
Fairfax County	10/1/93	10/1/2014	6	20	10
Town of Vienna	10/1/1996	10/1/2011	8	10	5
Loudoun County	10/1/1992	5/1/2003	10	0	0
Prince William County	10/1/1996	10/1/2019	7	15	5

[227] Federal Emergency Management Agency. (n.d.). *Community Status Book Report Virginia: Community Participating in the National Flood Program*. https://www.fema.gov/cis/VA.pdf

8. Mitigation Strategy

Requirements

- **§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 hazard 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. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.
- **§201.6(c)(3)(iii)** – [The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section 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.
- **§201.6(c)(4)(ii)** – [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvements, when appropriate.

2022 HMP Update

- Goals and objectives from the 2017 NOVA HMP 2017 were reviewed and revised into a streamlined goal statement to ensure consistency with FEMA mitigation requirements.
- Mitigation actions were adapted from the 2017 NOVA HMP to include additional analysis of progress in mitigation.
- Updated funding descriptions and requirements were added per the latest FEMA guidance documents and the 2018 Virginia State Hazard Mitigation Plan.

8.1. Overview

The mitigation strategy serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The Stafford Act directs hazard mitigation plans to describe hazard mitigation actions and establish a strategy to implement those actions. Therefore, all other requirements for a hazard mitigation plan lead to and support the mitigation strategy.

This Plan update is an opportunity for NOVA jurisdictions to assess previous goals and adjust them to address current realities.[228] Updated and streamlined mitigation goals and objectives are presented in this section. The mitigation strategy is designed to support these goals and objectives.

[228] Federal Emergency Management Agency. (2011, October 1). *Local Mitigation Plan Review Guide*. https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-plan-review-guide_09_30_2011.pdf

The status of mitigation actions included in the 2017 HMP is discussed, as are new action items and how these action items were prioritized. All actions support the goals and objectives and promote an inclusive mitigation strategy. A summary of the types of actions identified by participants is presented to display the wide range of projects chosen, which represents a broad and inclusive approach to mitigation in the region.

A description of how participants will incorporate and integrate the mitigation risk assessment and goals into existing jurisdictional plans and procedures is described, and a list of potential federal, nonprofit, and Commonwealth funding sources is provided as a resource for participants to utilize when exploring financial support options for mitigation projects.

8.2. Review and Update Process

The 2017 NOVA HMP included six regional mitigation goals with the purpose of reducing or eliminating long-term risk for communities in the planning area. The NOVA Planning Group reviewed these goals during a mitigation strategy planning workshop and chose to condense and streamline them without changing their nature and intent.

8.3. 2022 Goals and Objectives

The NOVA Planning Group reviewed the mitigation goals included in the 2017 HMP and unanimously agreed to forego them and adopt the following hazard mitigation goals:

> ***"Our goals are to protect life and reduce bodily harm from the natural and non-natural hazards identified in this Plan, and to lessen the impacts of these hazards on property, the environment, and the community."***

These streamlined goals provide a long-term policy statement and vision that supports the mitigation strategy and will be achieved through the completion of the hazard mitigation actions and action plans identified in each jurisdiction's annex. These actions and action plans state a specific strategy for achieving these mitigation goals over the next five years. The mitigation actions detail the specific actions the jurisdictions will take, and the action plans describe how the actions will be prioritized and implemented to reduce the risk of hazards identified in the HMP. These goals are the basis of this Plan and summarize what the NOVA Hazard Mitigation Planning Group will accomplish by implementing it.

8.4. Status of 2017 Mitigation Actions

A thorough review of mitigation actions identified in the 2017 HMP was conducted to determine the effectiveness of each action and the progress made to date. Each participating jurisdiction was asked to review and update the status of each action to determine whether: the action was completed; the strategy is no longer applicable; or if the action should be moved forward and included in the 2022 Plan update. The updated status of previous mitigation actions is provided in the individual jurisdiction annexes.

8.5. New Mitigation Actions

Each participating jurisdiction updated its list of mitigation actions based on the review of its risk assessment, its existing capabilities, and the status of its action items in the 2017 HMP. The lists of actions include community-specific details from a comprehensive range of action item categories and are included in each jurisdiction annex.

Additionally, jurisdictions were urged to complete a New Action Information Page for each new action item included in the HMP. This optional page gave participants the tools to critically think through action

items, and the information included serves as a strong starting point for hazard mitigation grant applications. Details covered on this page include a detailed description of the action, a cost-benefit analysis, a plan for implementation, and three alternative actions considered. These pages are included in the annexes of the jurisdictions that completed them.

FEMA identifies four primary types of mitigation actions to reduce long-term vulnerabilities: local plans and regulations; structure and infrastructure; natural systems protection; and public education and awareness. Additional details about these types of actions are shown in Table 131. These actions are also traditionally eligible for hazard mitigation and other types of funding.

Table 131: Primary Types of Action Items[229]

Local Plans and Regulations	
Definition	**Examples**
These actions include government authorities, policies, or codes that encourage risk reduction.	• Comprehensive plans • Land use ordinances • Subdivision regulations • Development review • Building codes and enforcement • NFIP Community Rating System (CRS) participation • Capital improvement programs • Open space preservation • Stormwater management regulations and master plans • Community wildfire protection plans, fuels management, and fire breaks
Structure and Infrastructure Projects	
Definition	**Examples**
These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. These actions also include constructing new structures to reduce the impact of hazards. This could apply to public or private structures as well as critical facilities and infrastructure.	• Acquisitions and elevations of structures in flood-prone areas • Utility undergrounding • Structural retrofits (e.g., shelters) • Floodwalls and retaining walls • Detention and retention structures • Culverts • Safe rooms
Natural Systems Protection	
Definition	**Examples**

[229] Federal Emergency Management Agency. (2016, October). *State Mitigation Planning Key Topics Bulletins: Mitigation Strategy*. https://www.fema.gov/sites/default/files/2020-06/fema-state-mitigation-strategy-planning-bulletin_10-26-2016_0.pdf

Local Plans and Regulations	
Definition	**Examples**
These are actions that minimize damage and losses while preserving or restoring the function of natural systems.	• Sediment and erosion control • Stream corridor restoration • Forest management • Conservation easements • Wetland restoration and preservation
Public Education and Awareness Programs	
Definition	**Examples**
These are long-term, sustained programs to inform and educate the public and stakeholders about hazards and mitigation options. This can also include training.	• Radio or television spots • Websites with maps and information • Social media • Real estate disclosure • Presentations to school groups or neighborhood organizations • Mailings to at-risk populations and residents in hazard-prone areas • StormReady certification • Participation in the FireWise USA program

A strong mitigation strategy includes an analysis of actions and projects that are based on a jurisdiction's risk, vulnerabilities, and community priorities. These actions should represent a comprehensive range of mitigation alternatives that address the vulnerabilities to the hazards that the jurisdictions determine are most important.[230]

Table 132 shows the number of each type of FEMA-identified primary action item types. This range of projects demonstrates how planning participants are dedicated to taking a multifaceted approach to risk reduction.

Table 132: Number of Types of Action Items Selected by Participants

Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Public Education and Awareness Programs	Training	Preparedness
108	171	24	53	24	6

8.6. Prioritization of Mitigation Actions

The Planning Group reviewed the action items prioritization process from the 2017 HMP and agreed to adopt the same process as part of the 2021 update. Through discussion and self-analysis, each jurisdiction used the STAPLE/E criteria when considering and prioritizing mitigation actions. Only actions

[230] Federal Emergency Management Agency. (2011, October 1). *Local Mitigation Plan Review Guide* https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-plan-review-guide_09_30_2011.pdf

that satisfied the STAPLE/E criteria to the satisfaction of the jurisdiction and had the potential to reduce vulnerability to hazards were included in the Plan.

The STAPLE/E evaluation method uses seven criteria for evaluating a mitigation action: social, technical, administrative, political, legal, economic, and environmental. Within each of these criteria are additional considerations that may call upon the hazard risk assessment and other sources of information for evaluation. Table 133 describes each category and its considerations.

Table 133: STAPLE/E Evaluation Criteria for Mitigation Actions

(S) Social	
Definition	**Considerations**
The public must support the overall mitigation implementation strategy and specific mitigation actions. The mitigation action is evaluated in terms of community acceptance and impact on the population.	• **Community acceptance:** will the action disrupt housing or cause the relocation of people? Is the action compatible with present and future community values? • **Impact on population:** will the proposed action adversely affect one segment of the population?
(T) Technical	
Definition	**Considerations**
It is important to determine if the proposed action is technically feasible, will help to reduce losses in the long term, and has minimal secondary impacts. This category evaluates whether the action is a whole or partial solution, or not a solution at all.	• **Technical feasibility:** how effective is the action in avoiding or reducing future losses? • **Long-term solution:** does the action solve the problem or only a symptom? • **Secondary impacts:** will the action create more problems than it solves?
Administrative	
Definition	**Considerations**
This category examines the anticipated staffing, funding, time, and maintenance requirements for the mitigation action to determine if the jurisdiction has the personnel and administrative capabilities to implement the action or whether outside help will be necessary.	• **Staffing:** does the jurisdiction have the capability (staff, technical experts, and training) to implement the action? • **Funding allocated:** does the jurisdiction have the funding to implement the action or can it readily be obtained? • **Time:** can the action be accomplished in a timely manner? • **Maintenance/Operations:** can the community provide the necessary maintenance? It is important to remember that most federal grants will not provide funding for maintenance.

(P) Political	
Definition	**Considerations**
This category considers the level of political support for the mitigation action.	• **Political support:** is there political support to implement and maintain this action? Have political leaders participated in the planning process so far? • **Local champion or proponent:** is there a respected community member willing to help see the action to completion? • **Public and stakeholder support:** is there enough public support to ensure the success of the action? Have all stakeholders been offered an opportunity to participate in the planning process?
(L) Legal	
Definition	**Considerations**
Whether the jurisdiction has the legal authority to implement the action or whether the jurisdiction must pass new laws or regulations is important in determining how the mitigation action can be best carried out.	• **Commonwealth authority:** does the Commonwealth have authority to implement the action? • **Existing local authority:** are proper laws, ordinances, and resolutions in place to implement the action? • **Potential legal challenge:** is there a technical, scientific, or legal basis for the mitigation action (i.e., does the mitigation action "fit" the hazard setting)? Are there any potential legal consequences? Is the action likely to be challenged by stakeholders who may be negatively affected?
(E) Economic	
Definition	**Considerations**
Economic considerations must include evaluation of the present economic base and projected growth. Cost-effective mitigation actions that can be funded in current or upcoming budget cycles are more likely to be implemented than actions requiring general obligation bonds or other instruments that would incur long-term debt to a community.	• **Benefits of action:** what financial benefits will the action provide? • **Cost of action:** does the cost seem reasonable for the size of the problem and the likely benefits? What burden will be placed on the tax base or local economy to implement this action? • **Contribution to economic goals:** does the action contribute to community economic goals, such as capital improvements or economic development? • **Outside funding required:** are there currently sources of funding that can be used to implement the action? Should the action be considered "tabled" for implementation until outside sources of funding are available?

(E) Environmental	
Definition	**Considerations**
The impact on the environment is an important consideration due to public desire for sustainable and environmentally healthy communities. Statutory considerations, such as the National Environmental Policy Act (NEPA), also need to be kept in mind when using federal funds.	• **Impact on land/water bodies:** how will this action impact land/water? • **Impact on endangered species:** how will this action impact endangered species? • **Impact on hazardous materials and waste sites:** how will this action impact hazardous materials and waste sites? • **Consistency with community environmental goals:** is this action consistent with community environmental goals? • **Consistency with federal laws:** is the action consistent with federal laws, such as NEPA?

After considering the STAPLE/E criteria, each jurisdiction assigned a prioritization category of low, medium, or high to each action item being created or retained. The categories were defined as:

- **Low:** The action has the potential to reduce vulnerability to hazards, is based on one to two STAPLE/E criteria and is feasible and important for the jurisdiction. The action should be implemented as funding becomes available. The projected timeline for completion is 5 or more years.
- **Medium:** The action has the potential to reduce vulnerability to hazards and based on three to four STAPLE/E criteria, is feasible and important for the jurisdiction. Its implementation is not as urgent as a high-priority action item, and it can be implemented in the long term. The projected timeline for completion is 3 to 5 years.
- **High:** The action has the potential to reduce vulnerability to hazards, is based on five or more STAPLE/E criteria and is feasible and important for the jurisdiction. It is especially important for the jurisdiction to implement it in the short term and as quickly as possible. The projected timeline for completion is 1 to 2 years.

8.7. Funding Priorities

As necessary, jurisdictions will seek outside funding sources to implement mitigation projects in both pre-disaster and post-disaster environments. When applicable, potential funding sources have been identified for proposed actions listed in the mitigation strategies.

Funding priority will go toward action items with a high positive impact on community resilience as measured by the action's scope and cost-benefit analysis.

8.8. Integrating Mitigation into Existing Plans and Procedures

Through effective communication of the hazard mitigation opportunities and benefits that exist in communities, local leaders and elected officials can achieve agreement on efforts to integrate hazard mitigation into local planning. Educating jurisdictional leadership, staff, and community members about the benefits of mitigation actions is the best way to ensure seamless integration between mitigation planning and other local planning efforts.

The jurisdictions in NOVA continue to work on developing strategies and opportunities to better incorporate mitigation actions from the previous Plan into ongoing local planning activities. Additionally, jurisdictions have identified approaches to promote the integration of action items included in the 2022 HMP into local planning mechanisms.

The primary means for integrating mitigation strategies into other local planning mechanisms will be the revision, updating, and implementation of each jurisdiction's individual plans that require specific planning and administrative tasks (for example, Plan amendments, ordinance revisions, and capital improvement projects).

The members of the Planning Group will remain charged with ensuring that the goals and strategies of new and updated local planning documents for their jurisdictions are consistent with the goals and actions of the HMP and will not contribute to increased hazard vulnerability in the planning area or its participating jurisdictions.

Best practice while updating other community plans, such as a comprehensive plan, capital improvement plan, or emergency management plan, is for jurisdictions to provide a copy of the NOVA HMP to the appropriate parties. This will ensure that plans are integrated and all goals and strategies of new and updated local planning documents are consistent with and support the goals of the Plan and will not contribute to increased hazards in the jurisdiction or planning area.

It is recommended that the Plan be publicly posted on county, city, and town websites for review by the public and stakeholders to support community mitigation efforts. The following steps are suggestions for implementing this HMP into local plans:

1. Change is proposed by an elected official or other interested party.
2. The proposal is placed on the local agenda of the governing body.
3. The agenda is published at least 10 days in advance of the meeting at which it will be discussed, so members of the public have an opportunity to attend the discussion meeting. Publication may be made by posting the agenda on the city's website, in the city newsletter, or on a public bulletin board.
4. The proposal is discussed at the public meeting, including any comments by members of the public in attendance.
5. The proposal is voted on by the governing body.
6. If the proposal is passed, the change is implemented by the appropriate local authority.

8.9. Action Plan for Implementation and Integration

Several notable challenges and missed opportunities to incorporate hazard mitigation into local planning efforts have been identified by FEMA,[231] including the following:

- Hazard mitigation plans are often developed or updated without the active participation or leadership of local planning and community development staff.
- Local land use planners are less willing to embrace hazard mitigation planning as falling within their professional purview.
- Hazard mitigation plans often include mitigation strategies or actions that are focused on a disconnected series of emergency services, structure or infrastructure protection projects, and

[231] Federal Emergency Management Agency. (2013, March 1). *Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials*. https://www.fema.gov/sites/default/files/2020-10/fema_integrating-hazard-mitigation_case-studies_tools-community-officials.pdf

public outreach initiatives, with less emphasis on non-structural measures available through local land use planning or policy alternatives.

- Hazard mitigation plans are typically completed as stand-alone documents that cover multiple jurisdictions, and it is relatively uncommon for them to be directly linked or integrated with other community-specific planning tools such as comprehensive land use plans and development regulations.

To combat these challenges, increase accountability, and more clearly identify how jurisdictions will incorporate the hazard mitigation risk assessment and goals into existing plans and procedures, participants completed an Action Plan for Hazard Mitigation Implementation and Integration assessment during the planning process. Participants identified which existing plans and procedures they would work to incorporate mitigation into and provided a brief action plan for how this will be achieved. Jurisdiction-specific Action Plans are provided in the annexes.

8.10. Implementation Resources and Funding Opportunities

Determining current and/or potential implementation resources and funding opportunities for each identified action item is a vital part of the mitigation strategy planning process. By exploring, identifying, and designating funding sources now, jurisdictions are poised to complete identified action items as implementation and funding opportunities arise.

Under 44 CFR §201.6, local governments must have a FEMA-approved local mitigation plan in order to apply for and/or receive hazard mitigation project grant funds for the following federal Hazard Mitigation Assistance (HMA) programs:

- Hazard Mitigation Grant Program (HMGP)
- Building Resilient Infrastructure and Communities (BRIC)
- Flood Mitigation Assistance (FMA)
- Repetitive Flood Claims (RFC)
- Severe Repetitive Loss (SRL)

FEMA funding programs for cost-effective hazard mitigation for facilities damaged by natural disasters which are eligible under the Stafford Act, HMA and National Flood Insurance Act of 1968 are illustrated in Figure 65.

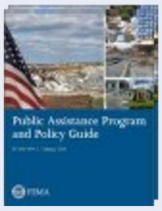
Stafford Act Section 406	Stafford Act Section 404	National Flood Insurance Act of 1968 NFIA	Stafford Action Section 203
PA Programs	**HMA Programs**		
Disaster-related programs	***Disaster-related programs***	***Non-disaster-related programs***	***Non-disaster-related programs***
PA: Mitigation of incident-caused damage 	**HMGP:** Multi-hazard statewide mitigation 	**FMA:** Flood mitigation for insured properties 	**BRIC:** Planning, Large-scale infrastructure projects 
Funding: Available for disaster-damaged facilities only*	Funding: Available for damaged and non-damaged facilities based on a percentage of dollars obligated to the PA and IA programs		
NOTE: **PA** = Public Assistance **HMA** = Hazard Mitigation Assistance **HMGP** = Hazard Mitigation Grant Program		**FMA = Flood Mitigation Assistance** **BRIC =** Building Resilient Infrastructure and Communities **IA** = Individual Assistance	
* *Exception for Alternative Procedures Projects (See Guide)*			

Figure 65: Federal Policies That Provide Funding for Local Hazard Mitigation

Mitigation activities can and should be implemented through a variety of funding streams. FEMA funding sources, including the Hazard Mitigation Grant Program (HMGP), the Building Resilient Infrastructure and Communities (BRIC) program, the Flood Mitigation Assistance (FMA) program, and Sections 404 and 406 of Hazard Mitigation Funding tend to be relied on heavily for mitigation action completion. However, it is important to research and leverage other available funding opportunities and not to limit funding sources to FEMA assistance programs. Funding opportunities may include other federal agencies, Commonwealth, local and tribal programs, as applicable, or private funding. In addition to funding, mitigation implementation resources such as regulatory and technical assistance are available to assist jurisdictions in completing action items and integrating mitigation into planning and resilience efforts.

In addition to the sources identified above and in Table 3.8, Coronavirus (COVID-19) relief funds were distributed by the United States Congress to federal, state, and local government agencies, nonprofit organizations, and individuals in 2020 and 2021. The main funding programs were the Coronavirus Aid, Relief, and Economic Security (CARES) Act (2020), the Coronavirus Response and Consolidated Appropriations Act (2021), and the American Rescue Plan Act (ARPA) (2021).[232] These funds have a broad range of allowable expenses, including supporting public health expenditures, replacing lost public sector revenue, and investing in water, sewer, broadband, and cybersecurity infrastructure. Within these overall categories, recipients have broad flexibility to decide how best to use this funding to meet the

[232] USA Spending. (2021, September 20). *The Federal Response to COVID-19* https://www.usaspending.gov/disaster/covid-19?publicLaw=all

needs of their communities[233]. As of December 2021, $350 billion has been allocated to states, counties, cities, tribal governments, territories, and non-entitlement units of local government[234].

Another recent influx in federal funds that can be used for mitigation actions is the Infrastructure Investment and Jobs Act which was passed by Congress on November 6, 2021. This once-in-a-generation investment in infrastructure includes legislation that addresses repairing and rebuilding roads and bridges with a focus on climate change, mitigation, and resilience, and making the nation's infrastructure resilient against the impacts of climate change, cyberattacks, and extreme weather events[235]**. The methods by which this legislation will be implemented were still being determined at the time this Plan was written.**

8.10.1. Hazard Mitigation Grant Program (HMGP)

The **Hazard Mitigation Grant Program (HMGP)** is authorized under section 404 of the Robert T. Stafford Act and 44 C.F.R. part 206. The purpose of HMGP is to provide funds to states, territories, Indian tribal governments, and communities to significantly reduce or permanently eliminate future risks to lives and property from natural hazards. Entities pursuant of HMPG funding must have fully patriated in a FEMA-approved hazard migration plan.

- Because the Commonwealth has an enhanced hazard mitigation plan, HMGP funds are 20% of the federal share of a federally declared presidential disaster and are broken down into three categories:
  - 5% initiative projects
  - 7% plan development and revision
  - 88% regular projects
- The grant application period is open for 12 months after the declaration date. All applications are made through and reviewed by the Commonwealth and approved by FEMA.

The **Flood Mitigation Assistance Program (FMA)** is a competitive grant program that provides funding states, territories, Indian tribal governments. FMA funds can be used for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program (NFIP).

- The Virginia Department of Emergency Management administers the Flood Mitigation Assistance program. Its purpose is to implement cost-effective measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured under the NFIP.
- The FMA funds planning activities that assess a community's flood risk and identify actions to reduce risk. Additionally, FMA funds property acquisitions, structure demolitions, and structure relocations, along with other flood mitigation activities.
- The repetitive and severe repetitive loss strategy outlined in this Plan serves to allow a cost share of 90% federal funds for repetitive and severe repetitive loss mitigation activities.

- **Building Resilient Infrastructure and Communities (BRIC)**

[233] United States Department of the Treasury. (n.d.). *Coronavirus State and Local Fiscal Recovery Funds* https://home.treasury.gov/policy-issues/coronavirus/assistance-for-state-local-and-tribal-governments/state-and-local-fiscal-recovery-funds
[234] USA Spending. (2021, September 20). *The Federal Response to COVID-19* https://www.usaspending.gov/disaster/covid-19?publicLaw=all
[235] The White House. (2021, November 6). *Fact Sheet: The Bipartisan Infrastructure Deal* https://www.whitehouse.gov/briefing-room/statements-releases/2021/11/06/fact-sheet-the-bipartisan-infrastructure-deal/

- The newest FEMA pre-disaster hazard mitigation program replaced the Pre-Disaster Mitigation (PDM) program. FEMA opened the first application period for the FY2020 Notices of Funding Opportunities that included BRIC.
- BRIC supports communities through capability- and capacity-building, encouraging and enabling innovation, promoting partnerships, enabling large projects, maintaining flexibility, and providing consistency.
- Priorities are to incentivize public infrastructure projects and projects that mitigate risk to one or more community lifelines, incentivize projects that incorporate nature-based solutions, and increase funding to applicants that facilitate the adoption and enforcement of the latest published editions of building codes.

8.10.2. Sections 404 and 406 Hazard Mitigation Funding

The Stafford Act established 404 and 406 mitigation activities for facilities requiring repair, restoration, or replacement as a result of a presidentially declared disaster. Although Sections 404 and 406 are distinct programs with key differences in their scope, purpose, and funding, both support hazard mitigation goals.

- **Section 404- Hazard Mitigation Grant Program** funding is used to provide protection to undamaged parts of a facility or to prevent or reduce damages caused by future disasters.
- **Section 406- Public Assistance** funding provides discretionary authority to fund mitigation measures in conjunction with the repair of the disaster-damaged facilities, so is limited to declared counties and eligible damaged facilities.

Table 134: Eligible Activities by Hazard Mitigation Assistance Program

Eligible Activities	HMGP	FMA	BRIC
1. Mitigation Projects	√	√	√
▪ Property Acquisition and Structure Demolition	√	√	√
▪ Property Acquisition and Structure Relocation	√	√	√
▪ Structure Elevation	√	√	√
▪ Mitigation Reconstruction	√	√	√
▪ Dry Floodproofing of Historic Residential Structures	√	√	√
▪ Dry Floodproofing of Non-Residential Structures	√	√	√
▪ Generators	√		√
▪ Localized Flood Risk Reduction Projects	√	√	√
▪ Non-Localized Flood Risk Reduction Projects	√		√
▪ Structural Retrofitting of Existing Buildings	√	√	√
▪ Non-Structural Retrofitting of Existing Buildings and Facilities	√	√	√
▪ Safe Room Construction	√		√
▪ Wind Retrofit for One- and Two-Family Residences	√		√
▪ Infrastructure Retrofit	√	√	√
▪ Soil Stabilization	√	√	√
▪ Wildfire Mitigation	√		√
▪ Post-Disaster Code Enforcement***	√		√
▪ Advance Assistance	√		√

Eligible Activities	HMGP	FMA	BRIC
▪ 5 Percent Initiative Projects*	√		
▪ Aquifer and Storage Recovery**	√	√	√
▪ Flood Diversion and Storage**	√	√	√
▪ Floodplain and Stream Restoration**	√	√	√
▪ Green Infrastructure**	√	√	√
▪ Building Code Adoption and Enforcement***			√
▪ Partnership Expansion***			√
▪ Project Scoping***			√
▪ Miscellaneous/Other**	√	√	√
2. Hazard Mitigation Planning	√	√	√
3. Technical Assistance		√	√
4. Management Costs	√	√	√

*FEMA allows increasing the 5 percent initiative amount up to 10 percent for a Presidential Major Disaster Declaration under HMGP. The additional 5 percent initiative funding can be used for activities that promote disaster-resistant codes for all hazards. As a condition of the award, either a disaster-resident building code must be adopted, or an improved Building Code Effectiveness Grading Schedule is required.

**Indicates that any proposed action will be evaluated on its own merit against program requirements. Eligible projects will be approved provided funding is available.

***Activities are only eligible for funding under the BRIC State/Territory Allocation and BRIC Tribal Set Aside; they are not eligible for funding under the BRIC National Competition.

Sources: FEMA. (2015, February 27). *Hazard Mitigation Assistance Guidance.* https://www.fema.gov/sites/default/files/2020-04/HMA_Guidance_FY15.pdf and FEMA. (2021, November 12). *Building Resilient Infrastructure and Communities (BRIC)*. https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities/before-apply

Table 135: Sources for Mitigation Funding and Assistance from Federal Agencies and Organizations

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Grants.gov	Searchable catalog of federal grant opportunities across agencies.	United States Department of Health and Human Services (DHHS)	http://www.grants.gov/web/grants/home.html	x	x	x
Federal Grant Programs for State and Local Governments	Website that lists types of FEMA grant programs, and includes policies, eligibility, agencies, and types of funding instrument.	Federal Emergency Management Agency (FEMA)	https://www.grants.gov/web/grants/search-grants.html?keywords=FEMA		x	x
National Earthquake Hazards Reduction Program	Provides research to advance understanding of the occurrence and impact of earthquakes.	National Institute of Standards and Technology (NIST), National Science Foundation (NSF), and United States Geological Survey (USGS)	http://www.nehrp.gov/index.htm		x	
Decision, Risk, and Management Science Program	Scientific research directed at increasing the understanding and effectiveness of decision-making by individuals, groups, organizations, and society.	National Science Foundation (NSF)	https://beta.nsf.gov/funding/opportunities		x	
Aquatic Ecosystem Restoration	This program helps to restore significant ecosystem functions, structure, and dynamic processes that have been degraded.	United States Army Corps of Engineers (USACE)	http://www.nae.usace.army.mil/Missions/Public-Services/Ecosystem-Restoration-Authorities/	x	x	x
Beneficial Uses of Dredged Materials	Direct assistance for projects that protect, restore, and create aquatic and ecological habitats, including connection with dredging in authorized federal wetlands as part of navigation projects.	United States Environmental Protection Agency (EPA)	https://www.epa.gov/cwa-404/beneficial-use-dredged-material	x	x	x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Water Grants	A variety of grants related to water and wastewater infrastructure projects, including a catalog of federal funding for watershed protection projects.	EPA	https://www.epa.gov/nps/watershed-funding		x	x
Urban Waters Small Grants Program	Programs that protect and restore urban waters by improving water quality through activities that also support community revitalization and other local priorities.	EPA	https://www.epa.gov/urbanwaters/urban-waters-small-grants		x	x
Funding and Technical Assistance for Climate Adaptation	Multiple resources on technical and funding assistance for green infrastructure, Smart Growth, and creating resilient water utilities.	EPA	https://www.epa.gov/arc-x/federal-funding-and-technical-assistance-climate-adaptation		x	x
Community Development Block Grant (CDBG)	Grants to states and local governments to develop viable communities (e.g., housing, suitable living environments, expanded economic opportunities) and recover from federally declared disasters. Principally for low- and moderate-income areas.	United States Department of Housing and Urban Development (HUD)	https://www.hud.gov/program_offices/comm_planning/cdbg	x	x	x
Disaster Housing Assistance Program	Emergency assistance for housing, including minor repair of homes to establish livable conditions, and mortgage and rental assistance.	HUD	https://portal.hud.gov/hudportal/HUD?src=/program_offices/public_indian_housing/publications/dhap			x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
HOME Investment Partnerships Program	Grants to state and local governments and consortia for permanent and transitional housing, including financial support for property acquisition and rehabilitation for low-income persons.	HUD	https://www.hud.gov/program_offices/comm_planning/home			x
HUD Disaster Resources	Grants and a variety of disaster assistance related to housing, including mortgage assistance.	HUD	https://portal.hud.gov/hudportal/HUD?src=/info/disasterresources			x
CDBG Section 108 Loan Guarantee	Offers states and local governments financing for certain community development activities, such as housing rehabilitation, economic development, and large-scale physical development projects.	HUD	https://portal.hud.gov/hudportal/HUD?src=/hudprograms/section108			x
National Flood Insurance Program (NFIP)	Formula grants to states to assist communities in complying with NFIP floodplain management requirements; Community Assistance Program - State Support Services Element.	FEMA	https://www.fema.gov/national-flood-insurance-program	x		
High Hazard Potential Dam Grant Program	Provide technical, planning, design, and construction assistance in the form of grants for rehabilitation of eligible high hazard potential dams.	FEMA	https://www.fema.gov/emergency-managers/risk-management/dam-safety/rehabilitation-high-hazard-potential-dams	x	x	x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Hazard Mitigation Assistance Grant Program (HMA)	Grants to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from damage by future disasters. Includes FMA, HMGP, HMGP Post Fire, and BRIC, which are detailed below.	FEMA	http://www.fema.gov/hazard-mitigation-assistance		x	x
Flood Mitigation Assistance Program (FMA)	Grants to states and communities for pre-disaster mitigation planning and projects to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program.	FEMA	http://www.fema.gov/flood-mitigation-assistance-program		x	x
Hazard Mitigation Grant Program (HMGP)	Grants to states and communities for planning and projects providing long-term hazard mitigation measures following the declaration of a major disaster.	FEMA	http://www.fema.gov/hazard-mitigation-grant-program		x	x
Hazard Mitigation Grant Program (HMGP) Post Fire	Grants available to help communities implement hazard mitigation measures after wildfire disasters.	FEMA	https://www.fema.gov/grants/mitigation/post-fire			x
Building Resilient Infrastructure and Communities Grant Program (BRIC)	Grants for mitigation activities that support priorities, including natural hazard risk reduction activities that mitigate risk to public infrastructure and community lifelines.	FEMA	https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities	x	x	x
Public Assistance: Hazard Mitigation Funding under Sections 404 and 406	Hazard mitigation discretionary funding available under Sections 404 and 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act following a federally declared disaster.	FEMA	https://www.fema.gov/95261-hazard-mitigation-funding-under-section-406-stafford-act			x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Assistance to Firefighters Grant Program (AFG)	Assists in local funding for fire equipment, staffing, facility construction, and emergency response costs.	FEMA	https://www.fema.gov/welcome-assistance-firefighters-grant-program			x
Partners for Fish and Wildlife	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.	United States Fish and Wildlife Service (USFWS)	https://www.fws.gov/partners/resourceBenefits.html		x	x
Historic Preservation Financial Assistance - General	Federal financial assistance specifically for historic preservation. Initiatives include sustainability and climate resilience, and community revitalization and economic benefits.	Advisory Council on Historic Preservation	https://www.achp.gov/initiatives		x	x
Federal Highway Administration Emergency Relief Program	Funding for the repair or reconstruction of federal aid highways that have suffered serious damage as a result of natural disasters or catastrophic failures resulting from an external cause.	United States Department of Transportation (USDOT)	http://www.fhwa.dot.gov/programadmin/erelief.cfm			x
Rebuilding American Infrastructure with Sustainability and Equity (RAISE)	Investing in surface transportation infrastructure for roads, bridges, transit, rail, ports, or intermodal transportation. Replaces previous TIGER and BUILD programs.	USDOT	https://www.transportation.gov/RAISEgrants/about		x	x
Emergency Farm Loans Program	USDA's Farm Service Agency (FSA) provides emergency loans to help producers recovery from production and physical losses due to drought, flooding, other natural disasters or quarantine.	United States Department of Agriculture (USDA)	https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/emergency-farm-loans/			x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Landscape Planning Programs	Planning and programs that help improve natural resource management. Includes the Emergency Watershed Protection Program, the Watershed and Flood Prevention Operations Program, and the Watershed Rehabilitation Program.	USDA National Resources Conservation Service (NRCS)	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/		x	x
Regional Conservation Partnership Program	Co-investment funding for partners to implement projects that address on-farm, watershed, and regional natural resource concerns.	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/rcpp/	x	x	x
Environmental Quality Incentives Program	Provides financial and technical assistance for agricultural producers and non-industrial forest managers to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, increased soil health and reduced soil erosion and sedimentation, improved or created wildlife habitat, and mitigation against drought and increasing weather volatility.	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/	x	x	x
Conservation Innovation Grants (CIG)	A competitive program that supports the development of new tools, approaches, practices, and technologies to further natural resource conservation on private agricultural lands. CIG works to address water quality, air quality, soil health, and wildlife habitat challenges.	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/			x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Conservation Technical Assistance Program	Provides farmers, ranchers, and forestland owners with the knowledge and tools they need to conserve, maintain, and restore the natural resources on their lands and improve the health of their operations for the future.	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/		x	
Financial Assistance	Financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal, and related resources on agricultural lands and non-industrial private forest land.	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/		x	x
Easement Programs	Programs that provide financial and technical assistance to help landowners conserve agricultural lands and wetlands and their related benefits.	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/		x	x
Healthy Forests Reserve Program	Helps landowners restore, enhance and protect forestland resources on private lands through easements and financial assistance.	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/forests/		x	x
Land and Water Conservation Fund	Funding allows four federal agencies to acquire and develop private lands for public outdoor recreation areas and facilities, and congressional appropriation for matching funds for state and local government land acquisition projects.	United States Bureau of Land Management, United States Forestry Service, United States Fish and Wildlife Service (FWS), and National Park Service	http://www.lwcfcoalition.org/		x	x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Missions and Appropriations	Federal budget and funding to support USACE missions including research, feasibility studies, construction, and disaster relief.	USACE	https://www.usace.army.mil/Missions/	x	x	x
Flood Risk Management Program	Fosters public understanding of the options for dealing with flood hazards and promotes the prudent use and management of the nation's flood plains. Types of assistance include general technical services and general planning guidance.	USACE	https://www.iwr.usace.army.mil/Missions/Flood-Risk-Management/Flood-Risk-Management-Program/		x	
United States Climate Resilience Toolkit Funding Opportunities	A range of government entities and private foundations offer financial and technical resources to advance local adaptation and mitigation efforts.	United States Global Change Research Program	https://toolkit.climate.gov/content/funding-opportunities			x
Small Business Administration (SBA) Disaster Loan Assistance	SBA provides low-interest, long-term loans to facilitate recovery from physical and economic damage caused by a declared disaster. These include home and personal property loans, business physical disaster loans, economic injury disaster loans, and military reservists' economic injury loans.	SBA	https://www.sba.gov/loans-grants/see-what-sba-offers/sba-loan-programs/disaster-loans			x
National Dam Safety Program/High Hazard Potential Dam Grant Program	The primary purpose of the National Dam Safety Program is to provide financial assistance to states to strengthen their dam safety programs.	FEMA	https://www.fema.gov/emergency-managers/risk-management/dam-safety/grants			x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Community Emergency Response Team (CERT)	Nine-week citizen training program for disaster preparedness and basic disaster response skills for individuals, families, neighborhoods, community organizations, and businesses.	FEMA, state and local governments	https://community.fema.gov/PreparednessCommunity/s/welcome-to-cert		x	
Forest Legacy Program	Encourages the protection of privately-owned forest lands through conservation easements or land purchases.	United States Forest Service, USDA	https://www.fs.usda.gov/managing-land/private-land/forest-legacy			x
Historic Preservation Fund Disaster Recovery Grant Program	Provides financial assistance for the immediate needs of historic property owners after a disaster. The program is designed to foster partnerships between local, state, and federal community planners in order to ensure that important cultural resources are integrated with statewide hazard mitigation planning efforts.	National Park Service (NPS)	https://www.nps.gov/subjects/historicpreservationfund/disaster-recovery.htm		x	x
National Trust for Historic Preservation Grants	Offers grants that are primarily for planning preservation projects, though some special programs focus on preservation planning in particular fields or geographic regions or allow for the funding of physical preservation work.	National Trust for Historic Preservation	https://forum.savingplaces.org/build/funding/grant-seekers			x
National Coastal Wetlands Conservation Grant Program	Provides funding to protect, restore and enhance coastal wetland ecosystems and associated uplands.	FWS	https://www.fws.gov/coastal/coastalgrants/			x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
North American Wetlands Conservation Act	Offers grants to protect wetlands that provide valuable benefits such as flood control, reducing coastal erosion, improving water and air quality, and recharging groundwater.	FWS	https://www.fws.gov/birds/grants/north-american-wetland-conservation-act.php			x
Battlefield Land Acquisition Grant Program	Provides funding for the permanent protection of historic battlefield lands through fee simple acquisition or through the purchase of an interest in the land through a preservation covenant.	NPS	https://www.nps.gov/subjects/battlefields/battlefield-land-acquisition-grant-program.htm			x
The Coastal and Estuarine Land Conservation Program	Offers financial assistance to purchase threatened coastal and estuarine lands or obtain conservation easements.	National Oceanic and Atmospheric Administration Office of Coastal Management	https://coast.noaa.gov/czm/landconservation/?redirect=301ocm			x
Readiness and Environmental Protection Integration Program	Promotes conservation projects or natural resource restoration efforts around military bases.	United States Department of Defense (DOD)	https://repiprimers.org/	x	x	x
Army Compatible Use Buffer Program	This program is designed to minimize incompatible development and loss of habitat surrounding Army facilities by utilizing permanent conservation easements, fee-sales, or other interests in land from willing landowners.	DOD	https://www.repi.mil/Buffer-Projects/Service-Programs/			x
Homeland Security Grant Program	Supports efforts to build and sustain core capabilities across the five mission areas of Prevention, Protection, Mitigation, Response, and Recovery based on allowable costs.	United States Department of Homeland Security (DHS)	https://www.fema.gov/homeland-security-grant-program		x	x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Emergency Management Performance Grant (EMPG) Program	Assists local, tribal, territorial, and state governments in enhancing and sustaining all-hazards emergency management capabilities.	DHS	https://www.fema.gov/emergency-management-performance-grant-program		x	x

Table 136: Sources for Mitigation Funding and Assistance from National Non-Profit Organizations

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
American Red Cross	Shelter, food, support, supplies, and direct assistance to populations impacted by disaster.	American Red Cross, Virginia Region	https://www.redcross.org/local/virginia.html		x	x
The Nature Conservancy	Conservation organization partnering with communities, business, government, and other non-profits to protect ecologically important lands and waters for nature and people.	The Nature Conservancy	https://www.nature.org/en-us/		x	x
The Trust for Public Land	Assistance to state and local governments including land conservation transactions, conservation finance, and park design and development.	The Trust for Public Land	http://www.tpl.org/services/conservation-finance		x	x
Public Health Programs	Provides funding, expertise, information, leadership and/or connections to specific groups of people for projects addressing priority public health challenges.	CDC Foundation	http://www.cdcfoundation.org		x	x

Table 137: Sources for Mitigation Funding and Assistance from Commonwealth Agencies and Organizations

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Urban Area Security Initiative Program (UASI)	Supports efforts to build capabilities to prevent terrorism in high-density urban areas with high threat levels.	Virginia Department of Emergency Management	https://www.vaemergency.gov/divisions/finance/grants/preparedness-grant-programs/	x	x	x
State Homeland Security Program (SHSP)	Supports local government efforts in building capacity to prevent terrorism.	Virginia Department of Emergency Management	https://www.vaemergency.gov/divisions/finance/grants/preparedness-grant-programs/	x	x	x
Nonprofit Security Grant Program (NSGP)	Provides funding support for target hardening and other physical security enhancements and activities to nonprofit organizations that are at high risk of terrorist attack.	Virginia Department of Emergency Management	https://www.vaemergency.gov/divisions/finance/grants/preparedness-grant-programs/			x
Shelter Upgrade Fund	Provides matching funds to localities to install, maintain, or repair infrastructure related to backup energy generation for emergency shelters, including solar energy generators, and to improve the hazard-specific structural integrity (wind retrofit) of shelter facilities owned by the locality.	Virginia Department of Emergency Management	https://www.vaemergency.gov/divisions/finance/grants/			x
Dam Safety, Flood Prevention and Protection Assistance Fund	Commonwealth funded grants to help dam owners and Virginia localities enhance public safety and reduce the risk of dam failures and property damage from flooding.	Virginia Department of Conservation and Recreation	https://www.dcr.virginia.gov/dam-safety-and-floodplains/dsfpm-grants	x	x	x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Virginia Community Flood Preparedness Fund	The fund was established to provide support for regions and localities across Virginia to reduce the impacts of flooding, including flooding driven by climate change. The fund will prioritize projects that are in concert with local, state and federal floodplain management standards, local resilience plans and the Virginia Coastal Resilience Master Plan.	Virginia Department of Conservation and Recreation	https://www.dcr.virginia.gov/dam-safety-and-floodplains/dsfpm-cfpf			x
Virginia Recreational Trails Program	A federal 80-20 matching reimbursement program for building and rehabilitating trails and trail-related facilities. Eligible project types include new recreation trails, restoration and/or rehabilitation of existing trails, water trail facilities, and land acquisition.	Virginia Department of Conservation and Recreation	https://www.dcr.virginia.gov/recreational-planning/trailfnd			x
Open Space Recreation and Conservation Fund	Funding for projects such as acquisition of land for recreational purposes and preservation of natural areas, and the development, maintenance, and improvement of state park sites and facilities.	Virginia Department of Conservation and Recreation	https://www.dcr.virginia.gov/checkoff			x
Virginia Land Conservation Foundation	Provides funds for permanent conservation easements and to purchase open spaces and parklands, lands of historic or cultural significance, farmlands and forests, and natural areas.	Virginia Department of Conservation and Recreation	https://www.dcr.virginia.gov/virginia-land-conservation-foundation/			x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Clean Water Financing and Assistance Program	Protects and enhances water quality by providing flexible funding solutions and assistance to localities, organizations and citizens of the Commonwealth. The program administers three funding programs: Virginia Clean Water Revolving Loan Fund, Stormwater Local Assistance Fund, and Water Quality Improvement Fund. Eligible project types include land conservation, remediation of brownfield properties, and living shorelines.	Virginia Department of Environmental Quality	https://www.deq.virginia.gov/water/clean-water-financing			x
Virginia Coastal Zone Management Grant Program	Provides annual financial awards to promote coastal resource protection, coastal resource sustainable use, and coastal management coordination.	Virginia Department of Environmental Quality	https://www.deq.virginia.gov/coasts/coastal-zone-management			x
Conservation Reserve Enhancement Program	The program aims to improve Virginia's water quality and wildlife habitat by offering financial incentives, cost-share and rental payments to farmers who voluntarily restore riparian forest buffers, grass and shrub buffers, and wetlands using approved best management practices.	Virginia Department of Conservation and Recreation	https://www.dcr.virginia.gov/soil-and-water/crep			x
Open-Space Lands Preservation Trust Fund	Provides grants for acquisitions, easements, rights of way, and other methods of protecting open space for farming, forestry, recreation, wildlife, water quality, and more.	Virginia Outdoors Foundation	https://www.vof.org/protect/grants/			x

Program or Source	Description	Lead Agency or Agencies	Internet Resource	Type		
				Regulatory	Technical	Financial
Targeted Environmental Remediation and Restoration Accounts	Provides grants for conservation efforts, including natural area preserves and public education.	Virginia Outdoors Foundation	https://www.vof.org/protect/grants/			x
Get Outdoors	Provides grants for projects that increase equitable access to safe open space in Virginia's communities. Some examples of costs that can be covered include planning, capacity building, and infrastructure.	Virginia Outdoors Foundation	https://www.vof.org/protect/grants/			x
Virginia Department of Historic Resources Grants	These grants include funds for the preservation of historical graves and cemeteries, and archaeological sites threatened by erosion or impending development.	Virginia Department of Historic Resources	https://www.dhr.virginia.gov/grants/			x
Emergency Supplemental Historic Preservation Fund	Provides funding for projects that mitigate the threat of damage to historic properties from future natural disasters.	Virginia Department of Historic Resources	https://www.dhr.virginia.gov/grants/disaster-assistance/			x
Purchase of Development Rights Programs	This program is designed to compensate landowners who voluntarily place an agricultural conservation easement on their property for conservation purposes.	Virginia Department of Agriculture and Consumer Services	https://www.vdacs.virginia.gov/conservation-and-environmental-farmland-preservation-tools.shtml			x

9. Plan Maintenance

This volume of the Plan is a living document that will guide mitigation actions over time. As conditions and circumstances change, new information may become available, and actions may progress over the life of the Plan. The actions and Plan contents may adjust as necessary to maintain the relevance and effectiveness of the Plan.

Periodic revisions and updates of the volume should occur to ensure the goals of the Plan are kept current while considering potential changes in hazard vulnerability and mitigation priorities. In addition, periodic evaluation of the Plan will also ensure specific mitigation actions are being reviewed and carried out according to each participating jurisdiction's individual Mitigation Action Plan for Implementation and Integration.

Implementation and maintenance of the Plan work in parallel to ensure the success of the mitigation strategy. Maintenance of this volume may take place in concert with the maintenance activities of the Base Plan and jurisdiction annexes. Alternatively, the NOVA Planning Group may determine an alternative method and schedule for maintenance of the separate volume.

Northern Virginia Hazard Mitigation Plan

Annex 1: Arlington County

November 2022

Arlington County Overview

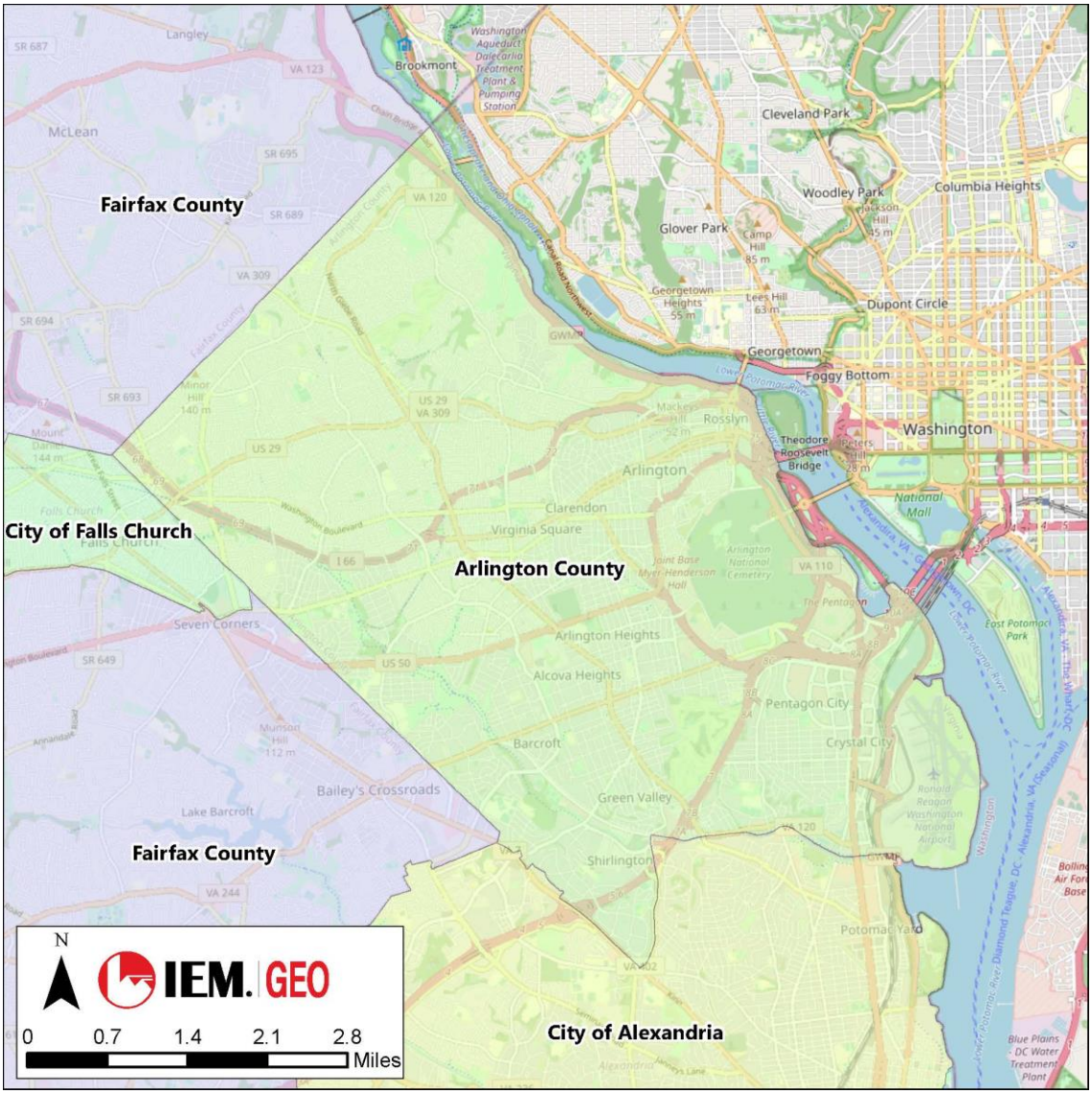


Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	2020 HOUSEHOLDS	MITIGATION FOCUS
1801	25.8 sq. mi.	238,643	2100 Clarendon Boulevard, Arlington, VA 22201	109,912	Flood/Flash Flood and Winter Weather

Arlington County's Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI), 1950–June 2021

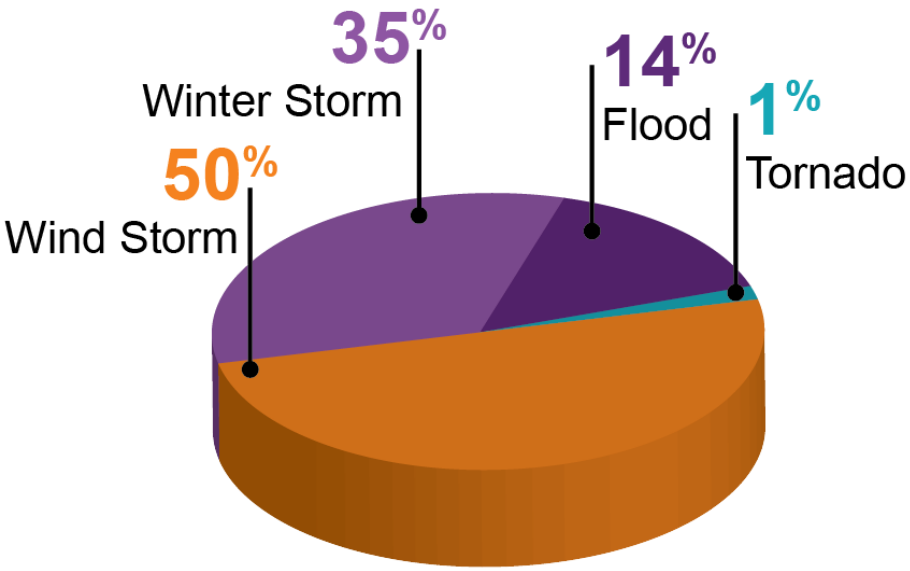


Figure 1: Percentage of Natural Hazards

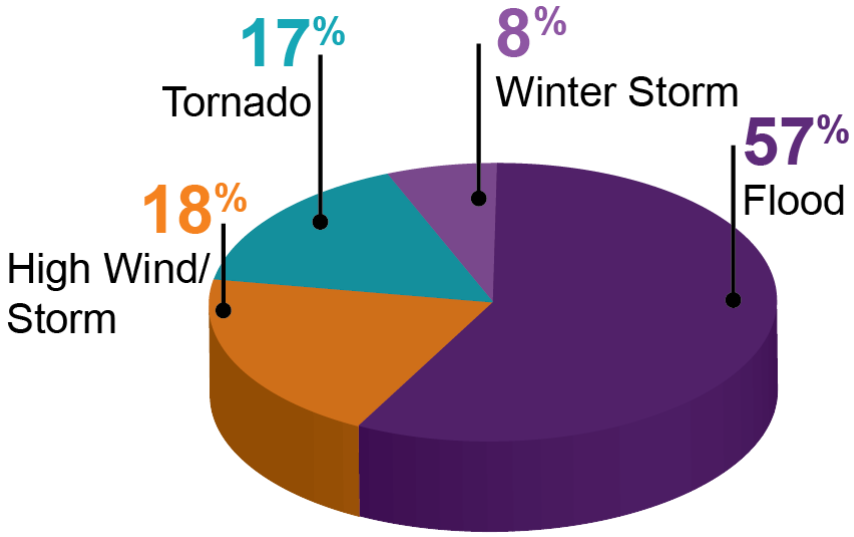


Figure 2: Property Damage Percentages from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Natural Hazard Risk Ranking

Hazard	Hazard Ranking
Winter weather	**High**
Flood	**High**
High wind/severe storm	**High**
Tornado	**Medium**
Extreme temperatures	**Medium**
Drought	**Medium**
Earthquake	**Low**
Karst/sinkhole/land subsidence	**Low**
Wildfire	**Low**
Dam failure	**N/A**
Landslide	**N/A**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	22
Food, Water, Shelter	6
Health and Medical	1
Energy	0
Communications	4
Transportation	335
Hazardous Materials	8

A lifeline enables the continuous operation of government and business functions, which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Summary of Mitigation Capabilities

Table 4: Capability Assessment Summary Ranking for Arlington County

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	High
Financial	Moderate
Education and Outreach	High

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Sydney McKenna, Emergency Preparedness Manager Department of Public Safety Communications and Emergency Management 1400 N. Uhle St., Suite 300 Arlington, VA 22201 smckenna@arlingtonva.us
Secondary Point of Contact	Elizabeth Thurber, Stormwater Infrastructure Program Manager/Floodplain Administrator/CRS Coordinator Department of Environmental Services 2100 Clarendon Blvd. Suite 705 Arlington, VA 22201 ethurber@arlingtonva.us

Arlington County

This annex presents the following jurisdiction-specific information provided by Arlington County for the 2022 update to the Northern Virginia Hazard Mitigation Plan (NOVA HMP).

Table of Contents

List of Tables

List of Figures

1. Jurisdiction Profile

Incorporated Towns	0[1]
Geographic Region	Piedmont/Coastal Plain[2]
Persons Per Household	2.14[3]
Persons Per Square Mile	9,180[4]
Median Age	34.8[5]
Elevations	Near sea level – 461 feet[6]

1.1. Location

Located in the northeast region of the Commonwealth of Virginia, Arlington County is situated on the southwestern bank of the Potomac River directly across from the District of Columbia. The County is bounded on the east across the Potomac River by the District of Columbia and bounded on the south by the City of Alexandria. Arlington County shares a border with Fairfax County and the City of Falls Church on the west and Fairfax County to the north. Arlington County is often referred to as Arlington, Virginia, although it does not have the legal designation of an independent city or an incorporated town under Virginia law.

1.2. History

The land that is now Arlington County was originally part of Fairfax County in the Colonial era, and it was mostly ceded to the United States federal government under the Residence Act of 1790. While the initial square-shape of the federal district, which included Alexandria (and present-day Arlington County), was allowed by the United States Constitution, the Residence Act of 1790 limited construction of any public buildings to the Maryland side of the Potomac River. The County of Alexandria was under exclusive control of Congress until 1846 when Congress allowed the area formerly under its control to be retroceded to the Commonwealth of Virginia, which was accepted by the Virginia legislature in 1847. The City of Alexandria was officially separated from the County in 1870, and in 1920, the name Arlington County was adopted.

Arlington County developed at a steady pace during its history, but by the 1950s, a large influx of new residents led to extensive residential and commercial development. Along with this growth, the transportation system of interstate highways and Metro rail lines expanded throughout the County. Growth has continued at an explosive rate in the twenty-first century.

[1] https://www.arlingtonva.us/Home
[2] https://pubs.usgs.gov/fs/fs-023-01/
[3] https://www.census.gov/quickfacts/fact/table/arlingtoncountyvirginia,alexandriacityvirginia/PST045221

[4] https://www.census.gov/quickfacts/fact/table/arlingtoncountyvirginia,alexandriacityvirginia/PST045221
[5] https://data.census.gov/cedsci/table?q=United%20States&t=Age%20and%20Sex%3APopulations%20and%20People&g=0500000US51013&tid=ACSDT5Y2020.B01002
[6] https://www.arlingtonva.us/Government/Projects/Data-Research/Fast-Facts

1.2.1. Climate

Due to the County's location on both the Virginia Piedmont and the Atlantic Coastal Plain, the County experiences a variety of weather. The diversity of Arlington County's landscape increases its vulnerability to a variety of hazards, most notably flooding and severe storms. In addition to snow melt and rain-related river and urban inland flooding episodes, low-lying areas of Arlington County along the Potomac River are also subject to tidal and storm surge flooding. Permanent inundation of low-lying areas along and near the river shoreline is also a threat as sea levels rise. Additionally, winter storms pose significant threats, as evidenced by the 23- and 31-inch snow levels in late January 2016; blizzard conditions also impacted travel and caused power outages during the 2015–2016 winter season.

1.3. Demographics, Economy, and Governance

Arlington County's population is 236,434, according to the 2020 Decennial Census, which is an approximate 14.9% increase from 2010. The County is densely populated with approximately 9,094.5 residents per square mile. Since 1980, the majority of households consist of a single person or nonrelated individuals.[7]

Table 6: Population and Growth Rate[8]

Year	Population	Decennial Percent Increase
1970	174,284	-
1980	152,599	−12.4%
1990	170,786	11.9%
2000	189,359	10.9%
2010	207,627	9.6%
2020	238,643	14.9%

[7] Arlington County 2022 Profile website. Retrieved at: https://www.arlingtonva.us/files/sharedassets/public/projects/documents/data-and-research/profile2022.pdf
[8] Ibid.

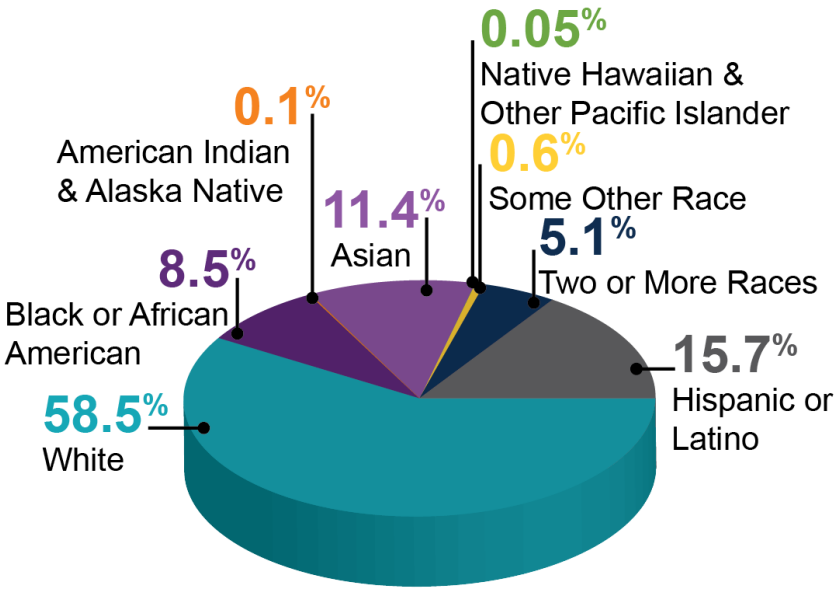


Figure 4: Race and Ethnicity Demographics from 2020 US Census

Table 7: Economic Data

Economy	Data
Median Household Income (2016–2020 American Community Survey 5-Year Estimates)	$122,604
Unemployment Rate (September 2021 U.S. Bureau of Labor Statistics Local Area Unemployment Statistics)	4.3%
Per Capita Income (2019, Bureau of Economic Analysis)	$99,407
Average Assessed Value, Single Family Detached (January 2021, Arlington County Department of Management and Finance)	$1,000,300
Percentage Below Poverty (2019)	6.5%
Top three at-place jobs in industry	Professional and Technical Services (25.1%) Other Services (22.2%) Government (20.6%)

Arlington County has been one of the highest median household income counties in the United States for many years, which is attributed to its close proximity to the District of Columbia, accessibility by car and public transportation, highly skilled labor force, and access to high-paying jobs. Arlington County has also attracted an increasingly varied mix of residential and commercial development. Much of the commercial development in Arlington County is centered around the transit corridors, which also includes high-density, multi-family residential units. Multi-family units make up more than 71% of all housing in Arlington County.[9]

Of the County's population over the age of 25, approximately 75% have a bachelor's degree or higher, and 40% have a graduate degree, making it one of the highest-educated workforces in the region. Top

[9] Arlington County 2021 Profile website. Retrieved at: https://www.arlingtonva.us/files/sharedassets/public/arlington/documents/profile_2021.pdf

private employers in the County, by number of employees, include Amazon, Bloomberg BNA, Booz Allen Hamilton, Virginia Hospital Center, and Nestle.

1.4. Built Environment and Community Lifelines

The information presented in this section was collected from multiple sources, including Arlington County Public Safety Communications and Emergency Management, Hazus (Version 4.2), and county government websites. Data extracted from the Hazus Level 1 assessment indicates that Arlington County has an estimated total of 682 community lifelines and critical assets. The Hazus data is a static point of time when this plan was prepared and does not contain a detailed list of all the facilities and structures in the County. Arlington County keeps an updated list for their records. For the 2022 NOVA HMP update, the community lifeline and critical facility inventory was limited to the Hazus Level 1 database.

Table 8: Number of Assets per Community Lifeline/Sector[10]

Lifeline/Sector	Number of Assets
Safety and Security	22
Food, Water, Shelter	6
Health and Medical	1
Energy	0
Communications	4
Transportation	335
Hazardous Materials	8

1.4.1. Safety and Security

Arlington County's safety and security assets include nine fire stations, one district-wide police station, one emergency communications center (911), and one emergency operations center. In addition to the County assets, the Hazus database lists two federal safety and security assets (one emergency operations centers and one fire station) within Arlington County, two Metropolitan Washington Airports Authority facilities, one state police division facility, and one volunteer fire station; however, they are not included as county assets in this plan.

1.4.2. Food, Water, Shelter

Food commodities are available from public retail providers and wholesalers throughout Arlington County. Contracted services also provide food for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

Arlington County provides water and wastewater services to its citizens. The Hazus database identifies six wastewater treatment facilities within the County, four owned and operated by the County and two under the authority of the United States Department of Defense.

Arlington County has identified facilities throughout the County that can function as a shelter in the event of an emergency or disaster that results in the need for temporary housing. Most emergency shelter facilities are Arlington Public Schools facilities or County-owned community centers. Two facilities have full power generators.

[10] Arlington County, Hazus

1.4.3. Health and Medical

The Hazus data identifies one health and medical facility in Arlington County (Virginia Hospital Center) that offers patient care, urgent care, emergency rooms, and other healthcare services.

1.4.4. Energy

No energy assets are identified in the Hazus database. Power providers in Arlington County include Dominion Virginia Power and Washington Gas.

1.4.5. Communications

Most communications and information systems and infrastructure in the United States are privately owned; however, the County maintains authority and control over public safety communications for fire, police, and other responding agencies. Four communications assets, radio, and television broadcasters are identified in the Hazus database. In recent years, the federal government has taken a stronger role in protecting information and communication infrastructure, which may present a challenge during disaster impacts. Increasing reliance on this infrastructure by individuals, businesses, and the government could cause vulnerabilities that emergency managers should take into consideration during pre- and post-incident planning and operations.

1.4.6. Transportation

Arlington County is serviced by the following major highways and commuter and rail lines:

- Interstates: 66, 395
- U.S. Highways: 1, 29, 50
- State Highways: 27, 110, 120, 123, 124, 233, 237, 244, 309
- Washington Metrorail: 11 stations for Orange, Blue, Yellow, and Silver lines
- Virginia Railway Express (VRE)
- 16 area rapid transit (ART) bus routes

The maintenance of transportation facilities and systems is the responsibility of the owner or entity with authority, including municipal, county, state, and federal highway departments, and agencies; toll and rail authorities; and the military. Arlington County maintains its own roads (359 miles) using Virginia Department of Transportation funding.

The Amtrak rail system connects at certain VRE stations for rail service beyond the Northern Virginia area.

The Ronald Reagan Washington National Airport is located in Arlington County.

The Hazus database notes a total of 346 transportation structures, facilities, or segments, including the following:

- Highway bridges: 169
- Highway segments: 125
- Highway tunnels: 2

- Railway bridges: 2
- Railway segments: 9
- Light rail facilities and segments: 25
- Bus terminals: 1
- Ports (including public and private wharfs and marinas): 5
- Airport facilities: 1

1.4.7. Hazardous Materials

The Hazus database identifies no oil or gas facilities within Arlington County. The Arlington County Fire Department oversees the hazardous materials team. The team includes firefighters and paramedics with the addition of specialized equipment for use when responding to hazardous material incidents. There are numerous Tier II facilities within the County that report hazardous materials. Furthermore, with many interstates going through the County, hazardous materials travel in and out daily.

1.4.8. Education

Arlington Public Schools (APS) is the 13th largest among Virginia's 132 school divisions. APS is comprised of 41 schools and programs, including 23 elementary schools, 6 middle schools, 4 high schools, 1 secondary school (grades 6-12), and 7 other programs. The APS division has approximately 26,895 students that hail from 142 nations and speak 115 languages.[11]

There are 39 additional educational facilities in Arlington County that include private pre-K–12 schools, colleges, universities, and technical and career schools.

1.4.9. Recreational, Cultural and Historic Sites, and Assets

Arlington County owns and operates 148 parks, in addition to a variety of other recreational facilities available to residents, including nature centers, athletic fields, and 52 miles of multi-use trails.[12] The multitude of parks and recreational lands within the County underscores its priority to protect environmentally sensitive resources and areas of historic significance.

The County maintains a Historic Resources Inventory of 394 historic assets of special architectural, historical, archaeological, or cultural value to residents and visitors. The inventory identifies 23 essential properties that have the greatest prominence in the community.[13] These sites are designated by the National Register of Historic Places, Virginia Landmarks Register, and/or the local landmarks process. The County's Comprehensive Plan addresses the preservation of these historic properties. In addition, Arlington County participates in the Certified Local Government program, which requires a level of commitment through land use planning, as well as community preservation efforts over and above regular zoning protection to prevent destruction of or encroachment upon historic districts and properties. These sites serve as an asset by providing significant context to the County's development over time and contributing to the community's tourism economy.

[11] Arlington Public Schools website. Retrieved at: https://www.apsva.us/wp-content/uploads/2022/01/APSQuickFacts-update0122.pdf
[12] Arlington County 2022 Profile website. Retrieved at: https://www.arlingtonva.us/files/sharedassets/public/projects/documents/data-and-research/profile2022_1.pdf
[13] HRI-Phase1.pdf (arlingtonhttps://www.arlingtonva.us/files/sharedassets/public/Projects/Documents/HRI-Phase1.pdfva.us)

Within Arlington County, there are several historical federal sites and facilities, including the following:

- Arlington House
- Arlington National Cemetery
- The Pentagon (including the National 9/11 Pentagon Memorial)
- Air Force Memorial
- U.S. Marine Corps War Memorial

1.5. Growth and Development Trends

The Arlington County General Land Use Plan provides policy guidance for future development in the jurisdiction using "smart growth" principles that concentrate future development along transit corridors. Referred to as "Planning Corridors," these areas are four times more dense than non-corridor areas, consisting of approximately 53% of the County's residents as of 2022.[14] The three Planning Corridors are the Rosslyn-Ballston (R-B) Corridor, Richmond Highway Corridor, and Columbia Pike Corridor. In 2002, Arlington County received one of the first National Award for Smart Growth Achievement from the U.S. Environmental Protection Agency for "overall excellence in smart growth"[15] for its Rosslyn–Ballston Metro Corridor.

Over the last few decades, Arlington County has evolved from a residential suburb of Washington, D.C., to a vital commercial, residential, office, and research hub. This substantial change has been reflected in the jurisdiction's land use pattern, with a vast expansion of non-residential land uses and, to a lesser extent, growth in residential land use (by acres).

As of 2021, Arlington County had an estimated 41.8 million square feet of rentable building area, largely made up of private office space.

The forecast for Arlington County is continual population growth over the next decades, which will impact development pressures to expand housing to accommodate new residents. Based on county projections, 84% of Arlington's population growth will occur in the Planning Corridors between 2020–2045.

Table 9: Arlington County Growth and Development Forecast[16]

Census Year	Number of Housing Units	Projected Population
2020	117,300	231,200
2025	126,800	249,200
2030	133,300	261,600
2035	139,700	273,900
2040	146,300	287,200
2045	152,500	299,500

[14] Arlington County 2022 Profile website. Retrieved at: https://www.arlingtonva.us/files/sharedassets/public/projects/documents/data-and-research/profile2022.pdf
[15] United States Environmental Protection Agency, 2002 National Award for Smart Growth Achievement Booklet. Retrieved January 22, 2022, at: https://www.epa.gov/smartgrowth/2002-national-award-smart-growth-achievement-booklet
[16] Ibid, p. 19.

The increased demand for future housing and related infrastructure may result in pressures to build in inappropriate areas that are susceptible to impacts from natural hazards, such as floods. Land use controls through the County's ordinances and regulations provide some protection against this pressure, but projected growth trends should be monitored in the next planning cycle with the intent of providing a more detailed statistical analysis of vulnerable populations and how this could potentially impact hazard consequences and mitigation opportunities.

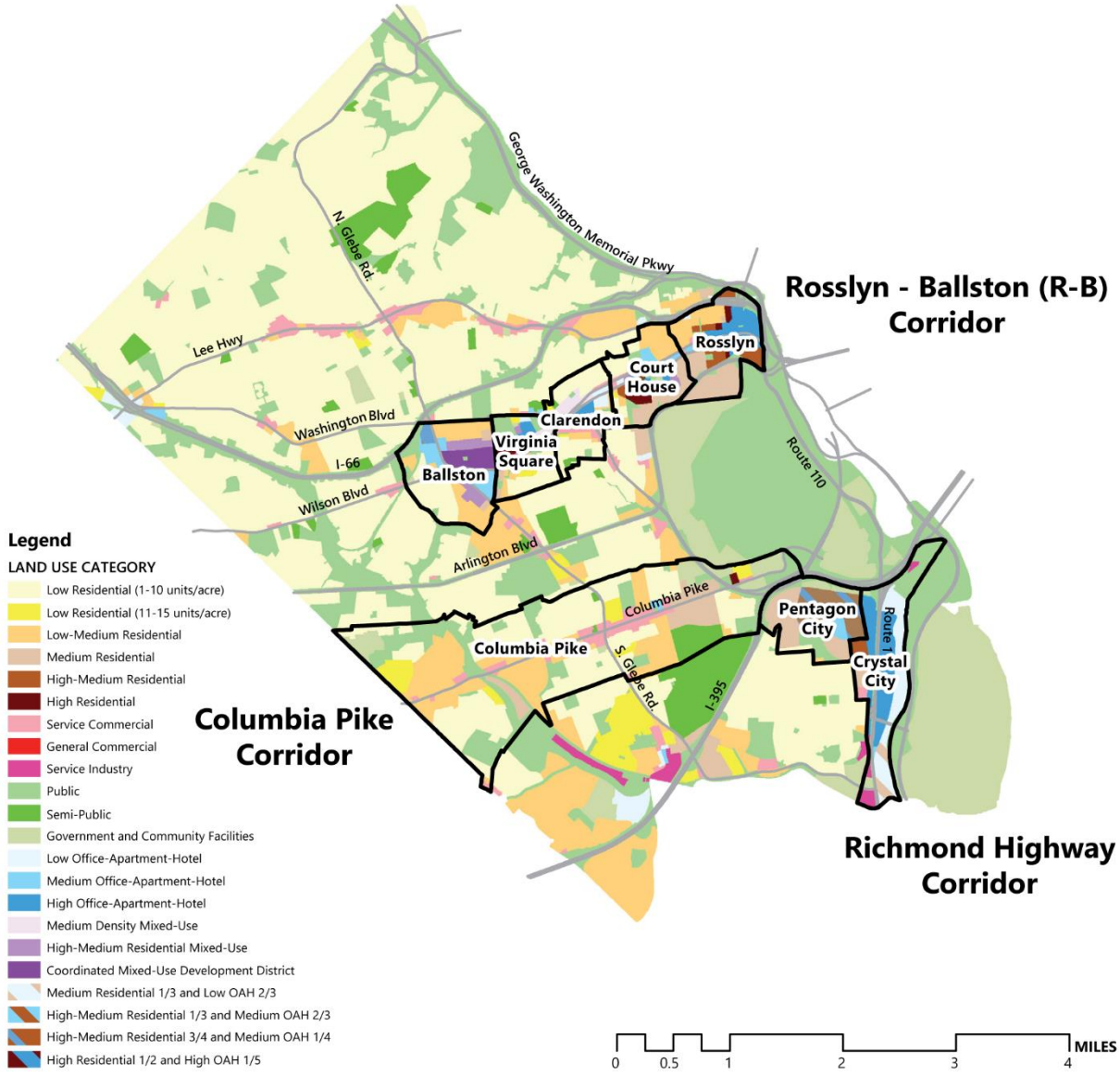


Figure 5: General Land Use Plan and Planning Corridors, Arlington County[17]

[17] Arlington County 2022 Profile website. Retrieved at: https://www.arlingtonva.us/files/sharedassets/public/projects/documents/data-and-research/profile2022.pdf

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, Arlington County followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Team, the County supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction, creating an Arlington County Hazard Mitigation Planning Group. The table below lists the Arlington County employees who participated in the 2022 Arlington County Hazard Mitigation Planning Group. The positions/titles listed may have changed since the final publishing and approval of this plan.

Table 10: Arlington County Hazard Mitigation Planning Team Participants

Name	Position/Title	Department/Agency
Erin DeLuca	Emergency Management Specialist	Department of Public Safety Communications and Emergency Management
Rich Dooley	AIRE Program Manager	Department of Environmental Services - Office of Sustainability and Environmental Management
Teresa Elkins	Risk Manager	Human Resources Department
Anthony Fusarelli, Jr.	Planning Division Chief	Department of Community Planning, Housing, and Development
Ryan Hudson	Communications Specialist and ESF 15 External Affairs Lead	County Manager's Office
Dave Hundelt	Chief Support Engineer	Department of Environmental Services – Water, Sewer and Streets Bureau
Dennis Leach	Deputy Director and ESF 1 Transportation Lead	Department of Environmental Services – Transportation and Development Division
Robert Lutz	Deputy Sheriff's Captain	Arlington County Sheriff's Office
Sydney McKenna	Emergency Preparedness Manager	Department of Public Safety Communications and Emergency Management
David Morrison	Emergency Operations Manager	Department of Public Safety Communications and Emergency Management
John Paras	Training and Exercise Coordinator	Department of Public Safety Communications and Emergency Management
Corrie Silcox	Senior Emergency Planner/Coordinator	Department of Human Services, Public Health Division
Michael Stewart	Deputy Director	Department of Management and Finance
Elizabeth Thurber	Stormwater Infrastructure Program Manager/Floodplain Administrator/CRS Coordinator	Department of Environmental Services
Steve Troyano	Lieutenant and ESF 13 Public Safety Lead	Arlington County Police Department
Hannah Winant	Public Affairs Manager	Department of Public Safety Communications and Emergency Management

Name	Position/Title	Department/Agency
Aileen Winquist	Stormwater Communications Manager	Department of Environmental Services – Environmental Management

The chief hazard mitigation planning responsibility as providing oversight in the planning process and providing County representation in the Emergency Managers Group. The County also identified the following tasks as part of its mitigation planning responsibilities:

- Management support for the planning effort
- Planning Group resource/subject matter expert
- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review plan drafts and provide input
- Public outreach activities
- Implementation of the plan
- Maintaining the plan

Arlington County Hazard Mitigation Planning Team conducted virtual meetings throughout the planning process. The participants completed a series of worksheets that provided a history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the NOVA Planning Team meetings is included in the **Base Plan, Appendix A.**

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a public hazard survey and access to the 2022 draft plan for review and input.

Notification of the hazard survey and draft plan release was made through a county's social media account. Documentation of the public survey and draft plan review is included in **Attachment 2** of this annex.

3. Jurisdiction-Specific Hazard Event History

Arlington County's comprehensive hazard history is described in **Section 5, Base Plan**. The diversity of the landscape increases the vulnerability to various hazards, most notably flooding and severe storms. In addition to snow melt and rain-related and urban inland river flooding, low-lying areas of the County along the Potomac River are also subject to tidal and storm surge flooding. Permanent inundation of low-lying areas along and near the river shoreline is also a threat as sea levels rise. Additionally, winter weather storms pose significant threats, as evidenced during the 2015–2016 winter season, which resulted in a federal disaster declaration.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database recorded 522 natural meteorological events that took place in the County between January 1, 1950, and June 30, 2021. Arlington County has also been included in three Federal Disaster Declarations and emergencies between 2017 and June 2021.

Table 11: Federal Disaster and Emergency Declarations (2017–2021), Arlington County[18]

Declaration	Date	Hazard	Assistance Type
DR-4512-VA	4/2/2020 (continuing)	COVD-19 Pandemic	Individual Assistance, Public Assistance
EM-3448-VA	3/13/2020 (continuing)	COVID-19 Pandemic	Public Assistance (Category B)
EM-3403-VA	9/11/2018	Hurricane Florence	Public Assistance (Category B)

The Arlington County Hazard Mitigation Planning Group submitted the following additional details related to significant hazard events since the 2017 plan. Additional risk information was provided in relation to flood/flash flood, infrastructure failure, and severe winter weather events.

Table 12: Significant Hazard Events Identified by Arlington County, 2017–2021

Date	Hazard	Event and Description
July 8, 2019	Severe Storm/Flash Flood	• On the morning of July 8, 2019, three to five inches of rain fell in approximately one hour during the morning rush hour. A record setting 3.3 inches fell in one hour at National Airport. This flash flood emergency prompted over 600 emergency calls to Arlington's Emergency Communications Center, though no fatalities or major medical issues were reported. The Fire Department reported 38 water rescues, including 25 in Arlington. • The Police Department received approximately 50 traffic complaints that resulted in the closure of several major roads at peak travel times. • The Department of Environmental Services received 151 calls about damage to private property, storm drain backups, indoor flooding, and roadway flooding. • The Department of Parks and Recreation reported that six pedestrian bridges in various parks were completely destroyed, in addition to damage to playgrounds and a storage building.

[18] FEMA

Date	Hazard	Event and Description
		• Damage to county-owned facilities totaled approximately $4 million. The information below provides summaries of damages to residential homes and commercial property. ***Residential Homes Damaged*** *(data collected through Crisis Track)* • Affected: 59 for a total of $1,616,190.00 • Destroyed: 1 for a total of $285,300.00 • Major: 27 for a total of $5,096,460.00 • Minor: 32 for a total of $2,976,925.00 • None: 17,311 for a total of $0.00 • **Grand Total: 17,430 for a total of $9,974,875.00** ***Commercial Property Damaged*** *(data collected through Crisis Track)* • Affected: 2 for sum of amount $0.00 for a sum of contents damage $0.00 • Major: 3 for sum of amount $150,000.00 for sum of content damage $200,000.00 • Minor: 3 for sum of amount $807,075.00 for sum of content damage $50,000.00 • None: 27 for sum of amount $0.00 for sum of content damage $0.00 • Unknown: 2 for sum of amount $0.00 for sum of content damage $0.00 • **Grand Total: 37 for sum of amount $957,075.00 for sum of content damage $250,000.00**
November 8, 2018	Infrastructure Failure – Water Main Break	On November 8, 2018, a 36-inch transmission water main broke on North Glebe Road near the intersection of Route 123 and Chain Bridge. The water main break caused major road damage to North Glebe Road and caused cascading impacts across Arlington County and Washington, D.C. • A boil water advisory was issued for Arlington and areas of northwest D.C. • Arlington County Public Schools were closed November 8.

4. Hazard Risk Ranking

After developing hazard profiles, the Arlington County Hazard Mitigation Planning Group conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an overall risk score, which is summarized as one of the following risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan**.

The overall risk score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5, Base Plan**, and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II of the Base Plan**.

Table 13: Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter weather	3.3	3.8	7.1	**High**
Flood	2.7	4.1	6.8	**High**
High wind/severe storm	2.7	3.0	5.7	**High**
Tornado	1.3	4.2	5.5	**Medium**
Extreme temperatures	2.3	2.9	5.2	**Medium**
Drought	1.7	3.2	4.8	**Medium**
Earthquake	1.3	2.8	4.1	**Low**
Karst/sinkhole/land subsidence	1.3	2.7	4.0	**Low**
Wildfire	1.0	3.0	4.0	**Low**
Dam failure	0	0	0	**N/A**
Landslide	0	0	0	**N/A**

Table 14: Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious disease/public health	2.7	5.0	7.7	**High**
Cyberattack	2.0	4.7	6.7	**High**
Terrorism	1.0	4.7	5.7	**Medium**
Civil unrest	1.0	4.7	5.7	**Medium**
Communication disruption	1.3	3.7	5.0	**Medium**
Hazardous materials	1.0	3.9	4.9	**Low**
Active violence	1.0	3.6	4.6	**Low**

4.1. Additional Hazard Risk Considerations

4.1.1. Flood/Flash Flood

The Arlington County Hazard Mitigation Planning Group noted that the frequency of flash flood incidents has increased in recent years. This trend is attributed to more frequent excessive rainfall events combined with aging drainage and stormwater infrastructure designed for lower capabilities. The County is addressing flooding issues by increasing the maintenance of drainage systems and capacity upgrades funded through capital improvement projects.

Figure 6: Arlington County Fire Department Performs Water Rescues, July 2019 Flash Flood Event, Arlington County[19]

[19] Arlington County Fire Department, Arlington County Department of Public Safety Communications and Emergency Management, May 10, 2021.

Table 15: Flood/Flash Flood Events in Arlington County, 1950–2021[20]

Impact	Data
Flood/Flash Flood Events	50
Direct Deaths	1
Direct Injuries	1
Property Damage	$3,753,000
Crop Damage	$0
Total Property and Crop Damage	$3,753,000

4.1.1.1. The County Flood Mitigation Efforts in Arlington County

Recent localized flooding from intense short periods of rainfall now challenges parts of Arlington County's stormwater system due to issues of capacity and limited overland relief. Arlington is working toward flooding resilience by defining balance between private and public responsibility, scaling levels of flood protection and mitigation, and making needs-based investments.

A web-based story map, "A Flood Resilient Arlington," [21] describes how early development practices in Arlington have led to flood impacts through succeeding years. The story map explains how the natural stream network that originally served as the stormwater management system was subsequently filled in and paved over to accommodate development over the years. As a result, many stormwater pipes used in the past are no longer adequate for the capacity needed to prevent urban flooding. The figure below shows a comparison of the original and current stream network in Arlington County.

As a component of the "A Flood Resilient Arlington" program, the County has identified local hot spots that have experienced repetitive flood damage (based on 911 calls). Locating these losses will assist in developing appropriate mitigation measures to address property and infrastructure exposure.

[20] NCEI Storm Events Database, January 1, 1950, to June 30, 2021. Retrieved January 12, 2022.
[21] A Flood Resilient Arlington, Story Map. Retrieved at: https://storymaps.arcgis.com/stories/d0bb906589d144e5939281b60160b583

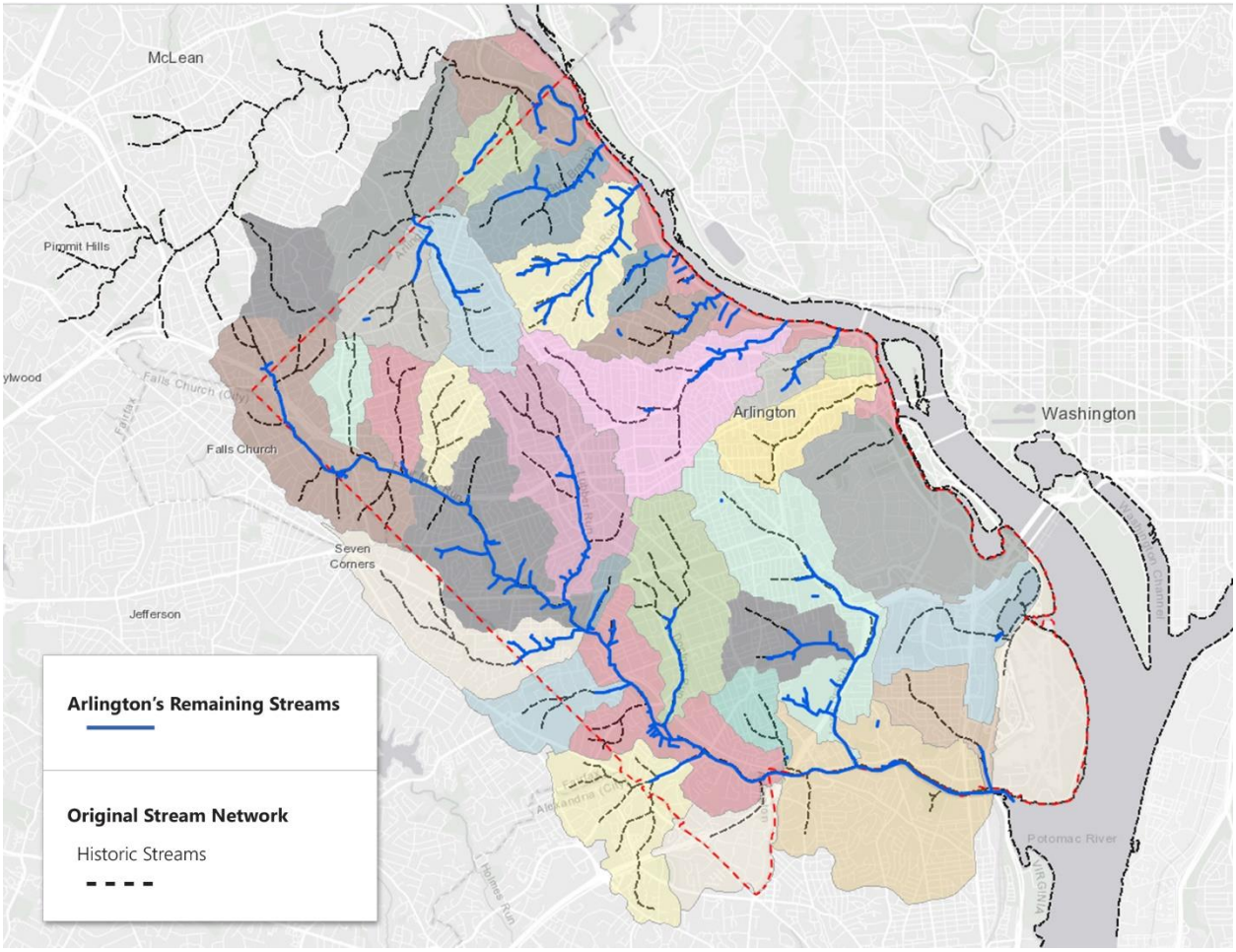


Figure 7: Comparison of Original and Current Stream Network in Arlington County[22]

[22] "A Flood Resilient Arlington, story map. Retrieved at: https://storymaps.arcgis.com/stories/d0bb906589d144e5939281b60160b583

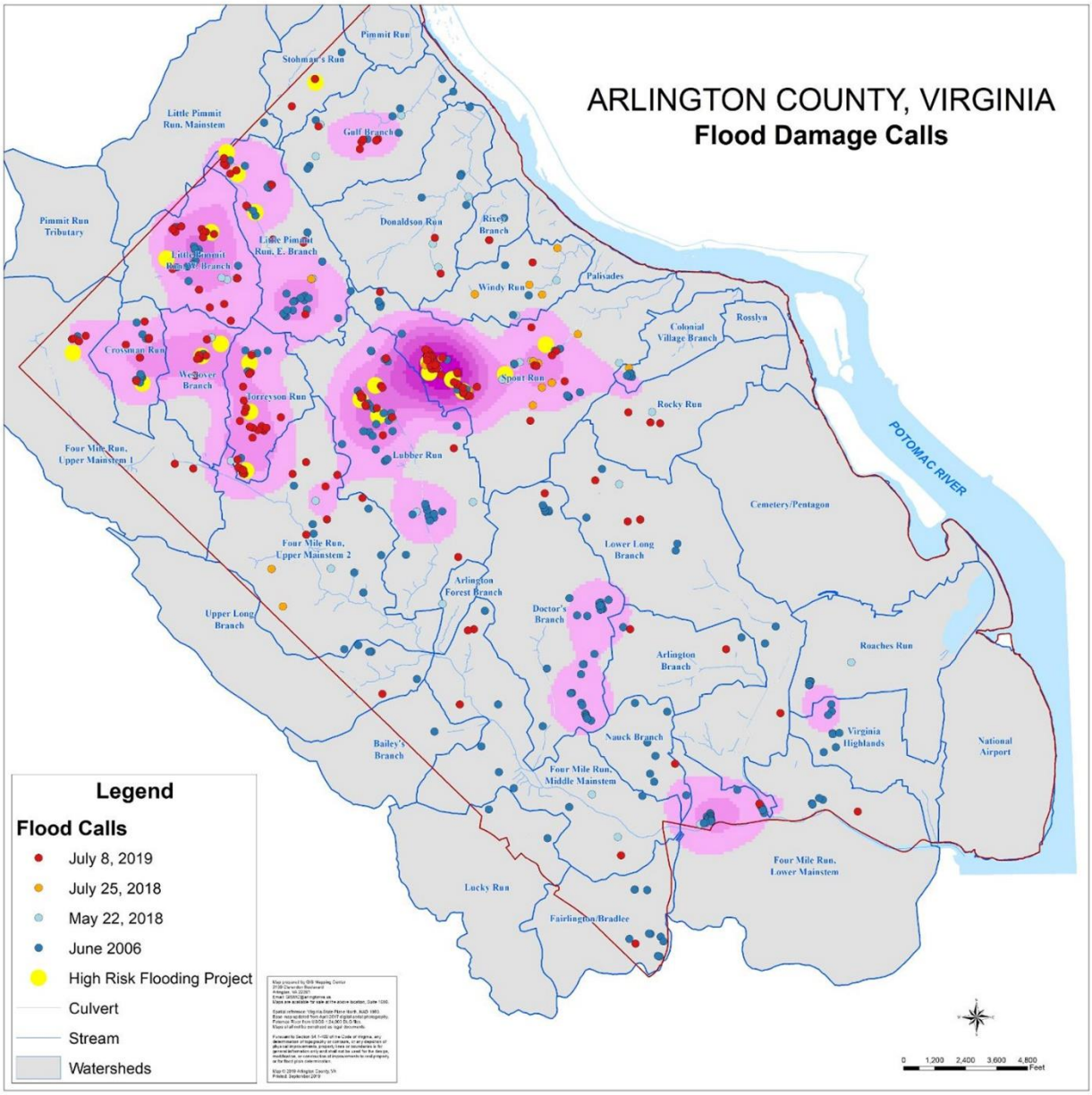


Figure 8: Comparison of Flood Damage Calls for 2006, 2018, and 2019 Flash Flood Events[23]

- The County noted multiple ongoing efforts to reduce the risk of flooding. The County NFIP Flood Insurance Rate Maps (FIRMs) were undergoing an update during the 2021 planning process and were projected to be finalized in 2022. FEMA restudied the entirety of Four Mile Run and re-designated all floodplain boundaries for Four Mile Run. This study will include new FIRMs. The County has submitted comments on the study, pending FEMA reply. FEMA accepted one of the County's appeals on the proposed maps, and the new FIRMS will be finalized in 2023.
- Arlington County and Alexandria will work together to dredge the flood control project along Four Mile Run ($3 million project).

[23] A Flood Resilient Arlington, story map. Retrieved at: https://storymaps.arcgis.com/stories/d0bb906589d144e5939281b60160b583

- Arlington County recently funded a project to develop a manual for flood resilient design guidelines that specifies resilient flood construction standards for homeowners. The manual will be completed in 2023. Its guidelines will be initially optional, becoming mandatory for certain construction types over time.
- The Office of Sustainability and Environmental Management is leading a county-wide project to develop the Risk Assessment Management Plan (RAMP), which is expected to be finalized in 2023. The RAMP will inform and prioritize strategic investments for mitigation risk, amplification, and optimization of the County's integrated stormwater management (capacity) system as well as valuation of project benefits and co-benefits (including avoidance costs) using a measurable return-on-investment methodology. The intent of the RAMP is to address the risk and uncertainty of flooding due to current and future climates and to project and map risk and consequential impacts in support of a long-term resiliency strategy. The RAMP will inform a prioritized capital improvement plan (CIP) with enhanced design standards and forward--looking asset management and adaptation strategies that will allow the County to maintain a responsive level of service (LOS) and a pathway for long-term system resiliency.

4.1.2. High Wind/Severe Storm

The number of severe storm events and impacts on people, property, and crops are documented in the NCEI Storm Events Database under the categories of hail, high winds, lightning, strong winds, and thunderstorm winds.

Table 16: High Wind/Severe Storm Events 1950–May 31, 2021[24]

Impact	Data
High Wind and Severe Storm Events	145
Direct Deaths	-
Direct Injuries	7
Property Damage	$6,521,100
Crop Damage	$5,750
Total Property and Crop Damage	$6,527,850

[24] NCEI Storm Events Database

4.1.3. Severe Winter Weather

Table 17 presents the number of severe winter storm events documented in the NCEI Storm Events Database, including blizzards, heavy snow, winter storms, and winter weather.

Table 17: Severe Winter Weather Storm Events in Arlington County, 1950–2021[25]

Impact	Data
Severe Winter Weather Events	120
Direct Deaths	1
Direct Injuries	0
Property Damage	$440,000
Crop Damage	$0
Total Property and Crop Damage	$440,000

[25] NCEI Storm Events Database, January 1, 1950, to June 30, 2021.

5. Vulnerability Assessment

The Vulnerability Assessment quantifies the people and property that may be impacted by various hazards. Quantitative loss estimates are provided when available. The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

FEMA's hazard model Hazus was used to estimate potential losses to flood, wind, and earthquake hazards. Accompanying the data is a discussion of community assets potentially at risk during a hazard event. Additional details related to the vulnerability assessments are provided in **Section 4, Base Plan**.

Quantitative loss estimates are provided when available. Using the FEMA hazard model Hazus, qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

Arlington County is a participant in the National Flood Insurance Program (NFIP). In addition, the County participates in the voluntary Community Rating System (CRS) program under the NFIP. Arlington County is currently a Class 8 in CRS, which is associated with a 10% flood insurance discount for policyholders.

Table 18: National Flood Insurance Program Status, Arlington County[26]

Initial FHBM Identified	Initial FIRM Identified	Current Eff Map Date	Reg-Emer Date	CRS Entry Date	Current Eff Date	CRS Class	% Disc SFHA	% Disc Non SFHA
-	10/1/1969	8/19/2013	12/31/1976	10/1/1993	10/1/2014	8	10%	5%

Table 19: NFIP Policy Status, as of September 14, 2021

Policy Statistics		Claim Statistics	
Policies in Force	Premiums Paid	Total Claims	Total Payment
780	$447,253	129	$372,316

Table 20: NFIP Status, as of September 14, 2021

NFIP Topic	Source of Information	Comments
Insurance Summary		

[26] FEMA NFIP Community Status Report, September 9, 2021.

NFIP Topic	Source of Information	Comments
How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist	792 policies
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist	213 claims; $1.6 million paid Two substantial damage claims
How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA)	145 structures
Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	Areas outside of floodplains along trunk storm sewer lines
Staff Resources		
Are the Community FPA or NFIP Coordinator certified?	Community FPA	No, but there are Certified Flood Plan Administrators on staff
Is floodplain management an auxiliary function?	Community FPA	Yes – FPA has many other duties besides floodplain administration
Provide an explanation of NFIP administration services (e.g., permit review, geographic information system (GIS), education or outreach, inspections, engineering capability)	Community FPA	All listed – Public information and outreach, coordination with GIS to provide floodplain information, propose flood mitigation capital improvements, and plan reviews
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	Desire for economic development, staffing, and budget
Compliance History		
Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Are there any outstanding compliance issues (e.g., current violations)?		1
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		CAV – 3/18/2014 Workshop – 9/20/2019

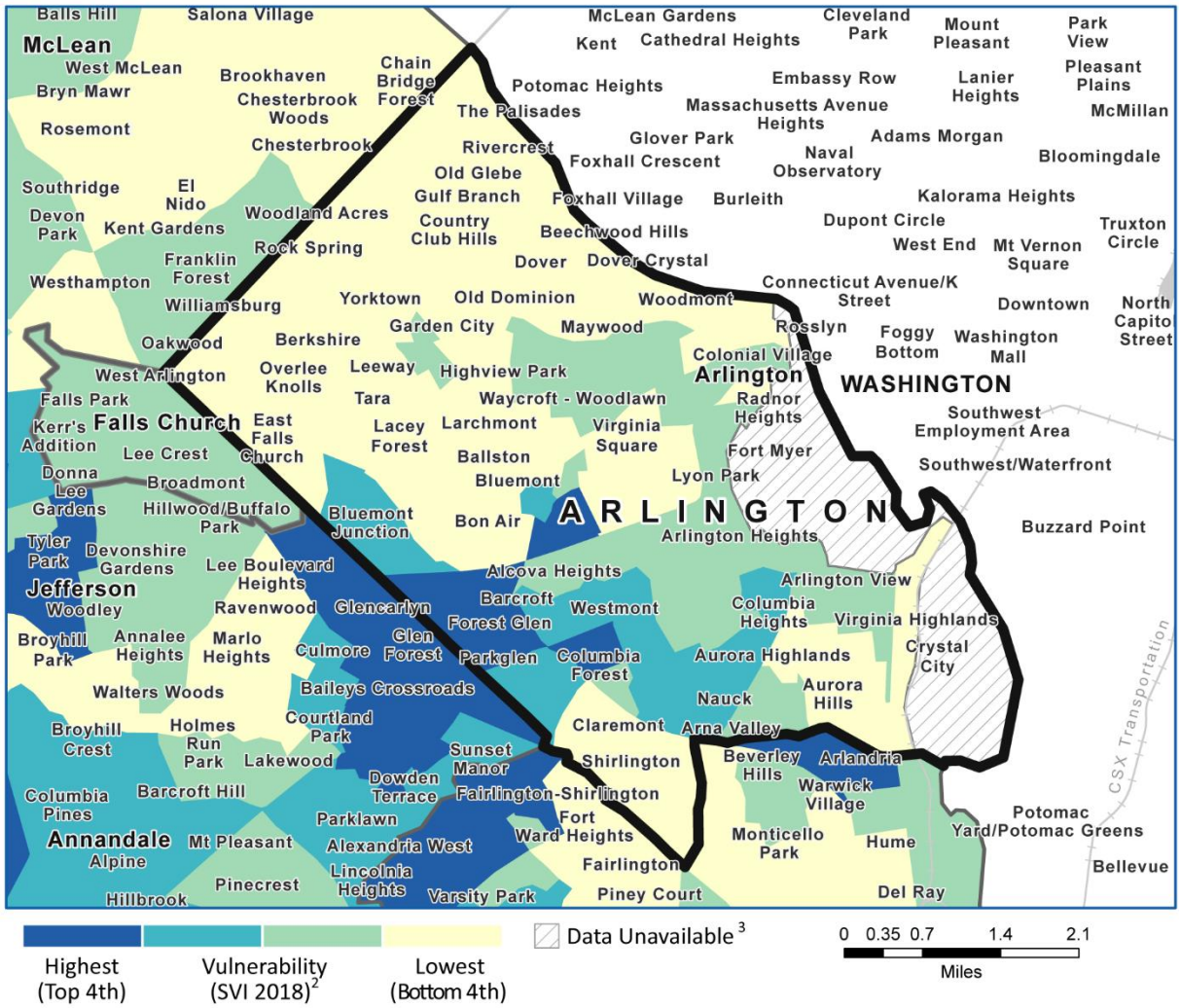
5.2. Population

Arlington County is a densely populated jurisdiction in the Washington metropolitan area. Consequently, in addition to hazard events that have a direct geographic impact within the jurisdiction, residents could be susceptible to impacts within the metropolitan area, especially because many residents work in the District of Columbia. Approximately 5.9% (3,970 residents) are identified as disabled due to access or

functional needs[27]and are more vulnerable to hazard events. The multi-county workforce could bring additional challenges in coordinating emergency information and educating residents about hazard risks and vulnerabilities as well as the benefits of hazard mitigation.

Estimates of the number of Arlington County residents vulnerable to each hazard are presented in the various hazard sections in the **Base Plan.**

The Centers for Disease Control and Prevention (CDC) Agency for Toxic Substances and Disease Registry (ASTDR) Social Vulnerability Index (SVI) (formerly referred to as the Centers for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI)) uses 15 U.S. census variables to help local officials identify communities that may need support before, during, and after disasters. Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters (e.g., tornadoes or disease outbreaks) to human-caused threats (e.g., toxic chemical spills). The SVI groups the 15 census track level variables into four themes: socioeconomic status, household composition/disability, race/ethnicity/language, and housing type/transportation. The overall CDC SVI illustrated in Figure 9 indicates that the southwestern area of the County has the highest overall vulnerability, including the following locations: Barcroft, Forest Glen, Virginia Heights, and Parkglen.



[27] Arlington County 2021 Profile. Retrieved at: https://www.arlingtonva.us/Government/Projects/Data-Research/Demographics

Figure 9: Overall Social Vulnerability Index, Arlington County[28]

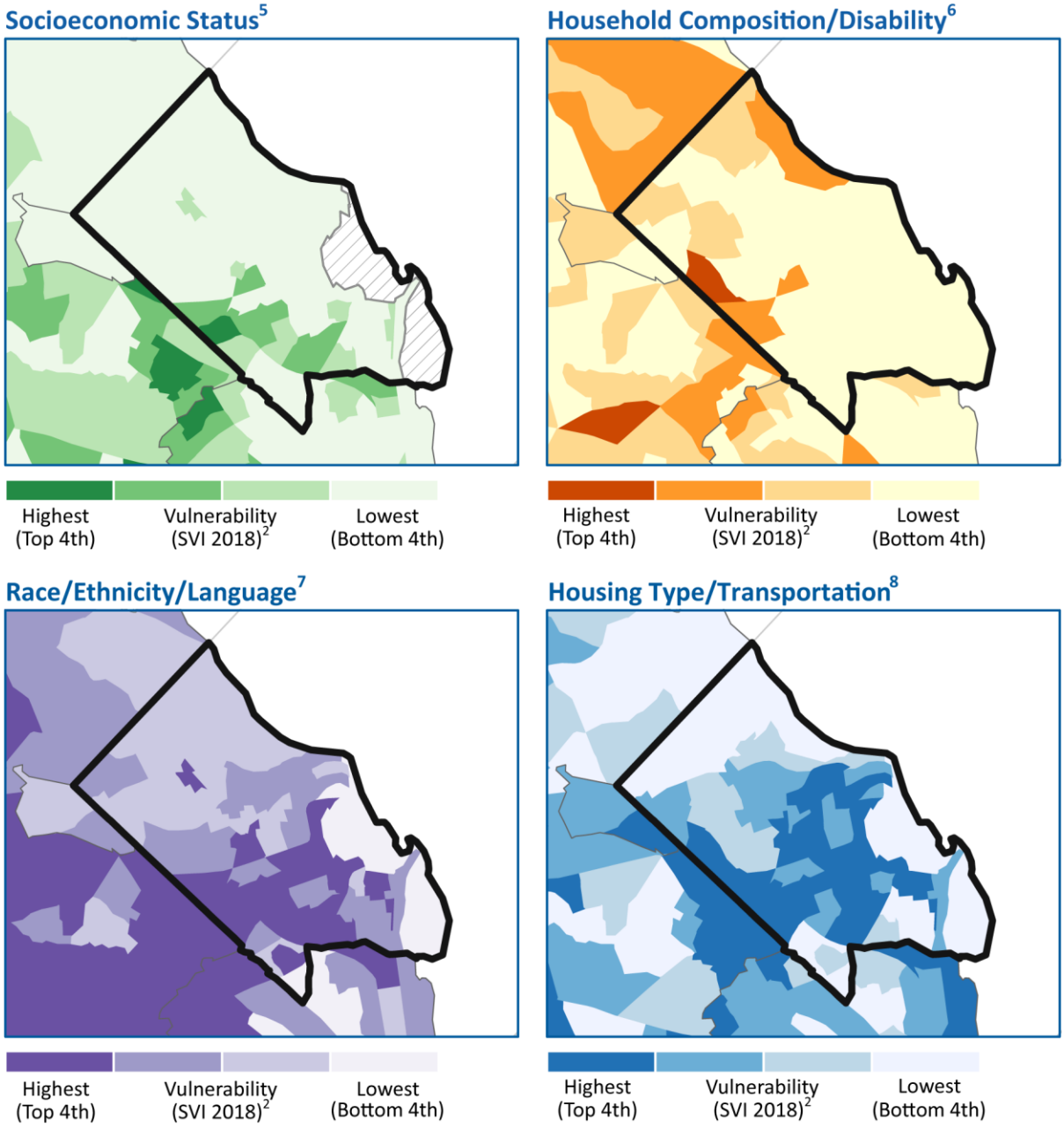


Figure 10: Social Vulnerability, by Theme, Arlington County[29]

The themed maps illustrate the County's higher level of vulnerability within the race/ethnicity/language and housing type/transportation themes, demonstrating the importance of communicating essential hazard mitigation, preparedness, response, and recovery information to the public in a variety of formats

[28] Centers for Disease Control and Prevention, 2018 Social Vulnerability Index. Retrieved at: https://svi.cdc.gov/Documents/CountyMaps/2018/Virginia/Virginia2018_Arlington.pdf
[29] Centers for Disease Control and Prevention (https://svi.cdc.gov/map.html)

and in multiple languages. When examined by the vulnerability theme, the planning districts with highest vulnerabilities include:

- Socioeconomic status – Parkglen
- Household composition/disability – Glencarlyn, Parkglen, Buckingham
- Race/ethnicity/language – Glencarlyn, Parkglen, Buckingham, Highview Park, Addison Heights, Virginia Heights, Arlington Village
- Housing type/transportation – Glencarlyn, Parkglen, Buckingham, Highview Park, Addison Heights, Virginia Heights, Arlington Village

5.3. Built Environment

Arlington County contains over $33 billion of building stock that could be potentially exposed to and damaged by natural or manmade hazards. The table below summarizes the value of this building stock by general occupancy category.

Table 21: Total Value of Arlington County Building Stock Exposure by General Occupancy[30]

Type	Amount
Residential	$27,386,560,000
Commercial	$4,390,075,000
Industrial	$345,710,000
Agricultural	$26,163,000
Religion	$614,708,000
Government	$371,546,000
Education	$277,738,000
TOTAL	**$33,412,500,000**

5.4. Community Lifelines and Assets

Arlington County reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events.[31] Critical facilities in Arlington County were analyzed to determine whether they are located in FEMA's 100-year and 500-year floodplains. Buildings and infrastructure located inside floodplain areas have a higher probability of experiencing flooding. Although Arlington County maintains a separate critical facilities database, the Hazus' critical facilities database was used for this analysis to maintain consistency with other jurisdictions in the planning area.

[30] Hazus.
[31] Although Arlington County maintains a separate critical facilities inventory, information used in this analysis is extracted from the Hazus critical facilities database to maintain consistency with other jurisdictions.

Table 22: Critical Facilities Exposed to FEMA Effective Floodplains, Arlington County[32]

Facility Type	Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
Fire Stations	15	1	1
Highway Bridges	169	17	10
Highway Segments	125	36	18
Light Rail Segments	15	4	4
Railway Bridges	2	1	0
Railway Segments	9	2	0
Schools	73	1	2
Wastewater Treatment Plants	6	0	4
TOTAL	**414**	**62**	**39**

[32] Ibid.

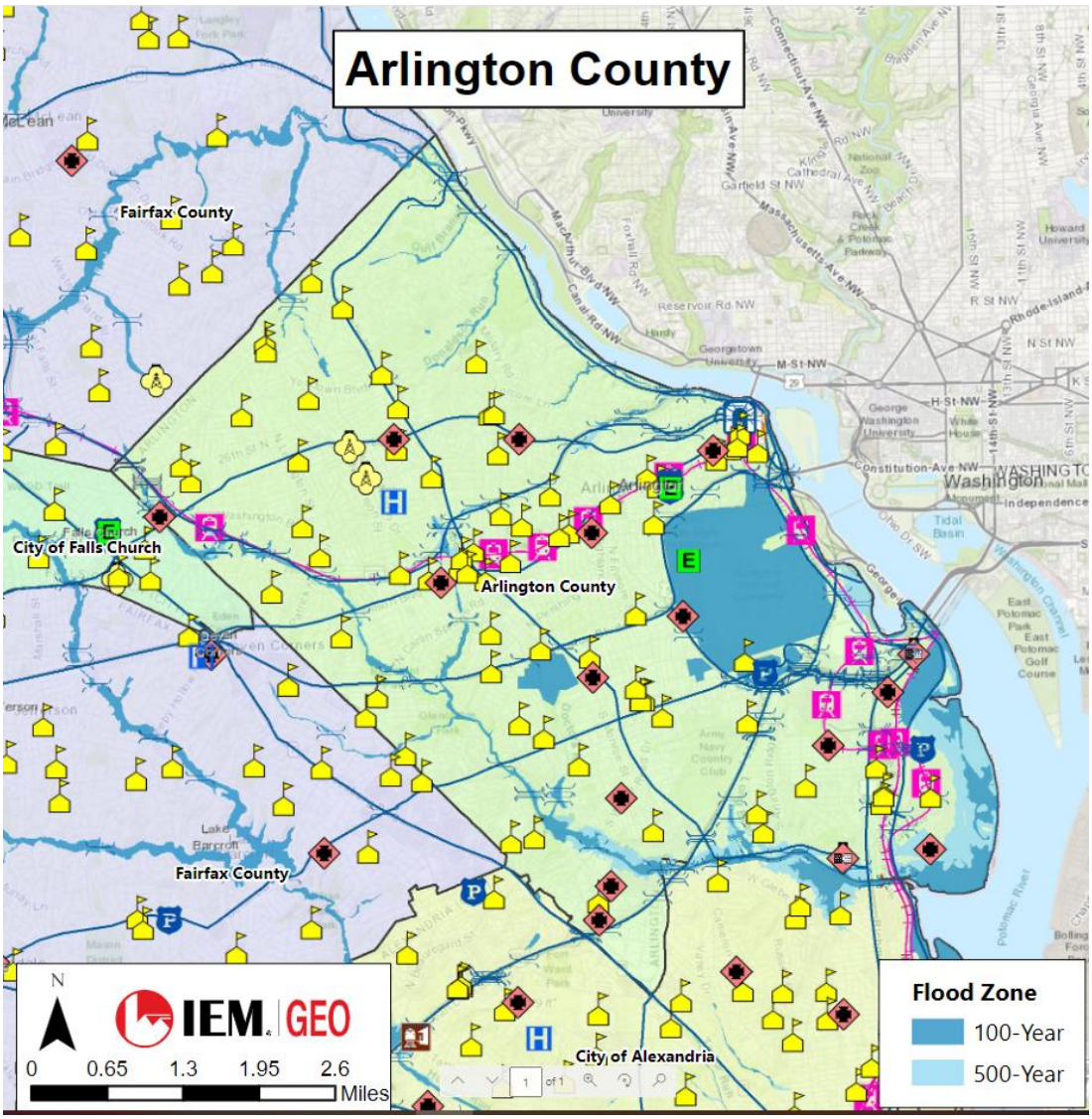


Figure 11: Community Lifelines/Critical Facilities and the 100- and 500-Year Effective Floodplains, Arlington County[33]

[33] Hazus 100- and 500- Year Flood Scenarios, August 3, 2021.

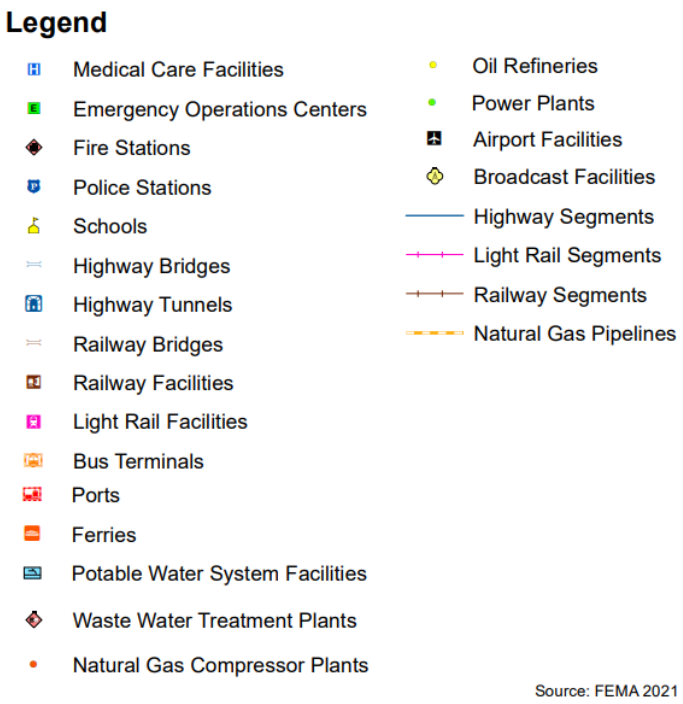


Figure 12: Map Legend for Figure 11

5.5. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

Additional environmental concerns for Arlington County are related to the Potomac River, watersheds, waterways, and potential for flooding. The County also has a high number of public parks, outdoor sporting facilities, and National Park Service trails and parks that may be at risk from flooding.

5.6. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to earthquakes, floods, and hurricane winds events are identified by Hazus for specific assets.

Table 23: Direct Economic Losses Related to Earthquakes, Floods, and Hurricane Winds[34], Arlington County

Hazard	Buildings (capital stock and income)	Transportation	Utilities
Earthquakes (2500-Year, 6.5 Magnitude)	$359,916,000	$15,331,000	$5,748,000
Floods (100-Year)	$1,493,000	$0	$754,516,000

[34] Hazus (2500-year, 6.5 magnitude scenario)

Hurricane Winds	$20,128,000	$0	$0

Additional economic concerns for Arlington County are related to the area's economic base, which relies on the government, information technology, and finance. Major employers include Fortune 500 companies, the federal government, and the military.

5.7. Cultural/Historical

Information related to vulnerability of cultural and historical assets are presented in the hazard-specific sections of the **Base Plan**.
Arlington County has more than 70 historic buildings, sites, and neighborhoods listed in the National Register of Historic Places.

Historic structures and sites are frequently more vulnerable to flood hazards due to the historic development of a city or town along waterways. Because removing historic structures from their original sites affects their historical value, there are challenges to protecting these fragile sites.

Table 24: Cultural and Historic Properties Exposed to FEMA Floodplains, Arlington County

Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
62	4	5

6. Capability Assessment

Arlington County reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a capabilities assessment worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on mitigation strategy implementation. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the capabilities assessment worksheet, Arlington County completed a jurisdiction needs identification questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the levels of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans, and/or resources, and it can implement most mitigation actions.

Table 25: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	High
Financial	Moderate
Education and Outreach	High

6.1.1. Planning and Regulatory Capabilities Summary

The County utilizes the all-hazards approach when developing any jurisdictional plans, including emergency operations and continuity of operations as well as the HMP.

The following plans and regulatory measures have been newly developed or updated since the 2017 NOVA HMP:

- FY 2021 Adopted CIP
- Arlington, Virginia Emergency Operations Plan, June 2021
- County of Government Ordinance (related to COVID-19)
- County Continuity of Operations Plans
- Community Energy Plan, 2019
- Zoning Ordinance, 2021
- Preliminary FIRMs update, September 2020
- Energy Assurance Plan (EAP)

6.1.1.1. Capability Analysis: High

Significant planning and regulatory tools are in place within Arlington County and bring to light successful integration of hazard mitigation planning with existing planning mechanisms. This demonstrates that the jurisdiction recognizes the benefit of incorporating hazard mitigation in local planning and regulatory processes, such as the Comprehensive Plan, Capital Improvement Plan (CIP), and land development and floodplain regulations, as well as how to use these to develop and implement mitigation actions. The CIP includes bridge renovation and replacements, stormwater infrastructure investments, and localized flood projects. The County continues to promote and enforce appropriate land use based on development codes and ordinances.

During the 2022 plan update process, an Energy Assurance Plan (EAP) was in development to improve the County's (government and community) readiness and resilience to threats of energy disruption. Becoming more energy resilient generally means reduction of energy risk and, more specifically, helping Arlington County to prepare for, respond to, recover from, and mitigate against potential emergencies that impact energy while minimizing economic loss and protecting public health and safety.

6.1.2. Administrative and Technical Capabilities Summary

- Planning and zoning staff include planners, engineers, and a floodplain manager with an understanding of natural and non-natural hazards who are integrated with mitigation planning.
- The County maintains a GIS capability within the Department of Environmental Services.
- County emergency management staff, health department staff, and other staff are familiar with the community's hazards.
- The Department of Public Safety Communications and Emergency Management, Police Department and Fire Department have grant writers who coordinate with the hazard mitigation program.
- The Department of Public Safety Communications and Emergency Management has an emergency warning system for internal and external notifications and warnings.

The County identified the following departments and agencies as key stakeholders in the planning and implementation processes of the HMP:

- Arlington County Department of Community Planning, Housing, and Development
- Arlington County Department of Human Resources
- Arlington County Department of Public Safety Communications and Emergency Management (DPSCEM)
- Arlington County Fire Department
- Arlington County Manager's Office, Communications and Public Engagement Team
- Arlington County Police Department
- Arlington County Sheriff's Office
- Department of Environmental Services
- Department of Technology Services

6.1.2.1. Capability Analysis: High

Arlington County has a robust staffing capability that provides for a high level of coordination for the purpose of mitigation planning and action implementation. While enhancements in its administrative and technical capabilities were gained through the increase in department and agency positions, the jurisdiction noted an area of improvement to conduct a more detailed assessment of staff capabilities to better understand needs and gaps, and identify ways to expand capabilities to reduce risk in the future.

6.1.3. Safe Growth Capabilities Summary

- Growth guidance instruments, such as future land-use policies, regulations, and maps, identify natural hazard areas, such as floodplains, and discourage or prohibit development or redevelopment within those areas.
- The Comprehensive Plan includes a transportation element that addresses appropriate placement and utilization of transportation systems. The bicycle element of the plan recommends caution signage to alert multi-use trail users of potential hazards, including areas that experience frequent flooding. It also addresses optimization of the system to execute evacuation when necessary.

- Environmental policies encourage appropriate development to protect ecosystems.
- The capital improvement program integrates hazard mitigation projects identified in the HMP.
- The building code and floodplain regulations provide for a base flood elevation (BFE) sufficient to protect property from the 100-year flood event.

6.1.3.1. Capability Analysis: High

Arlington County has well-established and nationally recognized safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment. No additional enhancements are identified at this time. Areas for enhancing the capability include the following:

- Integrating goals from the 2022 NOVA HMP into the Comprehensive Plan.
- Including limits on zoning changes that allow greater density of use in natural hazard areas in rezoning procedures.
- Integrating mitigation actions from the NOVA HMP into the capital improvement program.

6.1.4. Financial Capabilities Summary

- The County's Capital Improvement Plan (CIP) provides funding for projects outside of the jurisdiction's annual operational budget. The 2020 CIP included $14.6 million to launch a 10-year, $189 million investment in the County's stormwater management infrastructure to better handle the impact of intensifying climate change and continued population growth.
- The County has the authority to incur debt through general obligation bonds and/or special tax bonds as well as fees for utility services and impact fees for new development.
- The County participates in multiple federal and state funding programs, such as Hazard Mitigation Assistance (HMA), FEMA's Homeland Security Grant Program, the Urban Area Security Initiative (UASI), and other programs through multiple disciplines.

6.1.4.1. Capability Analysis: Moderate

Although rising operational costs and limited financial resources are an everyday challenge to most local governments, Arlington County has significant experience and success in leveraging and combining local, state, and/or federal funding sources to implement mitigation-related projects. The process for identifying potential grants, developing and submitting applications, and managing grant-funded projects is time-consuming and challenging, especially if multiple disasters have occurred simultaneously. In addition, onsite work restrictions imposed during the COVID-19 pandemic (beginning March 2020 and continuing throughout 2021) have presented challenges in staff availability and coordination. To address these shortfalls, the jurisdiction may access technical assistance available to potential applicants provided by many grant programs or expand its capabilities to develop and manage mitigation actions through contracted services. The County identified a measure to enhance capability by continuing to explore programs to fund hazard mitigation. For example, the Department of Environmental Services is examining options to apply for FEMA HMA program grants to help fund various flood mitigation projects in the future.

6.1.5. Education and Outreach Capabilities Summary

- The Arlington County Department of Public Safety Communications and Emergency Management (DPSCEM) implements a robust public education and information program using multiple communication methods, such as programs, events, published materials, and social

media. The department heavily relies on partnerships with trusted community organizations and leaders for information sharing and outreach.

- Arlington County is creating an agile, diverse, and sustainable resident-driven group to identify barriers to, and solutions for, enhancing community resilience. This group, composed of residents, partners, and community leaders from all neighborhoods and sectors, will work alongside and amply existing resilience efforts within the County to assist Arlington residents prepare for and recover from a disaster or an emergency. In addition to amplifying existing efforts, the community resilience group will coordinate and integrate with County, state, and federal emergency preparedness organizations as well as schools, civic communities, commercial communities, services communities as well as other government agencies.
- DPSCEM has several robust volunteer-coordinated and operated organizations. The Community Emergency Response Team (CERT) is composed of a group of Arlington residents who are trained by professional responders in areas that will help them take care of themselves and others before, during and after a major emergency. CERT is known for their flexibility and quick boots-on-the-ground response capacity in addition to their extensive training courses including Until Help Arrives. RACES, or Radio Amateur Civil Emergency Service, is also a volunteer-led organization housed in DPSCEM. RACES establishes and maintains the leadership and organizational infrastructure necessary to provide Amateur Radio communications in support of emergency management entities throughout the United States.
- The Local Emergency Planning Committee (LEPC), which is housed under the Arlington County Fire Department, works in collaboration with the Department of Public Safety Communications and Emergency Management to help ensure that Arlington County is a safe and well-prepared place to live, work and visit.
- Arlington County is designated as a StormReady community (2020–2023), which includes components of public education and training related to multiple hazards.

CRS initiatives within the NFIP program can increase public awareness of and involvement in hazard mitigation.

Arlington County has identified programs or organizations that can help integrate hazard mitigation into community programs to increase public involvement and sustainability:

- Community Emergency Response Team (CERT)
- Community resilience group
- Arlington County Solid Waste Bureau
- Public–private partnerships, including the Arlington County – Amazon Vaccination Clinic, Spring 2021
- Police department – Personal safety
- American Red Cross
- Northern Virginia Volunteer Organizations Active in Disasters (VOAD)
- Partnerships with energy and water companies

6.1.5.1. Capability Analysis: High

Although Arlington County is highly proactive about informing residents, visitors, and others about hazard preparedness and mitigation, there continues to be opportunities to broaden public outreach and information to reach a wider audience. Arlington County strives to provide this information in a greater variety of languages and through multiple formats. Jurisdictions have multiple opportunities to promote hazard mitigation and increase involvement of stakeholders and the public. The Virginia Department of

Emergency Management mitigation staff can provide technical assistance to support increased jurisdictional involvement. Many hazard mitigation educational tools and materials are available from state agencies as well as from disaster preparedness and response organizations, such as the American Red Cross, FEMA, and faith-based organizations with disaster response missions.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, Arlington County identified activities related to each natural hazard that support risk reduction.

Table 26: Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and international building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	• Public education and operational plans address preparedness and response to reduce risk.
Flood/Flash Flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. • Stormwater management programs and projects address flood prevention and risk reduction. • The A Flood Resilient Arlington Program has increased the focus on flood risk and mitigation measures. • The multi-year capital improvement program to improve the stormwater management system will provide opportunities to reduce flood risk.
High Wind/Severe Storm	• State and international building codes provide for seismic design regulations.
Karst/Sinkhole/Land Subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Winter Weather	• Public education and operational plans address preparedness and response to reduce risk.
Non-Natural Hazards	• Public education and operational plans address preparedness and response to reduce risk.

Hazard	Activity
	• Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate Change	• The Community Energy Plan addresses potential impacts of future meteorological events and provides opportunities to reduce energy usage by the government and the public.

7. Resilience to Hazards

7.1. National Risk Index

The National Risk Index (NRI) is a dataset and online tool developed by the Federal Emergency Management Agency (FEMA) and other partners to help illustrate communities in the United States that are potentially at risk to 18 natural hazards. Hazard risk is calculated from data of a single hazard type and reflects the relative risk for that hazard type. This data is presented for general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. The NRI defines some hazards differently from the hazards in this plan, so a direct hazard-to-hazard comparison of risk cannot be determined.

Based on the NRI findings, the three hazards with the highest risk rating in Arlington County are tornado, strong wind, and winter weather; however, all 15 applicable hazards rated for risk were determined to be "very low." The NRI does not align with the NCEI Storm Events Database in that the actual number of historic hazard events is not consistent with the NRI rating. Consequently, the NRI should only be used as a comparative tool with risk levels in other jurisdictions and not as an indication of natural hazard risk in Arlington County.

Hazard Type	Risk Index Rating	Risk Index Score
Avalanche	Not Applicable	--
Coastal Flooding	Vert Low	0.31 (0 – 100)
Cold Wave	No Rating	0.00 (0 – 100)
Drought	Very Low	0.13 (0 – 100)
Earthquake	Very Low	0.42 (0 – 100)
Hail	Very Low	0.80 (0 – 100)
Heat Wave	Very Low	0.80 (0 – 100)
Hurricane	Very Low	0.70 (0 – 100)
Ice Storm	Very Low	0.99 (0 – 100)
Landslide	Very Low	1.56 (0 – 100)
Lightning	Very Low	1.61 (0 – 100)
Riverine Flooding	Very Low	1.09 (0 – 100)
Strong Wind	Very Low	2.11 (0 – 100)
Tornado	Very Low	2.15 (0 – 100)
Tsunami	Not Applicable	--
Volcanic Activity	Not Applicable	--
Wildfire	No Rating	0.00 (0 – 100)
Winter Weather	Very Low	1.81 (0 – 100)

Figure 13: Arlington County – Hazard Risk by Type, National Risk Index[35]

[35] National Risk Index, FEMA. Retrieved at: https://hazards.fema.gov/nri/map#

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of "low risk" is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience. Based on the NRI assessment, Arlington County has a relatively moderate community resilience.

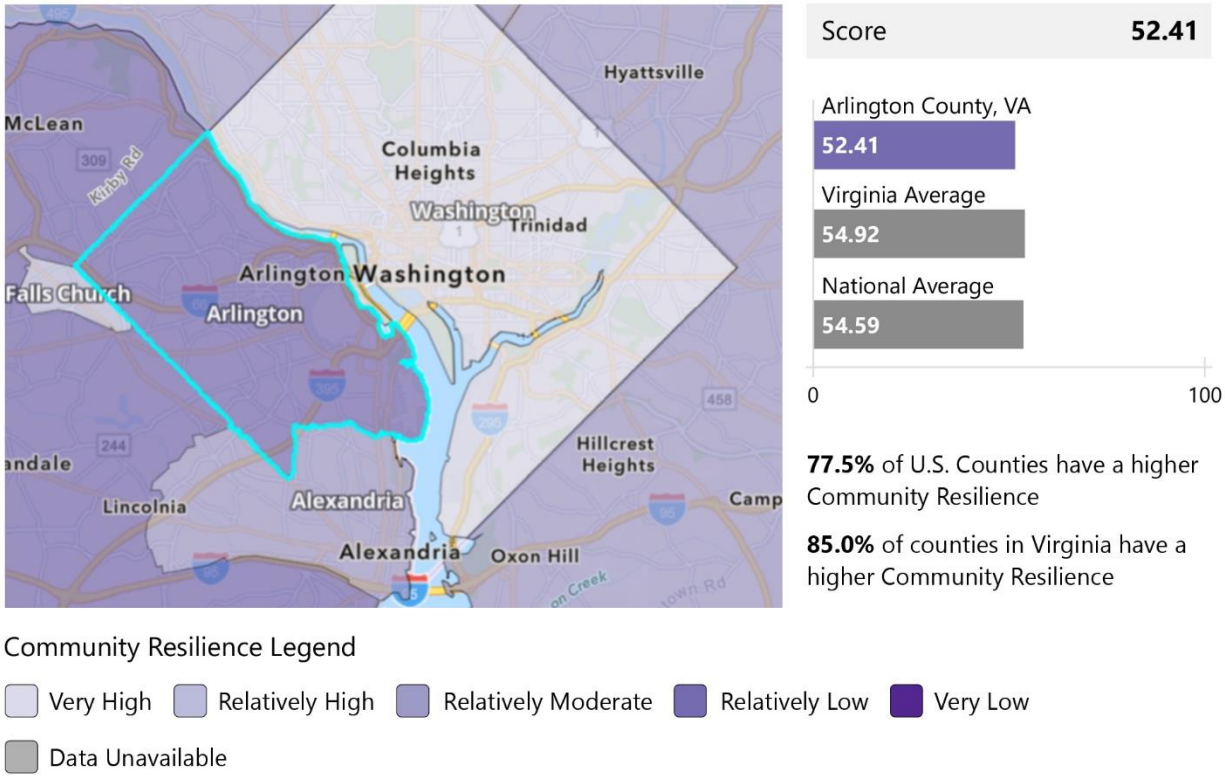


Figure 14: National Risk Index Community Resilience Rating, Arlington County[36]

Arlington County's NRI community resilience score of 52.41 represents a relatively low ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared with the rest of the United States. The NRI uses broad factors to account for resilience rating and may not have all of the up-to-date information, leading to a different outcome than the Planning Group's assessment.[37]

Table 27: Comparison of Arlington County Scores with Virginia and National Average[38]

Index	Arlington County	Virginia Average	National Average
Risk	1.04	6.50	10.60
Expected Annual Loss	12.57	9.22	13.33
Social Vulnerability	3.78	35.32	38.35
Community Resilience	52.41	54.92	54.59

[36] National Risk Index. Retrieved at: https://hazards.fema.gov/nri/map#
[37] https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf
[38] Ibid.

Table 28: Arlington County Risk Ranking Summary[39]

Index	Rank
Risk	Very Low
Expected Annual Loss	Relatively Low
Social Vulnerability	Very Low
Community Resilience	Relatively Low

7.2. Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be used to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household level risk factors.

The index produces aggregate-level (census tract, county, and state) small-area estimates, providing a tool for understanding how at-risk specific neighborhoods may be to disasters due to characteristics that might make specific segments of the population more vulnerable to the impacts and consequences of disasters. The following are the 10 risk factors.[40]

1. Income-to-poverty ratio
2. Single or zero caregiver household
3. Unit-level crowding
4. Communication barrier
5. Aged 65 years or older
6. Lack of full-time or year-round employment (household)
7. Disability
8. No health insurance coverage
9. No vehicle access (household)
10. No broadband internet access (household)

[39] Ibid.
[40] The Community Resilience Estimates are developed by the U.S. Census Bureau; initial release date, August 10, 2021. Methodology is described at the U.S. Census Bureau Community Resilience Methodology page (https://www.census.gov/programs-surveys/community-resilience-estimates/technical-documentation/methodology.html).

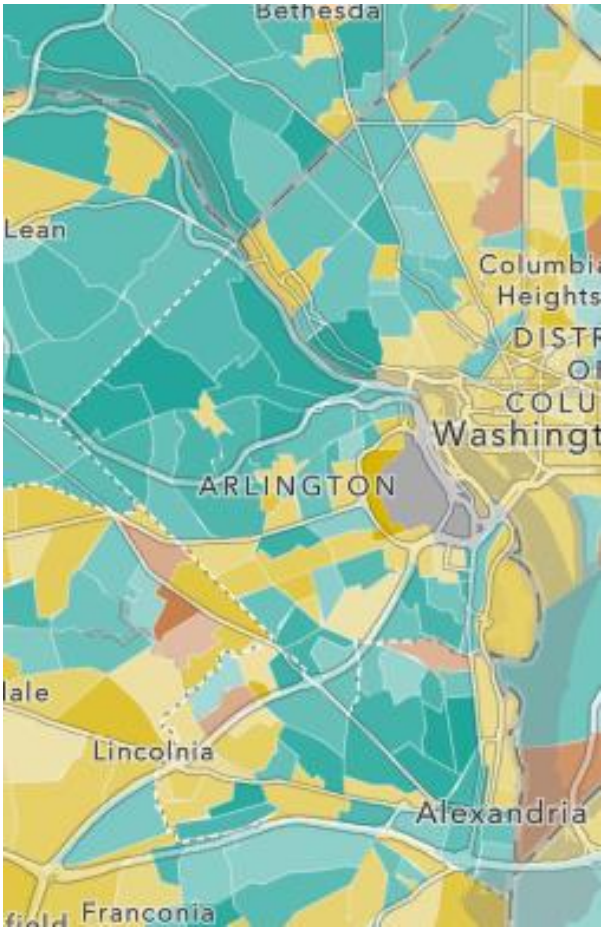


Figure 15: Community Resilience Estimate, Predominant Risk Factor Map[41]

The estimate is categorized into three groups: zero risks, one to two risks, and three or more risks. Yellow, gold, and orange map colors indicate increasing levels of risk. The CRE for Arlington County indicates that 34,900 of county residents have three or more risk factors.

The combination of data and analysis described in this section provides an overview of Arlington County's risk, vulnerability, and resilience to all hazards.

7.3. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

The Arlington County Hazard Mitigation Planning Group identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- The risk that cyber-related incidents pose to critical infrastructure and key resource sites,
- Climate change, and
- Increases in the number of excessive rainfall events that impact new areas with flooding.

[41] Community Resilience Estimates, U.S. Census Bureau. Retrieved at: https://experience.arcgis.com/experience/b0341fa9b237456c9a9f1758c15cde8d/

8. Mitigation Actions

8.1. Goals and Objectives

The Arlington County Hazard Mitigation Planning Group adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

Arlington County monitors actions and tracks progress through the periodic review, evaluation, revision, and update of the NOVA HMP. Some projects that contribute to risk reduction have been completed or are currently in progress but have not been included in this plan for one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and resulting risk reduction.

Table 29: Status of Previous Mitigation Actions

NOVA HMP Year	Number of Actions	Number of Actions Removed from Plan for 2022 Update	Justification for removal
2006	2	1	Completed
2010	17	12	Completed or no longer relevant
2017	2	2	Completed

The comprehensive list of previous mitigation actions, including descriptions of progress made and current status, is presented in **Attachment 3** of this annex.

While not captured in the 2017 NOVA HMP, the County has made significant progress toward completing several stormwater capacity projects identified in the 2014 Stormwater Master Plan. In general, the areas with completed projects have experienced reduced flooding. The current flooding challenges are in interior, urban locations where the system is overwhelmed by intense and short-lived storms. Arlington County has five critical watersheds where blended capacity solutions are being proposed to address these current challenges.

The first major project under the resilience initiative, a stormwater detention vault under athletic fields at a school, began construction in the fall of 2021.

8.2.1. Changes in Priorities Since the 2017 Plan

Since 2017, Arlington County has experienced changes in rainfall patterns and increased storm intensity. In July 2019, the region experienced widespread flooding from a summer storm that dropped 3.44” of rain in one hour, approximately equal to a 200-year storm event. Since then, Arlington County has shifted its stormwater program toward flood resilience and is focusing on adding additional capacity and flexibility to the storm drain system. Under A Flood Resilient Arlington, the following steps have been taken:

- Proposing a first-ever stormwater bond to voters in November 2020, which was approved.
- Expanding storm detention facility types and locations.
- Moving beyond increasing pipe capacity to detention vaults, stormwater pumping stations, and other facilities.
- Looking at new locations for stormwater facilities, such as underneath athletic fields and parks.
- Completing/Initiating the Risk Assessment and Management Plan – a vulnerability assessment with climate projections for 2040 and 2070 that will include updated rainfall curves and inundation maps.

The shifting focus of Arlington County's stormwater program to flood resilience will reduce flood risk from both short duration, high intensity rain events and longer duration, hurricane-type events. The County is expanding the types of storm detention facilities, moving beyond increasing pipe capacity in the public right-of-way to detention vaults, stormwater pumping stations, and other facilities. Arlington County is also looking at more locations for stormwater facilities, such as schools and parks as well as possible voluntary property acquisition in a few key locations.

8.3. New Mitigation Actions

Arlington County identified 37 mitigation actions for the 2022 update, which include previously identified actions from the 2006, 2010, and 2017 plans. **Attachment 3** of this annex includes a table that summarizes each new and continued mitigation action, describing the proposed activity, priority level, estimated cost, interim measures of success, and lead agency.

8.4. Action Plan for Implementation and Integration

The Arlington County Department of Public Safety Communications and Emergency Management (DPSCEM) is responsible for coordinating county departments and agencies that participate in hazard mitigation activities. The DPSCEM-designated Mitigation Coordinator is responsible for implementing the mitigation plan on two levels: implementation of the jurisdiction's actions and facilitating implementation of the multi-jurisdictional regional plan. Tasks to ensure that the jurisdiction's actions are implemented are integrated into the Action Plan for Implementation and Integration (which includes the prioritized list of mitigation actions). Plan maintenance procedures are described in the next section.

The Action Plan for Implementation and Integration describes how the County's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 30: Action Plan for Implementation and Integration, Arlington County

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into the local comprehensive plan.	The Arlington County Department of Public Safety Communications and Emergency Management (DPSCEM) will work with the Community Planning and Housing Department to determine the best way to integrate the hazard mitigation goals into the next update of the local comprehensive plan.
Maintain regulatory requirements of the National Flood Insurance Program (NFIP).	Arlington County will continue to maintain regulatory requirements of the NFIP by enforcing our floodplain management ordinance, reviewing site plans, participating in compliance reviews (community assistance contacts/community

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
	assistance visits), and participating in flood insurance studies and flood risk mapping.
Enhance floodplain management through the Community Rating System (CRS).	As a CRS community, Arlington County will continue to abide by the CRS program requirements and advance our standing in the CRS by conducting various flood mitigation activities to reduce our risk of flooding.
Continue public engagement in mitigation planning.	Hazard mitigation is a key component of the DPSCEM's community engagement mission and will be incorporated into future outreach projects.
Identify opportunities for mitigation education and outreach.	One future opportunity for mitigation education outreach includes embedding hazard mitigation education into Preparedness Month by September 2022, including programming hosted by APS. For example, DPSCEM will collaborate with the Department of Environmental Services to host education opportunities at civic events (e.g., civic association meetings, neighborhood fairs) to showcase county-sponsored hazard mitigation opportunities, such as flood protection programming and rainwater harvesting, in addition to general preparedness tips.
Review/update stormwater plans and procedures for consistency with mitigation goals.	The stormwater management plan and capital improvement plan will be reviewed and updated to align with mitigation goals.
Review/update emergency plans to address evacuation and sheltering.	Arlington County maintains a shelter plan/SOP that is reviewed and updated every 2–3 years.
Monitor funding opportunities.	Monitor local, state, and federal funding opportunities that could be utilized for hazard mitigation. This includes hazard mitigation assistance opportunities and non-traditional mitigation funding sources.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**. This facilitator is not from Arlington County.

Table 31: Arlington County Plan Maintenance Responsibilities for the Northern Virginia Hazard Mitigation Plan, Base Plan

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP, Base Plan**, the Arlington County Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in fifth year

Table 32: Arlington County Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with the Arlington County Hazard Mitigation Planning Team. 2. Review the status of all mitigation actions, using the Mitigation Action Implementation Worksheet (**Section 3, Attachment A, NOVA HMP Base Plan**).	Produce an annual report that includes the following: • Status update of all mitigation actions • Summary of any changes in hazard risk or vulnerabilities and capabilities • Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	1. Schedule the annual plan evaluation with jurisdiction Arlington County Hazard Mitigation planning team. 2. Evaluate the current hazard risks and vulnerabilities as well as the hazard mitigation capabilities using the Planning Considerations Worksheet (**Section 3, Attachment C, NOVA HMP Base Plan**).	Submit the annual report to the NOVA HMP Project Team point of contact
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption designation, adopt the updated plan.	Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

Mitigation actions presented in the Arlington County Jurisdiction Annex may be reviewed, revised, and updated at any time. This will ensure that mitigation actions remain current and positioned for potential funding as it becomes available.

Arlington County will continue to be a planning partner with multiple jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan.

10. Annex Adoption

The Arlington County Jurisdiction Annex will be adopted simultaneously with the adoption of the *NOVA HMP*.

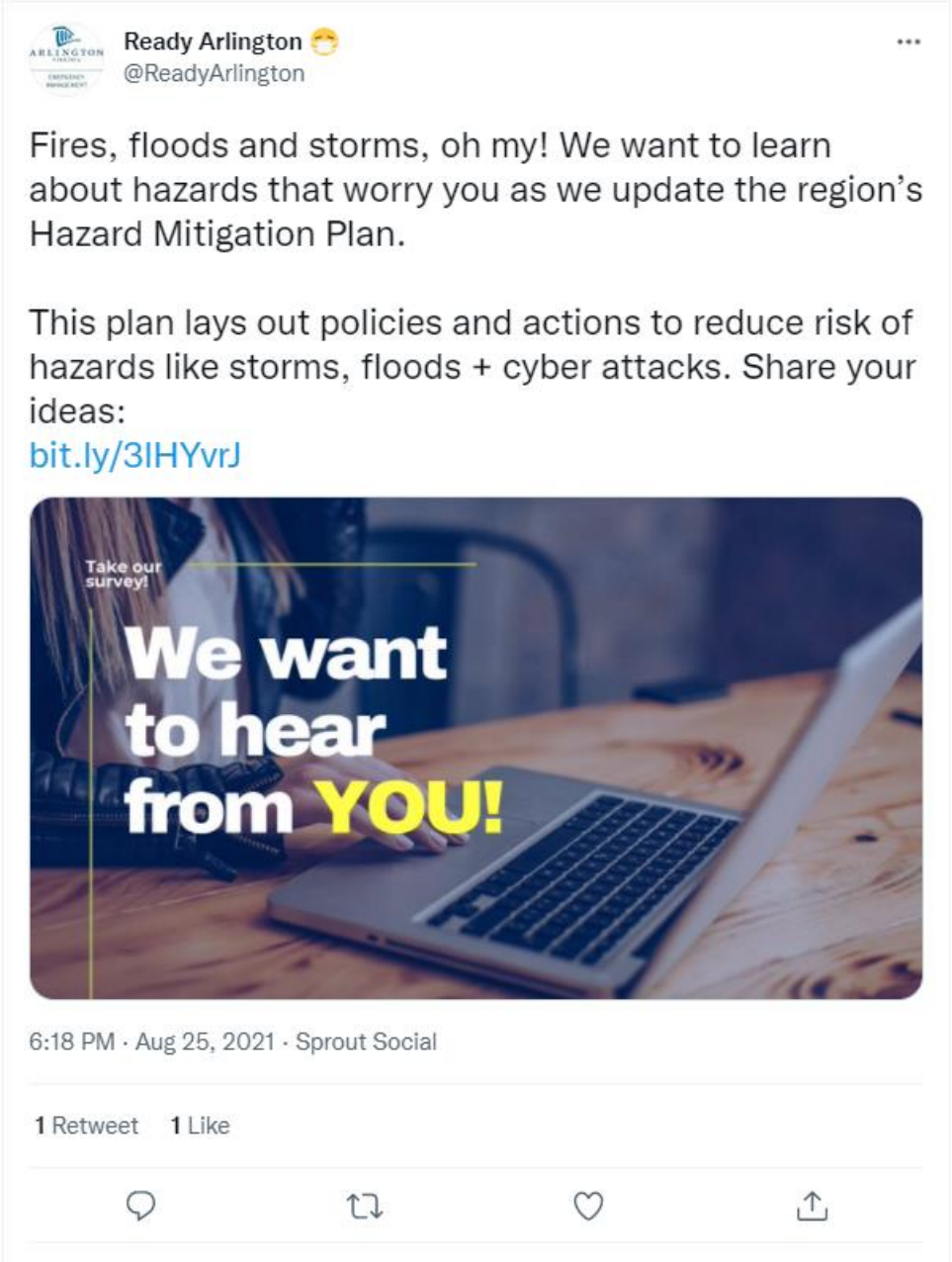
11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

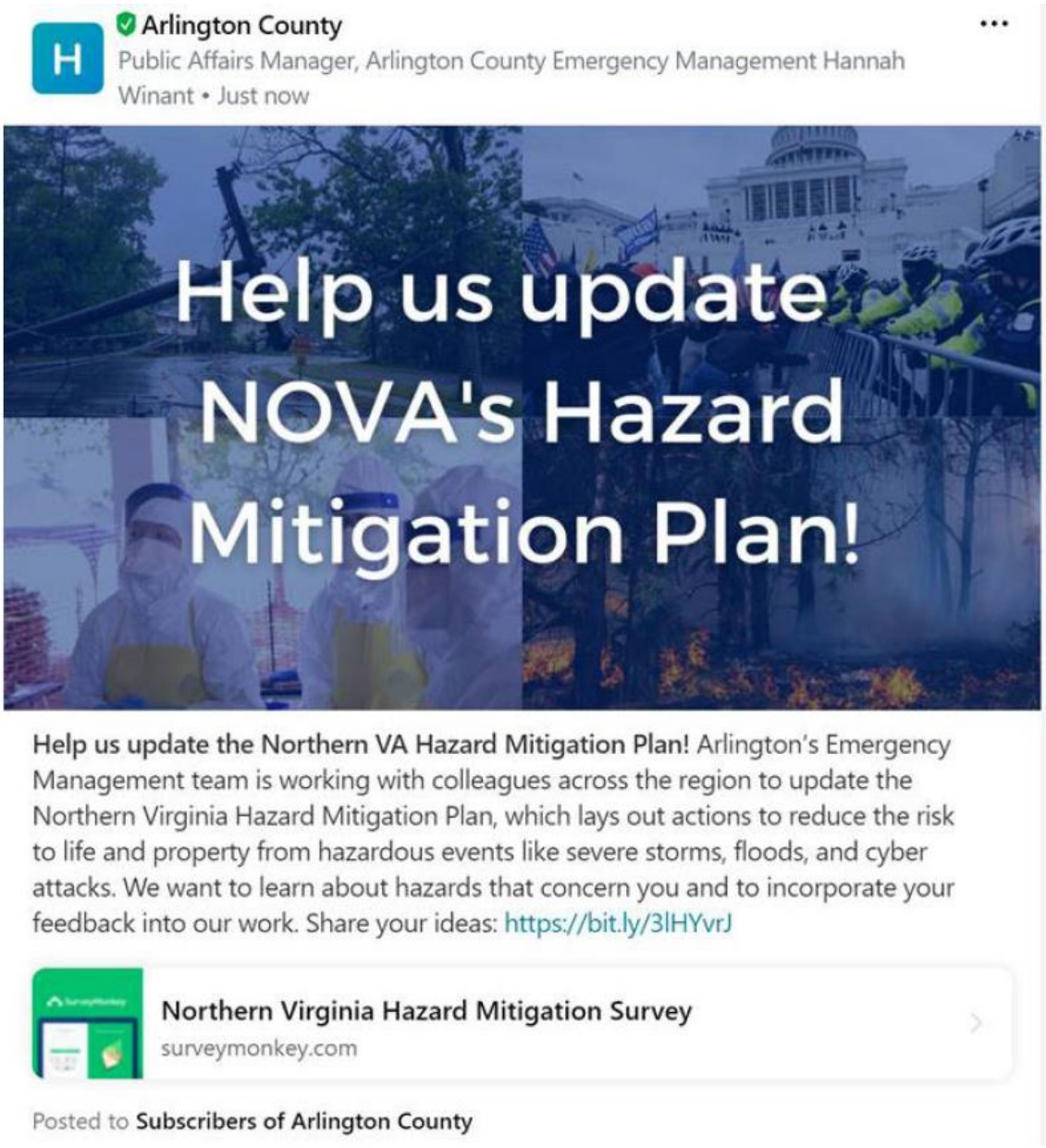
[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Documentation of Public Participation



Ready Arlington
@ReadyArlington

Fires, floods and storms, oh my! We want to learn about hazards that concern you as we update the region's Hazard Mitigation Plan. This plan lays out policies and actions to reduce risk of hazards like storms, floods + cyber attacks. Share your ideas: bit.ly/3lHYvrJ


Arlington County
Public Affairs Manager, Arlington County Emergency Management Hannah Winant • Just now
Help us update NOVA's Hazard Mitigation Plan!
Help us update the Northern VA Hazard Mitigation Plan! Arlington's Emergency Management team is working with colleagues across the region to update the Northern Virginia Hazard Mitigation Plan, which lays out actions to reduce the risk to life and property from hazardous events like severe storms, floods, and cyber attacks. We want to learn about hazards that concern you and to incorporate your feedback into our work. Share your ideas: https://bit.ly/3lHYvrJ
Northern Virginia Hazard Mitigation Survey
surveymonkey.com
Posted to Subscribers of Arlington County

- The County Board will host community conversations on Missing Middle Housing from September to October 2022. Register here and submit questions in advance for upcoming information sessions.
- Join the first Missing Middle Housing Information Session on Housing Development and Economics virtually on Wed., September 14, at 7 p.m. Submit your questions in advance to this and other upcoming information sessions.
- County transportation staff will host a virtual meeting on Thurs., September 15, at 7 p.m. to review the proposed design and share your feedback on the proposal to reconstruct 23rd Street South between Route 1 and Crystal Drive.
- Provide feedback on how the General Land Use Plan (GLUP) designation for the Sunrise Senior Living property at North Glebe Road and 20th Street North could change in the future, now through September 19.
- Do your current broadband internet services meet your needs? Share your input through September 30 for the Digital Equity Broadband Study eCheckup as a resident or as a business to help the County better understand the community's internet access and use.
- Provide your feedback on the Draft Forestry and Natural Resources Plan through October 3 (formulario en español). Arlington's Forestry and Natural Resources Plan is designed to address environmental challenges and ensure Arlington's natural resources for current and future generations.
- The 2022 Northern Virginia Hazard Mitigation Plan is open for public comment! This plan aims to minimize impact from hazards that affect our community, such as flooding, winter weather, and other disasters. Learn more and share you feedback through October 8.

For more information on engagement opportunities, check the Engage Page.

Digital Equity Broadband Study eCheckup - Feedback Form through Sept. 30: Share your input as a resident and/ or business on the broadband study to help the County better understand the community's internet use and broadband access. Learn about this study by visiting the project page.

Draft Forestry and Natural Resources Plan - Feedback Form through Oct. 3: Share your feedback on the Draft Forestry and Natural Resources Plan to help assure the future benefits of nature. Visit the project page to learn about the plan and leave a comment directly.

Northern Virginia Hazard Mitigation Plan Public Comment Period - Feedback Opportunity through Oct. 8: Share your input with Northern Virginia Emergency Response Managers on the 2022 Hazard Mitigation Draft Plan. The plan will aim to minimize impact from hazards that affect our community, such as flooding, winter weather, and other disasters. Visit their project page to learn more and review documents to help guide your comments.

Ready Arlington @ReadyArlington · Sep 9

Fires, floods, hurricanes and blizzards - oh my! The Northern Virginia Hazard Mitigation plan is officially open for public comment. Check it out and let us know what you think by October 8: nvers.org/hmp

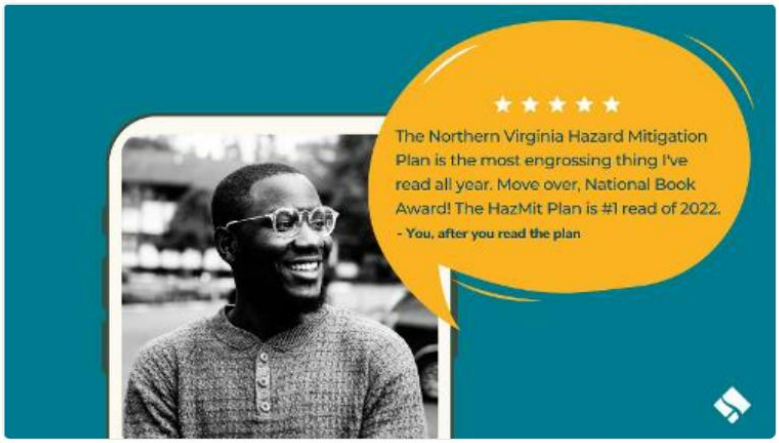
Email questions + comments to NOVA2022PublicComment@iem.com.

Ready Arlington @ReadyArlington · Sep 15

If you're looking for some quality bedtime reading then we sure have the link for you.

Check out the Northern Virginia Hazard Mitigation Plan (www.nvers.org/hmp) and let us know what you think about it by emailing NOVA2022PublicComment@iem.com.

#nova #arlingtonva



Ready Arlington @ReadyArlington · Oct 3

Embrace #spookyszn and #scares by reading about the greatest hazards facing Northern Virginia (and our plans to mitigate them): www.nvers.org/hmp

Let us know what you think by Oct 8. Email questions and comments to NOVA2022PublicComment@iem.com.

#arlingtonva #nova #dmv

11.3. Attachment 3: Mitigation Actions

Table 33: Previous Mitigation Actions

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
2006-1	Upgrade county EOC to modern standards.	Department of Public Safety Communications and Emergency Management (DPSCEM)	• All Hazards	UASI, county funds	December 2025	Funding sources identified/ secured by June 2023. EOC upgrade plan completed	High	R – Retain for 2022 HMP	Currently seeking leased space. Funding stream remains unclear after project was removed from County CIP. The County EOC has not been upgraded. Project remains a priority.
2006-7	Continue training for employees and partners on the Incident Command System.	DPSCEM	• All Hazards	DHS and Authority	Continual	Continue periodic training and exercise activities internally and with Arlington County	Medium	Completed	This is an ongoing program that our department provides to employees and local partners.
2010-1	Enhance the ability of patrol officers, through increased training and additional equipment to respond to active shooter and/or terrorist attacks.	Police Department	• Mass Casualty/ Mass Fatality	Bureau of Justice Administration DHS Funding	Continual	Funding Secured Training in progress. Equipment upgrades ongoing.	Critical	Completed	Completed 2012 and ongoing. Note that this action item addresses non-natural hazards (e.g., active shooter, active violence, and terrorism).

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
2010-6	Secure additional special needs supplies to support the special needs population.	Arlington Red Cross	• All Hazards	UASI	Continual	Secure funding and storage and order supplies by January 2011.	High	Completed	Completed regionally in 2016.
2010-10	Coordinate regionally to integrate evacuation plans.	VDEM/DPSCEM	• Flood • Landslide • Tornado • Wildfire	State and federal funding sources	Continual	Regional evacuation plan developed by August 2011.	High	Completed	Completed based off 2017 HMP project status.
2010-11	Secure prisoner transportation resources in the event of a jail evacuation.	Sheriff's Office	• Flood • Landslide • Tornado • Wildfire	County funding	December 2025	Determine number and type of assets required by March 2023.	High	R – Retain for 2022 HMP	Update action description to: Draft and finalize memorandums of understanding with ART bus, Metrobus, and/or Arlington Public Schools to utilize buses to transport prisoners in the event of a jail evacuation.
2010-12	Identify building(s) to house the courts, if the courthouse is compromised.	Sheriff's Office/ Department of Environmental Services	• All Hazards	County funding	June 2011	Determining capacity and resource requirements to house the courts by February 2011.	High	N – No longer relevant	This is no longer considered a mitigation action but rather a step that will be taken through the continuity of operations planning process.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
2010-15	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (e.g., grant assistance) and mitigation measures (e.g., flood insurance information) that can assist them in reducing their flood risk.	DPSCEM	• Flood	FEMA Unified Hazard Mitigation Assistance (HMA) funding	Ongoing	Develop outreach materials or identify appropriate outreach materials for dissemination by June 2025.	Medium	R – Retain for 2022 HMP	Complete- The DES conducted outreach in July 2021 to repetitive loss properties. This is using an old set of repetitive loss property data from FEMA. There are limitations to access to up-to-date repetitive loss data currently.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
2010-16	Support mitigation of priority flood-prone structures through promotion of acquisition, demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction, and, where feasible, using FEMA HMA programs where appropriate.	DPSCEM	• Flood	FEMA Unified HMA funding	Ongoing	Identify all priority flood-prone structures by December 2025	Medium	R – Retain for 2022 HMP	Ongoing- Purchased our first acquisition property. Developing demolition plan currently. Will turn into a micro-forest. Did not use grants; just used CIP funding. Maintaining a "watch list" of properties that we are interested in acquiring in the future. Once CIP funding is secured, may be able to move forward with other acquisitions. Continuing to conduct outreach to other property owners.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
2010-17	Promote structural mitigation to assure redundancy of critical facilities, including but not limited to roof structure improvement, meeting or exceeding building code standards, upgrading electrical panels to accept generators, etc.	DPSCEM	• All Hazards	FEMA Unified HMA funding	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review	Medium	R – Retain for 2022 HMP	Ongoing- The County is in the process of developing a Risk Assessment and Management Project (RAMP) that analyzes the County's flood risk and maps flood inundation areas, maps critical facilities/checks vulnerability of these facilities to flooding, and calculates risk of taking no action to mitigate these properties. The County is looking at adopting more flood resilient building codes in the future. (BCGES)

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
2010-18	Review locality's compliance with the National Flood Insurance Program (NFIP) with an annual review of the floodplain ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by completing form FEMA AW-501.	DPSCEM	• Flood	County funding	Ongoing	Establish a schedule of review and a review committee (if necessary) by June 2025.	Medium	R – Retain for 2022 HMP	Ongoing- Completed an audit and completed the annual verification for NFIP. Continuing to comply with CRS. In the process of updating our FEMA FIRMs, in the appeals process currently. After, will be working on updating our floodplain management ordinance to comply with FEMA/Virginia regulations.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
2010-19	Develop a communications plan with the private industry within Arlington County for emergency management (preparedness and response) purposes.	Office of Communica-tions	• All Hazards	County funding	Continual	Create a partnering committee with at least five members of the private industry to assist in developing the plan by January 2012.	Medium	N – No longer relevant	Complete – Significant retirement will require training. A communications system exists to support this function. A plan is no longer necessary. DPSCEM crafts messaging and AED disseminates.
2010-20	Conduct a gap analysis of workforce safety within the County.	Department of Human Resources	• All Hazards	County funding	Continual	Establish parameters of analysis (i.e., determine what areas need to be analyzed specifically) by April 2011.	Medium	Completed	Completed – Departmental Safety Officer Staffing increased significantly in 2010. Completion indicated in 2017 plan
2010-21	Establish a partnership with members of the academic community. Look at specific opportunities to partner with Virginia Tech.	DPSCEM	• All Hazards	County funding	Continual	Schedule a meeting between county and academic partners to discuss opportunities by January 2011.	Medium	Completed	Ongoing- DPSCEM has engaged with academic partners, including Virginia Tech, to support various emergency management programs and initiatives.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
2010-22	Conduct preparedness presentations in the community to ensure public awareness of steps the public can take to care for themselves during an emergency.	Arlington Red Cross	• All Hazards	Arlington Red Cross	Continual	Schedule the first presentation by April 2011.	Medium	Completed	Ongoing- DPSCEM has established a community engagement unit that is responsible for organizing and putting on community training and preparedness events. There is also a regional Red Cross liaison who conducts public awareness campaigns.
2010-26	Acquire the ability to have remote access to medical records	Sheriff's Office	• All Hazards	County funding	January 2018	Secure funding by January 2012.	Medium	Completed	In progress- ACPD/Sherriff's Office have the ability to access remote medical records.
2010-27	Identify the most effective tools for communications with the public during emergencies, including leveraging emergency technologies(e.g. , social media)	Office of Communica-tions	• All Hazards	FEMA Unified HMA grants	Continual	Improve situational awareness to enhance public outreach and notification by April 2011.	Medium	Completed	Ongoing- This is a continual capability of our Office of Communications; therefore, the action is completed.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
2010-28	Identify effective means of communicating with special populations (e.g., non-English speakers, special needs, tourists, non-digital).	Office of Communica-tions	• All Hazards	FEMA Unified HMA grants	Continual	Planning underway.	Medium	Completed	Ongoing- This is a continual capability of our Office of Communications; therefore, the action is completed.
2010-29	Ensure delivery of critical emergency text messages (Arlington Alert) to Arlington Public Schools' Schools Talk Alert System.	Office of Communica-tions	• All Hazards	FEMA Unified HMA grants	Continual	Hold discussions with Arlington Public Schools and set up process.	Medium	Completed	Ongoing- This is a continual capability of our Office of Communications; therefore, the action is completed.
2017-01	Acquire additional snow melting equipment.	Department of Environmental Service (ESF 3)	• Winter Weather	County Operational funds	December 2017	Identify the right type of equipment.	Low	Completed	The additional snow melting equipment was acquired.
2017-2	Develop and adopt threat and hazard identification and assessment plan for the County.	DPSCEM	• All Hazards	County funding	December 2017	Draft ready by June 2017.	High	Completed	THIRA completed by Arlington County in 2018.

Table 34: 2022 Mitigation Actions

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2006-1	Upgrade county EOC to modern standards.	Department of Public Safety Communications and Emergency Management (DPSCEM)	• All Hazards	UASI, county funds	December 2025	Funding sources identified/ secured by June 2023. EOC upgrade plan completed	High	R - Retained from previous HMP Currently seeking leased space. Funding stream remains unclear after project was removed from County CIP. The County EOC has not been upgraded. Project remains a priority.
2010-11	Secure prisoner transportation resources in the event of a jail evacuation.	Sheriff's Office	• Flood • Landslide • Tornado • Wildfire	County funding	December 2025	Determine number and type of assets required by March 2023.	High	R- Retained from previous HMP Update action description to: Draft and finalize memorandums of understanding with ART bus, Metrobus, and/or Arlington Public Schools to utilize buses to transport prisoners in the event of a jail evacuation.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2010-15	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (e.g., grant assistance) and mitigation measures (e.g., flood insurance information) that can assist them in reducing their flood risk.	DPSCEM	• Flood	FEMA Unified Hazard Mitigation Assistance (HMA) funding	Ongoing	Develop outreach materials or identify appropriate outreach materials for dissemination by June 2025.	Medium	R - Retained from previous HMP Complete- The DES conducted outreach in July 2021 to repetitive loss properties. This is using an old set of repetitive loss property data from FEMA. There are limitations to access to up-to-date repetitive loss data currently.
2010-16	Support mitigation of priority flood-prone structures through promotion of acquisition, demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction, and, where feasible, using FEMA HMA programs where appropriate.	DPSCEM	• Flood	FEMA Unified HMA funding	Ongoing	Identify all priority flood-prone structures by December 2025	Medium	R - Retained from previous HMP Ongoing- Purchased our first acquisition property. Developing demolition plan currently. Will turn into a micro-forest. Did not use grants; just used CIP funding. Maintaining a "watch list" of properties that we are interested in acquiring in the future. Once CIP funding is secured, may be able to move forward with other acquisitions. Continuing to conduct outreach to other property owners.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2010-17	Promote structural mitigation to assure redundancy of critical facilities, including but not limited to roof structure improvement, meeting or exceeding building code standards, upgrading electrical panels to accept generators, etc.	DPSCEM	• All Hazards	FEMA Unified HMA funding	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review	Medium	R – Retained from previous HMP Ongoing- The County is in the process of developing a Risk Assessment and Management Project (RAMP) that analyzes the County's flood risk and maps flood inundation areas, maps critical facilities/checks vulnerability of these facilities to flooding, and calculates risk of taking no action to mitigate these properties. The County is looking at adopting more flood resilient building codes in the future. (BCGES)

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2010-18	Review locality's compliance with the National Flood Insurance Program (NFIP) with an annual review of the floodplain ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by completing form FEMA AW-501.	DPSCEM	• Flood	County funding	Ongoing	Establish a schedule of review and a review committee (if necessary) by June 2025.	Medium	R- Retained from previous HMP Ongoing- Completed an audit and completed the annual verification for NFIP. Continuing to comply with CRS. In the process of updating our FEMA FIRMs, in the appeals process currently. After, will be working on updating our floodplain management ordinance to comply with FEMA/Virginia regulations.
2022-1	Policy/regulatory changes relating to large-scale stormwater facilities.	Community Planning and Housing Department (CPHD) – Planning/Department of Environmental Services (DES)	• Flood	Future County General Fund	End of CY2024	Policy updates and zoning ordinance amendments.	High	At a minimum, anticipated to include Zoning Ordinance updates to better accommodate large-scale stormwater detention facilities

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-2	Historic resources inventory (HRI) update – Conduct a comprehensive update to the HRI. The HRI identifies and ranks specific types of historic buildings in the County according to their historical and architectural significance. Buildings are categorized into one of six classifications: essential, important, notable, minor, altered/not historic, and demolished. The results of the HRI will assist property owners and the County in taking a prioritized approach to addressing preservation goals and development options simultaneously.	CPHD-HP	• Earthquake • Flood • High Wind • Landslide • Tornado • Winter Weather	Future county general fund; state or federal grants	End of FY2024	Adoption of the Historic Preservation Master Plan Update	High	HRI update will be done following the adoption of the Historic Preservation Master Plan

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-3	Pilot a program to install flood detection warning systems at two traffic intersections highly prone to flooding: Columbia Pike at S Greenbriar Street and Wilson Boulevard and North Manchester Street (along Bluemont).	Department of Environmental Services (DES)	• Flood	County General Fund	Summer 2022	Obtain detailed site surveys and project quote.	High	Currently have funding to install sensors at two intersections and will seek additional funding in the future to install at all four high-priority locations. Construction of two sensors is complete.
2022-4	Design and construct a 500,000 cubic foot stormwater detention vault capable of storing water up to the 10-year flood event to serve as a watershed-scale solution to reduce flood risk in Torreyson Run Watershed.	DES OSEM	• Flood	Stormwater bond referenda funding	CY2023 first quarter	Complete phase 2 project design.	High	There are other stormwater mitigation projects planned in the Torreyson Run Watershed that will be funded through 2030, using funding sources including but not limited to stormwater bond referenda, FEMA HMA grants, USACE grants, and the 2021 infrastructure bill. Construction of facility is underway.
2022-5	Develop a flood resilience design guidelines manual.	DES OSEM	• Flood	Seeking funding; currently have $250,000 set aside in CIP.	CY 2023	Secure additional funding. Develop outline of manual.	High	Procurement of consultant is underway.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-6	Complete a Risk Assessment and Management Project (RAMP) that includes updated climate projections and inundation maps to support vulnerability and risk assessments that will inform investments throughout future Capital Improvement Plan (CIP) cycles.	DES OSEM	• Flood	FY 2021 CIP funding	End of FY2023	Complete climate projections and inundation mapping.	High	Project is underway with additional scope of services beginning.
2022-7	Conduct regular training and outreach to county departments and staff to educate them about the County's flood risk, our stormwater management program, and future projects.	DES OSEM (lead), DPSCEM (support)	• Flood	County General Fund	2023	Develop presentation template for training that can be periodically updated with new information.	High	Ongoing
2022-8	Create and fill a full-time position dedicated to ESF 6 and Department of Human Services (DHS) emergency preparedness.	DHS	• All Hazards	Future County General Fund, grants	Mid-FY2022	Identify funding source, obtain approval, draft JIQ, post position and recruit, fill position, onboard new staff person.	High	This position would address all applicable natural hazards and non-natural hazards.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-9	Increase the tree pruning and maintenance of trees throughout Arlington County to lessen opportunities of trees falling during storms, and bring Arlington County's public trees into the average tree maintenance cycle as recommended by arborists.	DPR – Parks and Natural Resources (PNR) Forestry Team	• High Wind • Landslide • Tornado • Winter Weather	County General Fund, Virginia Department of Forestry Urban and Community Forestry Grant Program	December 2022	Create a maintenance plan for Arlington County's public trees, per recommendations by arborists.	High	
2022-10	Formalize and expand the remote call taking and dispatch program by identifying a supervisor to manage the program, developing policies and procedures, and acquiring additional equipment.	DPSCEM	• All Hazards	County General Fund	June 2022	Hire individual to manage the program, identify gaps/needs in current program	High	

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-11	Expand outreach and community engagement programming to be more equity-focused and build community resilience, including multi-lingual outreach, stronger relationships with community partners through the establishment of a COAD and attendance at ongoing roundtables like the Health Providers Network, and diversifying community advisory and volunteer groups.	DPSCEM	• All Hazards	County General Fund, FEMA BRIC program	December 2023	Implement multi-lingual programing by December 2021; identify and invite organizations to participate in the COAD.	High	
2022-12	Develop and maintain standby contracts for response and recovery personnel to bring on surge-staffing to augment full-time emergency management staff.	DPSCEM	• All Hazards	County General Fund	December 2022	Identify pool of contractors and potential scopes of work.	High	
2022-13	Develop a program of zoning and land use policy practices relating to disaster recovery efforts.	CPHD – Zoning	• All Hazards	Future County General Fund	End of CY2024	Staff training program, policy guide, and or zoning ordinance amendments	Medium	This is a draft placeholder for now, may evolve through further updates

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-14	Private property LHD exterior building documentation/site technical assistance – Perform exterior building documentation and site technical assistance for private property in local historic districts.	CPHD-HP	• Earthquake • Flood • High Wind • Landslide • Tornado • Winter Weather	Future county general fund; state or federal grants	End of FY2023	Develop schedule and timeline to begin review and documentation of properties	Medium	Will be done as part of historic preservation outreach
2022-15	Construct localized repetitive flood and drainage improvement projects on a sub-watershed scale and install tertiary system assets. Many of these projects encompass one street or block and may supplement a larger project.	DES OSEM	• Flood	Stormwater bond referenda, FEMA HMA grants, USACE grants, 2021 infrastructure bill	2025	Prioritize project implementation based on repetitive flood damage.	Medium	
2022-16	Acquire properties in watershed high risk flood areas (HRFAs) to provide critical overland relief or land required for capacity improvements.	DES OSEM	• Flood	Stormwater bond referenda, FEMA HMA grants, USACE grants, 2021 infrastructure bill	2025	Apply for and secure funding to acquire all interested repetitive and severe repetitive loss properties.	Medium	There are currently 28 properties on a watch list (subject to change in the future). The County currently has funding for five properties and will be seeking additional funding in the future for these acquisitions.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-17	Develop a training for DHS/Behavioral Healthcare Division (BHD) clients to assist with developing a personal emergency plan.	DHS	• All Hazards	Future County General Fund	End of FY2022	Identify existing trainings and adapt. Recruit different SMEs to participate in training Identify existing meetings in which trainings might be delivered.	Medium	This would likely be started following the creation and recruitment of an ESF 6 position. It could be similar to the trainings we have offered in senior buildings in the past in partnership with DPSCEM, ACFD, and the Red Cross. It would address all applicable natural and non-natural hazards.
2022-18	Assess and upgrade (as needed) emergency shelter locations to make sure they are set-up to receive generator connections to operate the building and/or have a generator on the property.	DPR (lead) working with DES and DHS (ESF 6)	• High Wind • Tornado • Winter Weather	VDEM Emergency Shelters Upgrade Assistance Grant Fund (or similar)	December 2025	Inter-department teams meet to develop needs assessment and plan to secure funds and implement the needed upgrades.	Medium	Virginia General Assembly approved $2.5 million for this Shelter Upgrade grant fund in FY2021, and we will seek similar funding in the future to support this project.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-19	Acquire shelf-stable meals that could be deployed during pandemics, weather emergencies, or long-term shelter-in-place events (put on by ESF 6).	DPR (lead) working with DHS (ESF 6) and DPSCEM (ESF 5)	• Earthquake • High Wind • Tornado • Winter Weather	Future County General Fund, FEMA Urban Areas Security Initiative (UASI) Regional Preparedness System (RPS) Grant	December 2022	Work with inter-department team to decide what should be acquired, make space in an existing location for maintenance of supplies, purchase supplies. Create a maintenance plan for reviewing and replenishing supplies.	Medium	
2022-20	Enhance the current inventory of emergency shelter-in-place kits located at community centers and create additional kits for programming teams (to include summer camps).	DPR – Athletic and Facility Services Division (AFSD), Safety Program, and Community Recreation Division (CRD)	• Tornado • Winter Weather	Future County General Fund, FEMA UASI RPS Grant	December 2022	Review/ update the list of contents in the current kits and acquire the needed supplies to update kits and make new ones. Create a maintenance plan for reviewing and replenishing supplies.	Medium	

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-22	Acquire tents that could be used as cooling or warming structures in times of emergencies and/or for special events or outdoor programming. Train various staff teams within DPR on how to set these up in various weather conditions.	DPR – CRD and PNR Teams	• Extreme Temperatures	County General Fund	December 2022	Identify types and number of tents to buy and storage locations. Develop a maintenance schedule. Secure source of funding.	Medium	
2022-23	Develop an access and functional needs capability responsible for reviewing and ensuring that all plans, policies, and procedures related to emergency management and ECC (911) take into account accessibility and the functional needs of the population.	DPSCEM	• All Hazards	Future County General Fund	December 2023	Identify if this resource or capability exists already in the County to support our need.	Medium	
2022-24	Plan and conduct an exercise (tabletop or functional) to socialize and practice the Arlington County Continuity of Operations Plan.	DPSCEM	• All Hazards	UASI RPS Grant	December 2022	Complete the COOP plan.	Medium	

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-25	Review and update damage assessment plans and SOPs, including integrating the Crisis Track tool and Windshield Assessment processes.	DPSCEM; DES	• Earthquake • Flood • High Wind • Tornado • Winter Weather	UASI RPS Grant	December 2023	Form a planning team, identify gaps in existing plans and SOPs, draft updated plans.	Medium	
2022-26	County-owned local historic district (LHD) building/site documentation – Develop a record of county-owned LHD buildings, documenting conditions, specification, and photos. This site documentation will serve as a record so that the County will know what existed previously if the building is damaged or destroyed.	CPHD/DES-Facility Design and Construction (FD&C)	• Earthquake • Flood • High Wind • Landslide • Tornado • Winter Weather	Future County General Fund	End of CY2024	Partnership (DES and DPR) and scope of work developed; vendor secured	Low	Coordination with DES FD&C, DPR, and APS is required

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-27	Design and construct multi-phase watershed scale capacity improvements for the Spout Run Watershed to include, but not limited to, distributed detention on public and private land (including underground detention in Woodstock Park), property acquisition, and pipe expansion and tertiary infrastructure.	DES Office of Sustainability and Environmental Management (OSEM)	• Flood	Stormwater bond referenda, FEMA HMA grants, USACE grants, 2021 Infrastructure Bill	2025	Secure funding through FY2025 to complete construction.	Low	Design of options ongoing
2022-28	Design and construct multi-phase watershed scale capacity improvements for the Lubber Run Watershed, including completing a watershed scale engineering analysis and survey and easement acquisitions (surveys, plats, etc.).	DES OSEM	• Flood	Stormwater bond referenda, FEMA HMA grants, USACE grants, 2021 infrastructure bill	2030	Secure funding through 2030 to complete construction.	Low	Conceptual planning is underway.

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-29	Conduct a study of several pedestrian bridges and also the Bon Air Park, all located within floodplains of Four Mile Run, to determine sustainable floodplain management solutions that may include, but are not limited to, mitigating degradation of the stream channel and relocation of community shelter and other park infrastructure outside of the floodplain.	DES OSEM, Department of Parks and Recreation (DPR)	• Flood	Future County General Fund, FEMA BRIC program	December 2025	Develop cost estimate for project. Secure funding through County General Fund and local/federal grants. Design and build the project.	Low	
2022-30	Develop an all-hazards pre-disaster recovery plan.	DPSCEM	• All Hazards	UASI RPS Grant	December 2023	Gain consensus on a county recovery organization and planning process.	Low	
2022-31	Develop an all-hazards evacuation plan.	DPSCEM	• All Hazards	UASI RPS Grant	December 2023	Gain consensus on county process and strategy for evacuation.	Low	
2022-32	Plan and conduct a tabletop exercise to socialize and practice the Arlington County Family Assistance Center Plan.	DPSCEM	• All Hazards	UASI RPS Grant	June 2023	Complete the FAC Plan.	Low	

Project No.	Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-33	Use census tract and THIRA information to target hazard education by language and geographic risk profile in the County to best meet resident needs.	DPSCEM	• All Hazards	Future County General Funding, UASI RPS Grant	CY2023	Complete THIRA plan update.	Low	

Northern Virginia Hazard Mitigation Plan

Annex 2: City of Alexandria

November 2022

City of Alexandria Overview

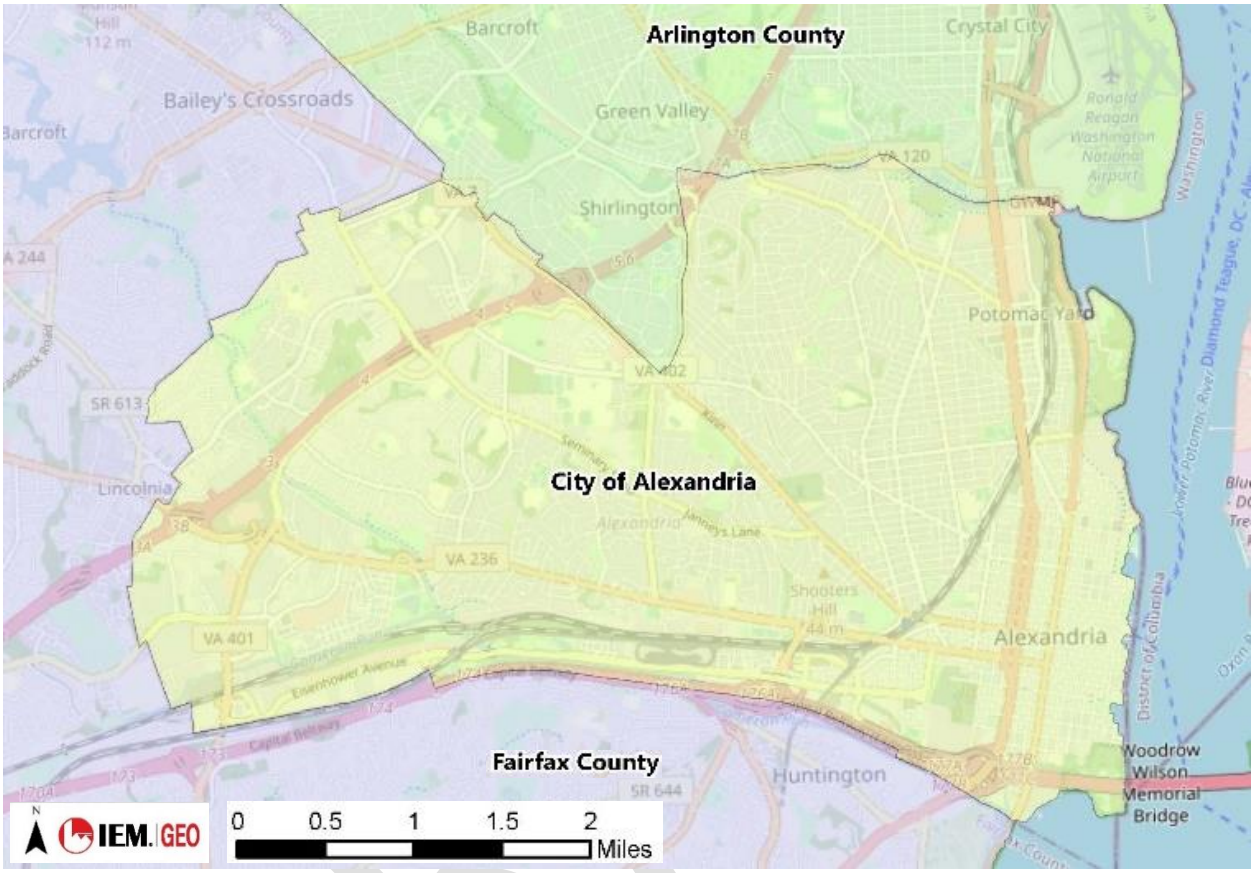


Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
Founded in 1749, Incorporated Independent City in 1870	15.75 sq. mi.	159,467	301 King Street, Alexandria, VA 22341	71,289	Flood/Flash Flood

City of Alexandria Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

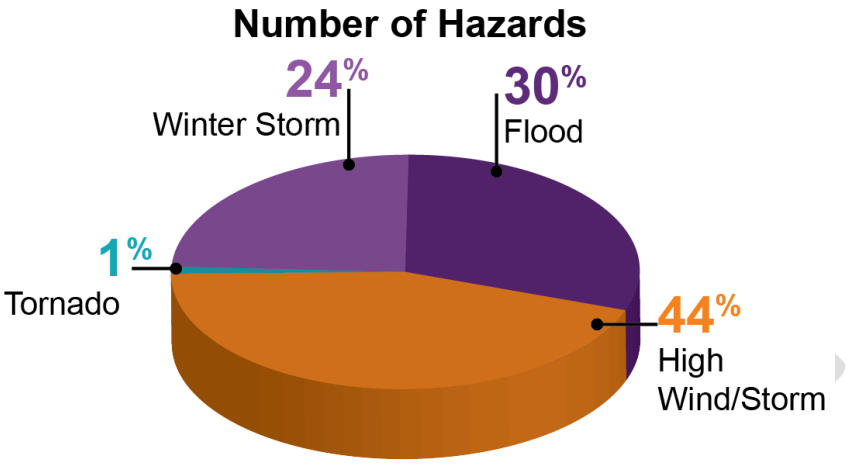


Figure 1: Percentage of Hazards

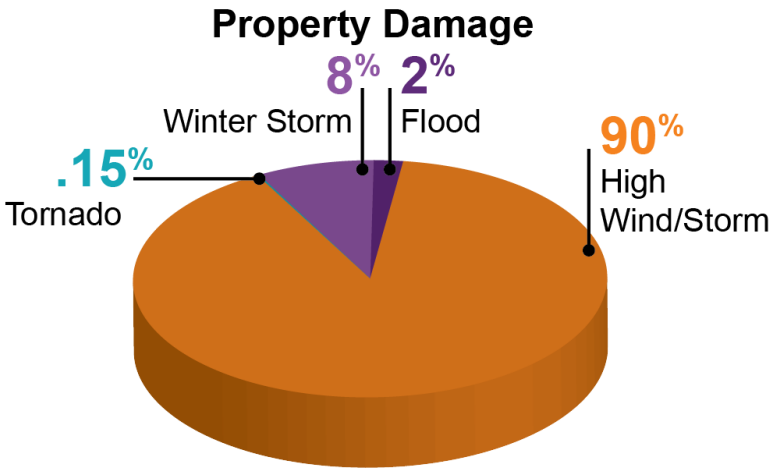


Figure 2: Reported Property Damage Percentages from Natural Hazard Events[1]

[1] NOAA, National Centers for Environmental Information, Storm Events Database, 1950 – June 30, 2021.

Natural Hazard Risk Ranking

Table 2: Ranking of Natural Hazards by Risk

Hazard	Hazard Ranking
Winter Weather	**High**
Flood	**High**
High Wind/Severe Storm	**High**
Earthquake	**High-Medium**
Tornado	**Medium**
Drought	**Medium**
Dam Failure	**Medium**
Extreme Temperatures	**Medium**
Wildfire	**Low**
Karst/Sinkhole/Land Subsidence	**Low**
Landslide	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	13
Food, Water and Shelter	4
Health and Medical	3
Energy	2
Communications	1
Transportation	205
Hazardous Materials	1
Education	42
Cultural/Historical	38
High Hazard Dams	0

A lifeline enables the continuous operation of government and business functions that are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for the City of Alexandria

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Kevin Coleman Deputy Emergency Management Coordinator City of Alexandria 2003 Mill Rd., Suite 3100 Alexandria, VA 22314 703-746-5267 kevin.coleman@alexandriava.gov
Secondary Point of Contact	Curicè O. Paulüs Deputy Emergency Management Coordinator City of Alexandria 2003 Mill Rd., Suite 3100 Alexandria, VA 22314 703-746-5296 curice.paulus@alexandriava.gov

City of Alexandria

This annex presents the following jurisdiction-specific information provided by the City of Alexandria for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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1. Jurisdiction Profile

Established	1749
Total Land Area	15.75 sq. mi.
Geographic Region	Piedmont
Persons Per Household	2.20
Persons Per Square Mile	10,125
Median Age	36
Elevation	Near sea level (~0 feet) – 39 feet

1.1. Location

Alexandria is an independent city in the Commonwealth of Virginia in the United States. Situated along the western bank of the Potomac River, the City of Alexandria is approximately seven miles south of downtown Washington, D.C.

The historic center of Alexandria is known as Old Town. With its concentration of boutiques, restaurants, antique shops, and theaters, it is a major draw for all who live in Alexandria as well for visitors. Like Old Town, many Alexandria neighborhoods are compact and walkable. It is the seventh largest and highest-income independent city in Virginia.

Alexandria's high population density and its location along the banks of the Potomac River increase the city's vulnerability to a variety of hazards, with flooding being a major concern. In addition to snow melt and rain-related river flooding episodes, Alexandria is also subjected to tidal and storm surge flooding. As sea levels rise, permanent inundation of low-lying areas along and near the river shoreline is also a concern.

1.2. History

What is now the City of Alexandria was first settled as part of the British Colony of Virginia in the late 1660s. In 1791, George Washington included portions of the city in what was to become the District of Columbia. That portion was returned to Virginia in 1846 and the City of Alexandria was rechartered in 1852. In 1870, the City became independent of Alexandria County, with the remainder of the County changing its name to Arlington County in 1920.

1.3. Demographics, Economy, and Governance

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context for the entire plan. The 2020 U.S. Census population estimate for the City of Alexandria was 159,467. The city is densely populated with 10,682 residents per square mile.

Table 6: Population and Growth Rate

Year	Population	Annual Percent Change
1980	103,217	
1990	111,183	7.7%
2000	128,283	15.4%
2010	139,966	9.1%
2020	159,467	13.9%

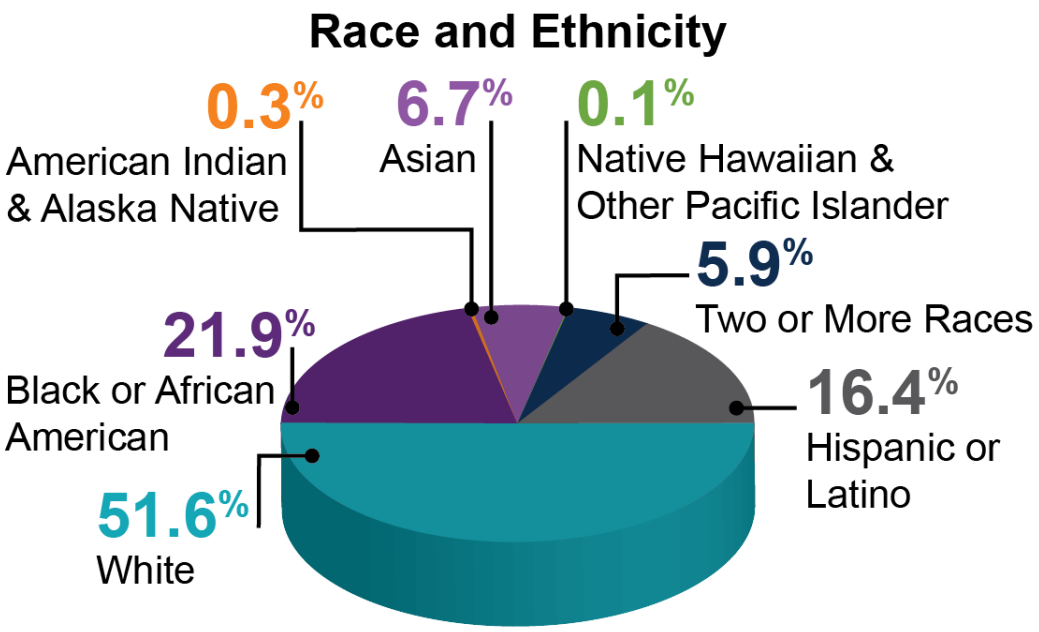


Figure 4: Race and Ethnicity Demographics from 2020 US Census

Table 7: Economic Data

Economy	Data
Median Household Income (2020)	$102,227
Unemployment Rate (Nov 2020)	5.4%[2]
Per Capita Income (2020)	$64,836
Median House or Condo Market Value (2020)	$572,900
Percentage Below Poverty (2019)	9.4%
Number of Businesses (2012)	17,540
Most Common Business (2020)	Office

[2] https://fred.stlouisfed.org/series/VAALEX5URN

Table 8: Government

Governance[3] - Independent City	Number
City Council (Mayor and Members)	7
City Boards and Commissions	70
FY 2023 Budget	$839.2 million[4]

Like the rest of Northern Virginia, modern Alexandria has been influenced by its proximity to the U.S. capital. It is largely populated by professionals working in federal civil service, the U.S. military, or for one of the many private companies that contract to provide services to the federal government. One of Alexandria's largest employers is the U.S. Department of Defense. Other large employers include the Institute for Defense Analyses, the National Science Foundation, and the U.S. Patent and Trademark Office.

1.4. Built Environment and Community Lifelines

The information related to Community Lifelines and critical assets in the City of Alexandria presented in this section has been collected from multiple sources, including Hazus (Version 5.0) and City government websites. Data extracted from the Hazus Level 1 assessment indicates that the City of Alexandria has an estimated total of 304 Community Lifelines and critical assets. The City of Alexandria maintains a detailed list of Community Lifeline facilities, sites, and critical assets.

Table 9: Number of Community Lifelines and Critical Assets in the City of Alexandria

Lifelines	Number of Assets
Safety and Security	6
Food, Water, Shelter	4
Health and Medical	2
Energy	2
Communications	1
Transportation	205
Hazardous Materials	1
Education	42
Cultural/Historical	38
High Hazard Dams	0

1.4.1. Safety and Security

The City of Alexandria has one fire department and three law enforcement entities (Alexandria Police Department, Alexandria Sheriff's Office, and Northern Virginia Community College Police). The Office of

[3] City Manager, Alexandria, VA, Recruitment Brochure
[4] https://www.alexandriava.gov/Budget

Emergency Management also maintains two City Emergency Operations Centers (one primary and one secondary).

1.4.2. Food, Water, Shelter

Food commodities are available throughout the City of Alexandria from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs. Virginia American Water provides drinking water in the City and the City of Alexandria sewage/wastewater service entity, Alexandria Renew, has four wastewater treatment plants that service the system.

1.4.3. Health and Medical

The Hazus data identifies one health and medical facility, Inova Alexandria Hospital, offering patient care, urgent care, emergency rooms, and other healthcare services in the City of Alexandria. Additionally, an Inova HealthPlex, with a comprehensive emergency room, is scheduled to open in the fall of 2023.

1.4.4. Energy

Dominion Energy provides electric power and Washington Gas provides gas services for the City of Alexandria. Covanta also generates some electricity which is distributed through Dominion Energy.

1.4.5. Communications

Most communications and information systems and infrastructure in the United States are privately owned; however, the City maintains authority and control over public safety communications for fire, police, and other responding agencies. The City of Alexandria Department of Emergency and Customer Communications (DECC) operates a Public Safety Answering Point (PSAP); 911 calls are routed through the PSAP where call takers then dispatch emergency services. Increasing reliance on information and communications infrastructure by individuals, businesses, and government increases vulnerabilities in the event of a disruption of service.

1.4.6. Transportation

The City of Alexandria is served by the following major highways:

- Interstates 395 and 95/495
- U.S. Highway 1 north (Patrick Street)
- U.S. Highway 1 south (Henry Street)
- State Highways 7 (King Street), 236 (Duke Street), 400 (Washington Street), 401 (Van Dorn Street), 402 (North Quaker Lane), 420 (Janney's Lane), and 90005 (George Washington Memorial Parkway)

Rail and Light rail lines that serve the jurisdiction include:

- Metrorail – Blue and Yellow Lines and Metro stations: Braddock Rd., King St., Eisenhower, Van Dorn, and Potomac Yard (expected to open in the Fall of 2022) (DC Metro Area Service)
- Virginia Railway Express (Northern Virginia Regional Service)
- Amtrak (National Service)

- CSX and Norfolk Southern

The City of Alexandria offers public transit through fare-free DASH buses. Most DASH routes operate 7 days a week. The Washington Metro Area Transit Authority (WMATA) also serves the city with stops at each metro station. Private transit service is available through services such as Uber and Lyft. Other available transportation options include shared mobility devices to include bicycles and scooters located throughout the city.

The maintenance of transportation facilities and systems is the responsibility of the owner or entity with authority, including municipal, state, and federal highway departments, and agencies; toll and rail authorities; and the military.

The Hazus database notes a total of 205 transportation structures, facilities, or segments, including the following:

- Highway Bridges: 74
- Highway Segments: 60
- Railway Bridges: 13
- Railway Facilities: 2
- Railway Segments: 44
- Light Rail Facilities: 5
- Light Rail Segments: 7

1.4.7. Hazardous Materials

While there are no hazardous materials facilities or storage sites currently listed in the Hazus database, the City is aware of and has identified several sites. One of these sites includes the Norfolk Southern Ethanol Transloading facility located at the Thoroughbred Bulk Transfer terminal. Other hazardous materials considerations include:

- Transportation of hazardous materials through the city via rail transport (CSX and Norfolk Southern railways)
- Existence of Colonial and Plantation pipelines running underground through the city
- Ground transportation of hazardous materials, particularly via interstate travel

The City of Alexandria and Arlington County have an automatic aid agreement allowing seamless integration and sharing of hazardous material response resources between jurisdictions.

1.4.8. Education

The City of Alexandria Public School District has approximately 20 pre-kindergarten through grade 12 schools and educational centers. Basic educational services are also offered at the City's juvenile detention facility. Some of the colleges and satellite campuses within the City of Alexandria include:

- George Washington University Alexandria Education Center
- Global Health College
- Northern Virginia Community College – Alexandria Campus
- Stratford University – Alexandria Campus
- Virginia Polytechnic Institute and State University – Alexandria Campus

- Strayer University – Alexandria Campus
- Virginia Tech Innovation Campus (under construction, expected completion 2024)

1.4.9. Cultural and Historic Sites, and Assets

Many of the City's premier historic sites fall under the administration of the Office of Historic Alexandria, the department of City government charged with the conservation, interpretation, and promotion of these links to the past. These sites bring Alexandria's varied and storied history to life. The Department of Planning and Zoning, Historic Preservation Division oversees local historic districts and sites and provides technical preservation and architectural assistance to property owners. Alexandria's two historic districts are the Old and Historic Alexandria District (OHAD) and the Parker Gray (PG) district. The Office of Historic Alexandria also promotes historic preservation initiatives throughout the City and conducts ongoing community outreach to the public.

Over 40 Alexandria districts, sites, buildings, and structures are listed on the National Register of Historic Places (NRHP). The NRHP, managed by the National Park Service, is the U.S. official list of structures, sites, objects, and districts that embody the historic and cultural foundations of the United States owing to their special architectural, historic, archaeological, or cultural value they hold to residents and visitors.

1.5. Growth and Development Trends

With a 2020 population of 159,467, the City of Alexandria is the 7th largest city in Virginia and the 169th largest city in the United States. Alexandria is currently growing at a rate of 0.22% annually and its population has increased by 14.42% since the 2010 Census.

The City has exhibited steady population growth in recent decades, driven primarily by the number of jobs in the area, including roles in the U.S. military, the Department of Defense, and other government and private entities.

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the City of Alexandria followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Group, the City supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction. The table below lists the employees who participated in the 2022 City of Alexandria Planning Group. The positions/titles listed may have changed since the final publishing and approval of this plan.

Table 10: Local Planning Group Participants

Name	Position/Title	Department/Agency
Kevin Coleman	Deputy Emergency Management Coordinator	Alexandria Fire Department/Office of Emergency Management
Ray Whatley	Acting Emergency Management Coordinator	Alexandria Fire Department/Office of Emergency Management
Emily A. Baker	Deputy City Manager	City Manager's Office

Name	Position/Title	Department/Agency
Yon Lambert	Director, Transportation & Environmental Services	Transportation & Environmental Services
William J. Skrabak	Deputy Director, Infrastructure & Environmental Quality, T&ES	Transportation & Environmental Services
Jesse E. Maines	Division Chief, Stormwater Management, T&ES	Transportation & Environmental Services
Karl Mortiz	Director, Planning and Zoning	Department of Planning and Zoning
Teresa Scott Hoggard	Former Deputy Emergency Management Coordinator	Alexandria Fire Department/Office of Emergency Management

The jurisdiction identified its chief hazard mitigation planning responsibility as providing oversight in the planning process and representation in the Emergency Manager's Group. The City also identified the following tasks as part of its mitigation planning responsibilities:

- Provide management support for the planning effort
- Serve as Planning Group resource/subject matter experts
- Conduct hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Conduct capabilities assessment
- Develop mitigation strategies
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Conduct public outreach activities
- Implement the Plan
- Maintain the Plan

The City of Alexandria planning participants coordinated primarily by means of virtual meetings during the planning process, and as needed, worked independently to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a posting of the NOVA hazard mitigation public survey on the City's social media account and access to the draft plan for review and input.

In addition to the survey, the public was offered the opportunity to review and provide input to the Draft 2022 Plan update. Notification of the release of the Draft Plan was made through the same social media account. Documentation of the public survey and draft plan review is in **Attachment 2** of this annex.

3. Jurisdiction-Specific Hazard Event History

The City of Alexandria's comprehensive hazard history is described in **Section 5, Base Plan**. The diversity of the landscape increases the vulnerability to a variety of hazards, most notably flooding and severe storms. In addition to snowmelt and rain-related river flooding episodes, low-lying areas of the City along the Potomac River are also subject to tidal and storm surge flooding. As sea levels rise, permanent inundation of low-lying areas along and near the river shoreline is also a threat. Additionally, winter storms pose significant threats, as evidenced during the 2015–2016 winter season, which resulted in a Federal Disaster Declaration.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 460 recorded natural meteorological events that took place in the City between January 1, 1950 and June 2021. The City has been included in three federal emergency and disaster declarations between May 2017 and May 2021.

Table 11: Federal Disaster and Emergency Declarations (2017-2021), City of Alexandria[5]

Declaration	Date	Hazard	Assistance Type
DR 4512	Apr. 2020	Virginia COVID-19 Pandemic	PA-B
EM 3448	Mar. 2020	Virginia COVD-19	PA-B
EM 3403	Sep. 2018	Virginia Hurricane Florence	PA-B

In addition to the hazard events profiled in **Section 5, Base Plan**, the City identified additional significant events that occurred since 2001.

Table 12: Significant Hazard Events Identified by the City of Alexandria (2001–2021)[6]

Date	Hazard	Event and Description
October 2021	Flooding	Alexandria experienced a high tidal event and concurrent period of heavy rains resulting in severe coastal flooding. The Potomac River gauge indicated moderate flood stage flooding of historic Old Town.
September 2021	Flash Flooding	This was a 10-year flood event based on the City's IDF curve. Impacts were primary centralized around Beach Park, but heavy rainfall and flooding occurred in SE Del Ray and near Mount Vernon.
August 2021	Flash Flooding	An intense overnight storm dropped between 3 to 5 inches of rain in an hour with heavier localized rainfall. The highest rain gauge reading was at George Mason Elementary, which recorded 3.19 inches in 30 minutes and a total of 4.43 inches in an hour. Based on the City's Intensity-Duration-Frequency (IDF) curves, these rainfall totals correspond to a 200–500-year event. Primary impacts included widespread flooding, power outages, sanitary backups, and sink holes.

[5] FEMA, Federal Disaster Declarations.
[6] https://www.alexandriava.gov/flood-action/severe-storm-and-flash-flood-events

Date	Hazard	Event and Description
September 2020	Severe Thunderstorms	The September 10, 2020 rainfall event dropped approximately 2.5 to 4 inches at a rate as high as 3 inches in 10 minutes. This was an intense, regional storm that caused widespread flooding throughout Alexandria, particularly in the eastern portion, and included storm sewer line surges and sanitary backups.
July 2020	Severe Thunderstorms	Heavy rain and strong winds from a line of strong storms caused City-wide flooding and downed trees.
July 2019	Severe Thunderstorms	On July 8, Alexandria received a month's worth of rain in approximately one hour, which resulted in widespread flooding. This historic weather event caused significant damage to public facilities, roads, businesses, and homes.
September 2018	Flooding	Old Town Alexandria experienced a coastal flooding event during high tide approximately 1 week prior to anticipated Hurricane Florence impacts. While Florence did not directly impact Alexandria, receipt of any anticipated rainfall (up to 16 inches was forecasted) would have exacerbated already saturated soils and high-water levels.
June 2012	Derecho	On Friday night, June 29, 2012, a widespread derecho event traveled 700 miles across the Mid-Atlantic states. More than 1.5 million customers in the NCR lost power as a result of this event. Some Alexandrians experienced prolonged power outages, all public schools closed the following Monday, and debris was scattered across the city.
August 2011	Earthquake	A 5.8 magnitude earthquake stuck near Mineral, Virginia. Alexandria experienced damage to chimneys and other buildings. In Old Town Alexandria, historic Gadsby's Tavern and City Hall sustained damage, as well as several other historic buildings.
November 2010	Thunderstorm	A tree was knocked onto a car and several six-inch limbs were also down near the intersection of Van Dorn Street and Taney Avenue.
June 2005	Lightning	An upper-level disturbance, in conjunction with a very warm, moist, and unstable airmass, caused a large outbreak of severe weather. Associated with this event was a large squall line of strong to severe thunderstorms. Damage was reported in portions of the Washington and Baltimore Metropolitan areas. Strong winds also occurred on the maritime waters of the Potomac River and Chesapeake Bay.

4. Hazard Risk Ranking

After developing hazard profiles, the City of Alexandria Planning Group conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan**.
The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5, Base Plan**, and local details are provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II** of this Plan.

Table 13: Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.3	3.5	6.8	**High**
Flood	2.0	4.2	6.2	**High**
High Wind/Severe Storm	2.7	3.3	6.0	**High**
Earthquake	2.3	4.7	7.0	**High-Medium**
Tornado	1.3	4.5	5.8	**Medium**
Drought	2.3	3.3	5.6	**Medium**
Dam Failure	1.0	4.4	5.4	**Medium**
Extreme Temperatures	2.7	2.5	5.2	**Medium**
Wildfire	1.0	3.0	4.0	**Low**
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	**Low**
Landslide	1.0	2.5	3.5	**Low**

Table 14: Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	3.0	5.7	8.7	**High**
Terrorism	1.0	5.9	6.9	**High**
Cyberattack	2.0	4.4	6.4	**High**
Civil Unrest	1.0	4.7	5.7	**Medium**
Communication Disruption	1.3	3.5	4.9	**Medium**
Hazardous Materials	1.0	3.9	4.9	**Low**
Active Violence	1.3	3.0	4.4	**Low**

Based on the hazard risk scores, the City of Alexandria evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high, medium-high, or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter Weather, Flood (riverine/flash flood), and High Wind/Severe Storm
- **Medium-High:** Earthquake (this hazard is ranked as such due to the potential for severe impacts should one of significant magnitude strike the region.)
- **Medium:** Dam Failure, Drought, Extreme temperatures, and Tornado

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, and Cyber Attack
- **Medium:** Civil Unrest and Communication Disruption

All other hazards were ranked as “low,” signifying a minimal risk to the City of Alexandria.

4.1. Additional Hazard Risk Considerations

4.1.1. Dam Failure

There are no dams located in the City of Alexandria; any effect from a dam breach would come from the Lake Barcroft dam in Fairfax County towards the northern border. The last reported failure of Lake Barcroft dam was in 1972 as a result of Hurricane Agnes.

4.1.2. Flood/Flash Flood

This table presents the number of flood events documented in the NCEI Storm Events Database, including flood, flash flood, and impacts on people, property, and crops.

Table 15: Flood/Flash Flood Events in the City of Alexandria 1950–June 30, 2021[7]

Impact	Data
Flood/Flash Flood Events	40
Direct Deaths	0
Direct Injuries	0
Property Damage	$695,000
Crop Damage	$0
Total Property and Crop Damage	$695,000

4.1.3. High Wind/Severe Storm

This table presents the number of severe storm events documented in the NCEI Storm Events Database, including high wind, and impacts on people, property, and crops.

Table 16: High Wind Events in the City of Alexandria, 1950–June 30, 2021[8]

Impact	Data
High Wind and Severe Storm Events	14
Direct Deaths	0
Direct Injuries	0
Property Damage	$4,533,000
Crop Damage	$0
Total Property and Crop Damage	$4,533,000

4.1.4. Tornado

This table presents the number of tornado events documented in the NCEI Storm Events Database, including tornadic wind, and impacts on people, property, and crops.

Table 17: Tornado Events in the City of Alexandria, 1950–June 30, 2021[9]

Impact	Data
Tornado Events	2
Direct Deaths	0
Direct Injuries	0
Property Damage	$7,500
Crop Damage	$0
Total Property and Crop Damage	$7,500

[7] NOAA, National Centers for Environmental Information, Storm Events Database, 1950–June 30, 2021.
[8] NOAA, National Centers for Environmental Information, Storm Events Database, 1950 – June 30, 2021.
[9] NOAA, National Centers for Environmental Information, Storm Events Database, 1950 – June 30, 2021.

4.1.5. Winter Weather

Table 18 presents the number of winter weather events documented in the NCEI Storm Events Database, including blizzard, heavy snow, winter storm, and winter weather.

Table 18: Winter Weather Events in the City of Alexandria, 1950-June 30, 2021[10]

Impact	Data
Winter Storm Events	31
Direct Deaths	0
Direct Injuries	0
Property Damage	$405,000
Crop Damage	$0
Total Property and Crop Damage	$405,000

Other hazard information for the City of Alexandria is presented in the **Base Plan**.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

The City of Alexandria is a participant in the National Flood Insurance Program (NFIP). In addition, the City participates in the voluntary Community Rating System (CRS) program under the NFIP with a CRS Class of 6, which is associated with a 20 percent flood insurance discount for policyholders. The *Floodplain Management Plan, Progress Report*, September 2019, describes the 24 mitigation actions related to flood developed since 2006 that were presented in the 2017 NOVA HMP. These actions cover a broad range of project types, including planning and regulatory, structural, natural system protection, and public outreach and education. The Progress Report provides an update as of September 2019 for maintenance of the City's CRS program, which documents continuing progress on the implementation of these actions.

[10] NOAA, National Centers for Environmental Information, Storm Events Database, 1950 – June 30, 2021.

Table 19: National Flood Insurance Program Status, City of Alexandria[11]

Initial FHBM Identified	Initial FIRM Identified	Current Eff FIRM Date	Reg-Emer Date	CRS Entry Date	Current Eff CRS Date	CRS Class	% Disc SFHA	% Disc Non-SFHA
8/22/1969	8/22/1969	6/16/2011	6/16/2011	10/1/1992	10/1/2021	6	20	20

Table 20: NFIP Policy Status, City of Alexandria[12]

Policies In-Force	Premiums Paid	Total Coverage
1,487	$1,375,830	$ 479,512,900

Table 21: NFIP Status, as of September 14th, 2021

Category	NFIP Topic	Source of Information	Comments
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	Yes. Certified Floodplain Manager (ASFPM)
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	No, Primary
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	Alexandria has a Class 6 designation in FEMA's Community Rating System (CRS), First in Virginia
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	None
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Compliance History	Are there any outstanding compliance		None

[11] National Flood Insurance Program (NFIP) Community Status Report, as of March 31, 2022
Community Rating System | FEMA.gov
[12] NFIP Community Status Report, as of March 31, 2022

Category	NFIP Topic	Source of Information	Comments
	issues (i.e., current violations)?		
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		FEMA's last review of the CRS program in Alexandria was 2018; the result of the CRS Cycle Verification Visit was a confirmation of the Class 6 designation by FEMA dated February 12, 2021

5.2. Population

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations. The CDC SVI depicts the vulnerability of communities at Census tract level, by county, into 15 Census-derived factors grouped into four themes—socioeconomic status, household composition/disability, race/ethnicity/language, and housing type/transportation. Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, and to human-caused threats, such as toxic chemical spills.

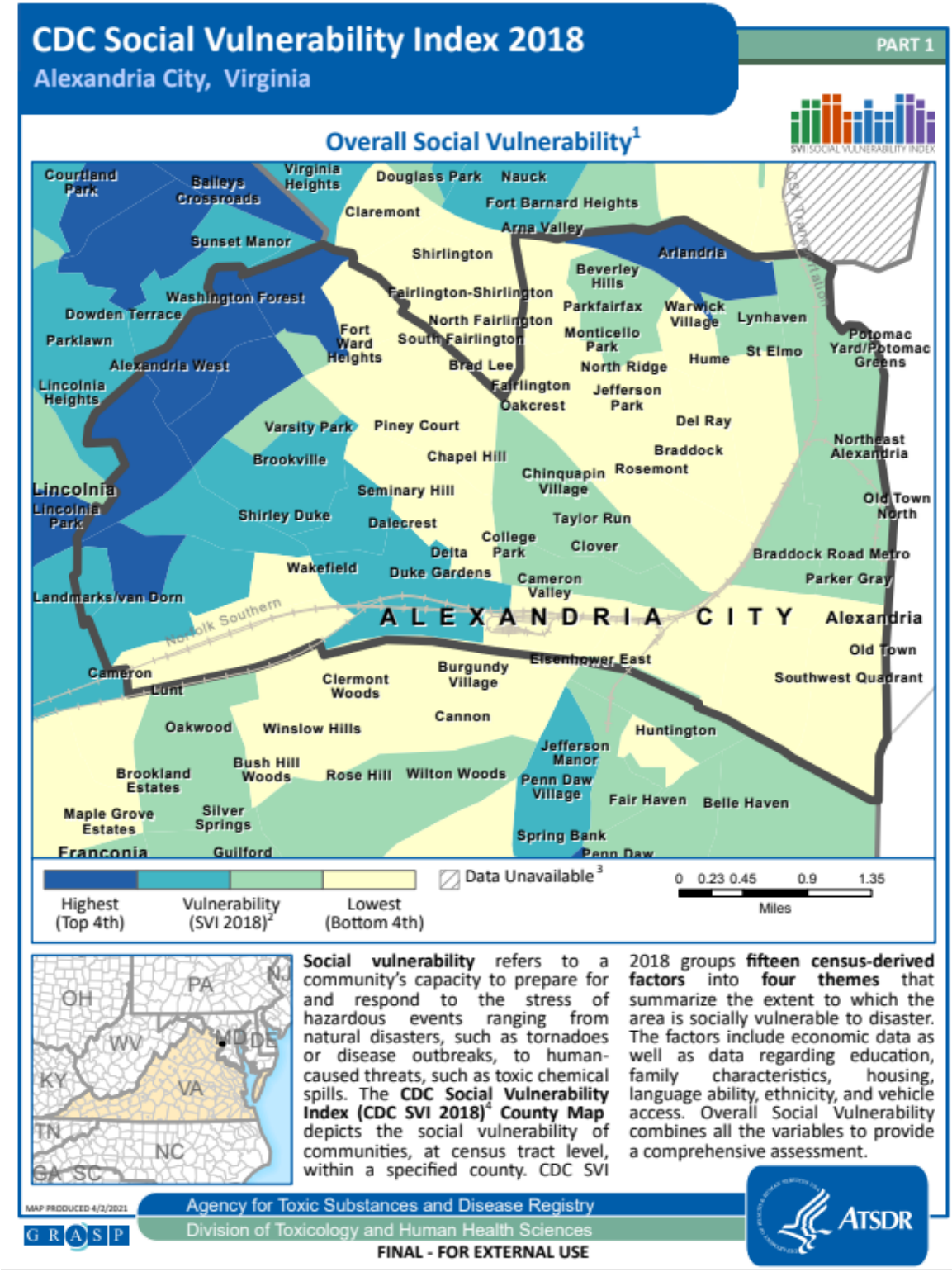


Figure 5: Overall Social Vulnerability (2018), City of Alexandria[13]

[13] Centers for Disease Control and Prevention, Social Vulnerability Index, Virginia, 2018. Retrieved at: Virginia2018_Alexandria city.pdf (cdc.gov)

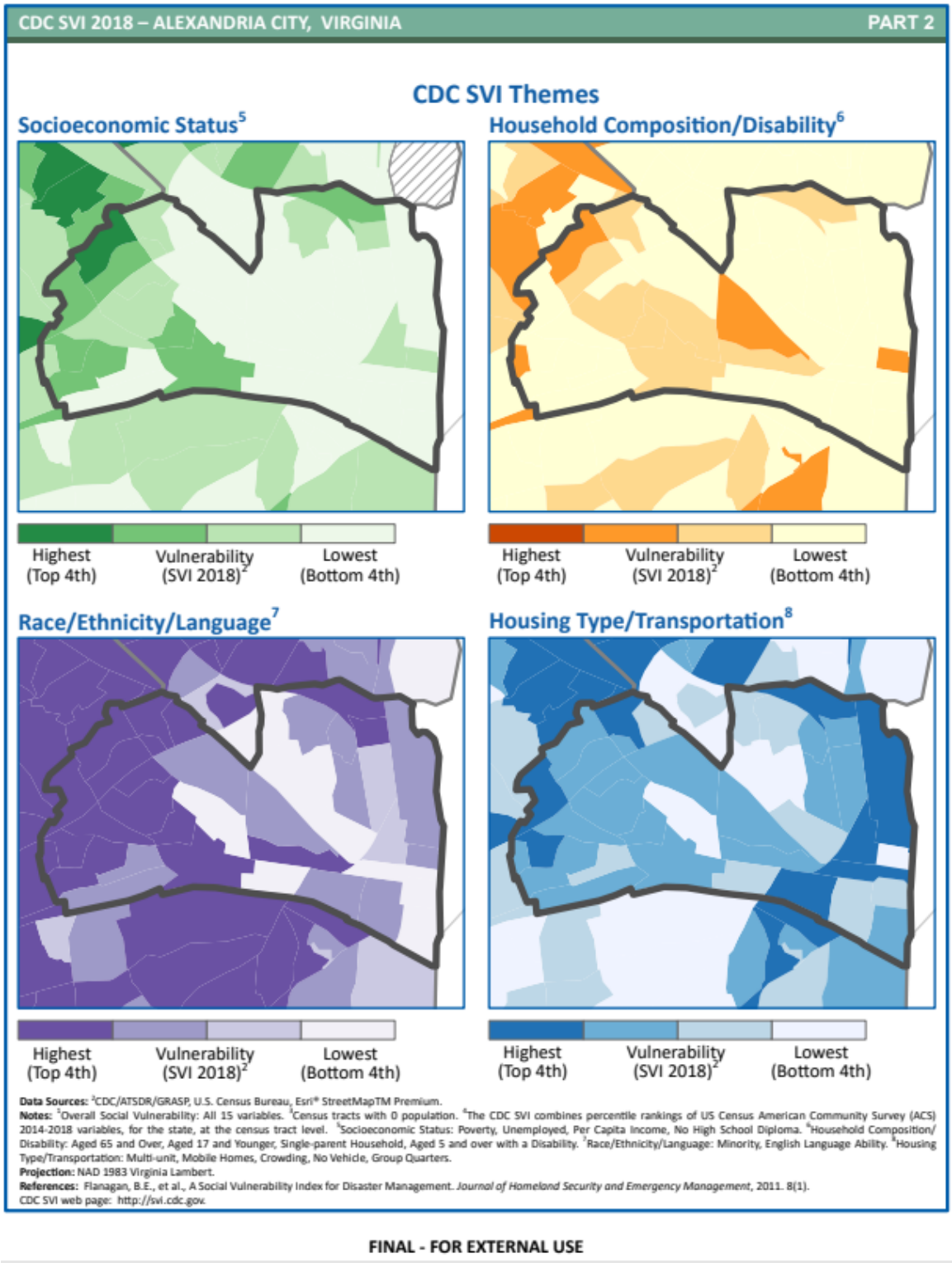


Figure 6: Social Vulnerability, by Theme, City of Alexandria[14]

[14] Centers for Disease Control and Prevention, Social Vulnerability Index, Virginia, 2018. Retrieved at: Virginia2018_Alexandria city.pdf (cdc.gov)

The themed maps illustrate the City's higher level of vulnerability within the race/ethnicity/language theme, demonstrating the importance of communicating essential hazard mitigation, preparedness, response, and recovery information to the public in alternate formats and multiple languages.

5.3. Built Environment

Based on data currently available through Hazus, the tables presented in this section provide a total number of exposed facilities and properties in relation to earthquake, flood, and hurricane winds.

Table 22: Building Stock Exposure by General Occupancy

Type	Amount
Residential	$18,477,776,000
Commercial	$3,608,216,000
Industrial	$304,079,000
Agricultural	$20,655,000
Religious	$567,753,000
Government	$128,869,000
Education	$919,729,000
TOTAL	**$24,027,077,000**

5.4. Community Lifelines and Assets

The City of Alexandria reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events. The vulnerability of critical infrastructure is presented in the lifeline sector categories identified by FEMA. The data is extracted from the Hazus scenario models for flood, earthquake, and hurricane.

Table 23: Critical Facilities Exposed to FEMA Floodplains, City of Alexandria

Facility Type	Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
Wastewater Treatment Plants	4	2	0
Schools	42	1	2
Railway Segments	44	10	5
Highway Bridges	74	27	7
Highway Segments	60	11	3
Light Rail Facilities	5	0	4
Light Rail Segments	3	2	1
Police Stations	3	0	2
Railway Bridges	13	9	0

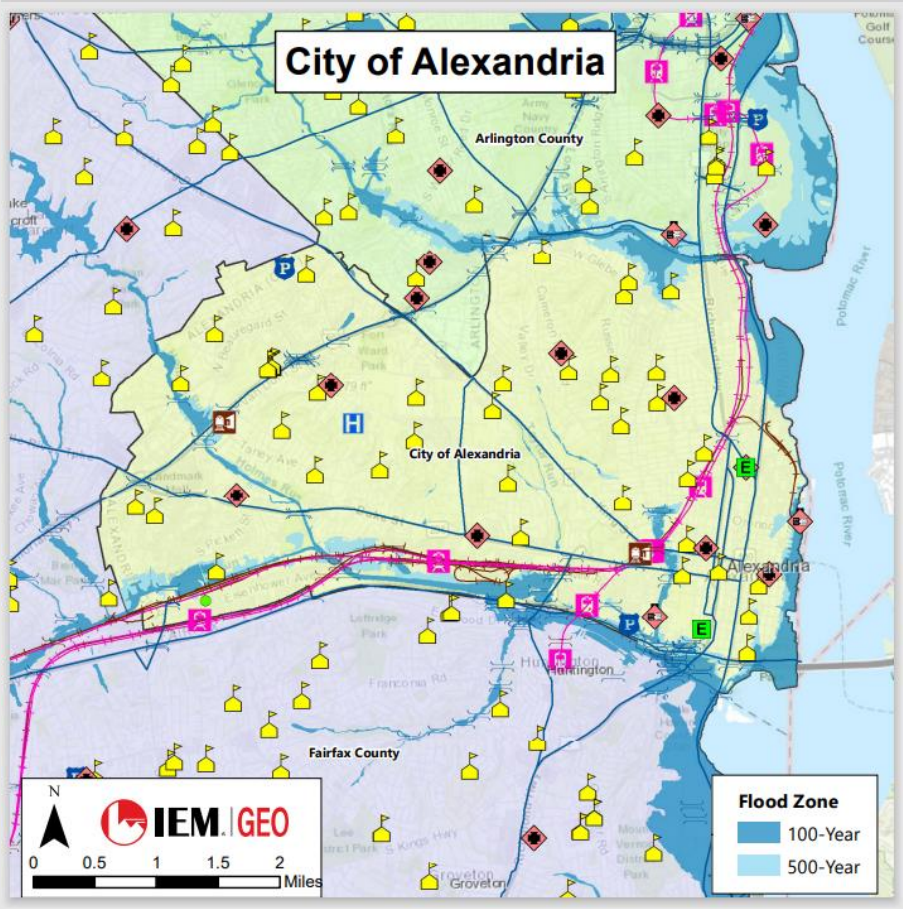


Figure 7: Critical Facilities in Flood Zones, City of Alexandria[15]

5.5. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

5.6. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2,500-year 6.5 magnitude earthquake event, 100-year flood event, and probabilistic hurricane wind event are identified by Hazus for specific assets.

[15] FEMA Flood Insurance Rate Maps; Hazus Flood Scenarios (100- and 500-Year), August 3, 2021.

Table 24: Direct Economic Losses Related to Earthquake, Flood and Hurricane Wind

Hazard	Buildings (capital stock and income)	Transportation	Utilities
Earthquake	$284,828,000	$6,294,000	$5,377,000
Flood	$162,402,000	0	0
Hurricane Wind	$15,168,000	0	0

5.7. Cultural/Historical

Information related to vulnerability of cultural and historical assets are presented in the hazard-specific sections of the **Base Plan**.

Historic structures and sites are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites.

Table 25: Cultural and Historic Properties Exposed to FEMA Floodplains, City of Alexandria[16]

Total Facilities	In 100-year Floodplain	In 500-year Floodplain
810	350	460

6. Capability Assessment

The City of Alexandria reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - City staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions

[16] City of Alexandria Planners

- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the City of Alexandria completed a Jurisdiction Needs Identification Questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the levels of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis, as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans, and/or resources, and it can implement most mitigation actions.

Table 26: Capability Assessment Summary Ranking

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary

The City utilizes the all-hazards approach when developing any jurisdictional plans, including the Emergency Operations Plan, Continuity of Operations Plan, and the Hazard Mitigation Plan.

The following plans have been newly developed or updated since the 2017 HMP:

- Comprehensive Plan
- Capital Improvements Plan
- Local Emergency Operations Plan
- Flood Action Alexandria – local website

Capability Analysis: High

Significant planning and regulatory tools are in place within the City of Alexandria and bring to light successes in integrating hazard mitigation planning with existing planning mechanisms. This demonstrates that the jurisdiction recognizes the benefit of incorporating hazard mitigation in local planning and regulatory processes such as the Comprehensive Plan, the Capital Improvement Plan, and floodplain regulations, as well as how to use these to develop and implement mitigation actions. The City recognizes improvement opportunities for updating codes and ordinances as science and information improves and continually implementing best practices based on after action reports.

6.1.2. Administrative and Technical Capabilities Summary

- Planning and Zoning staff include planners and engineers with an understanding of natural and non-natural hazards who are integrated into mitigation planning.
- Transportation and Environmental Services (T&ES) staff includes a Floodplain Manager and CRS Coordinator.
- The City maintains an Information Technology department with GIS personnel.
- City emergency management and other staff are familiar with the community's hazards.
- City administration has a grant writer who coordinates with the hazard mitigation program.

The City identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and implementation of the plan.

- Code Administration
- Emergency and Customer Communications
- Emergency Management
- Fire Department
- General Services
- Health Department
- Planning and Zoning
- Police Department
- Public Works Services
- Sheriff's Office
- Transportation and Environmental Services

Capability Analysis: High

The City of Alexandria has a robust staffing capability that enables a high level of coordination for the purpose of mitigation planning and action implementation. As a result of COVID-19, the City increased its staffing levels, resulting in enhanced administrative and technical capabilities. There is a need to continue funding these positions and to provide ongoing education and training. Staffing models should be evaluated to ensure adequate response capability and current technologies should be monitored to find appropriate uses, where applicable. The City should continue to refresh training and update policies and procedures to implement best practices and lessons learned.

6.1.3. Safe Growth Capabilities Summary

- Growth guidance instruments discourage development or redevelopment in natural hazard areas.
- Transportation limits access to hazard areas.
- Environmental policies provide incentives for development located outside protective ecosystems.

Capability Analysis: High

The City of Alexandria has well-established safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment. No additional enhancements are identified at this time.

6.1.4. Financial Capabilities Summary

- Capital Improvements projects: Storm management infrastructure
- Fees for water and sewer maintenance
- Federal funding: UASI, HMGP, and BRIC

Capability Analysis: Moderate

Rising operational costs and limited financial resources are an everyday challenge for most local governments. The process for identifying potential grants, developing and submitting applications, and managing grant-funded projects is both time-consuming and challenging, especially if multiple disasters are occurring simultaneously. In addition, onsite work restrictions imposed during the COVID-19 pandemic have presented challenges in staff availability and coordination. To address these shortfalls, the jurisdiction may access technical assistance available to potential applicants provided by many grant programs or expand its capabilities to develop and manage mitigation actions through contracted services. It should maintain awareness of potential grant programs and take advantage of them and evaluate effective use of budgetary funds and invest where it is most cost effective.

6.1.5. Education and Outreach Capabilities Summary

Community Rating System initiatives within the NFIP program can increase public awareness of and involvement in hazard mitigation.

- Work with local citizen groups and non-profits such as CERT and Volunteer Alexandria.
- Provide ongoing public education and information programs: community academy, and government, fire station, and police programs, for example.

Capability Analysis: Moderate

Jurisdictions have multiple opportunities to promote hazard mitigation and increase involvement of stakeholders and the public. There is a critical need to inform additional stakeholders and the public about the benefits of hazard mitigation planning and implementation. Virginia Department of Emergency Management mitigation staff can provide technical assistance to support increased jurisdictional involvement. Many hazard mitigation educational tools and materials are available from state agencies and disaster preparedness and response organizations, such as the American Red Cross, FEMA, as well as faith-based organizations with disaster response missions. It is important to locate best practices programs for educating and informing the public and capitalize on volunteer resources when implementing training programs.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, the City of Alexandria identified activities related to each natural hazard that support risk reduction. They are listed in the following table.

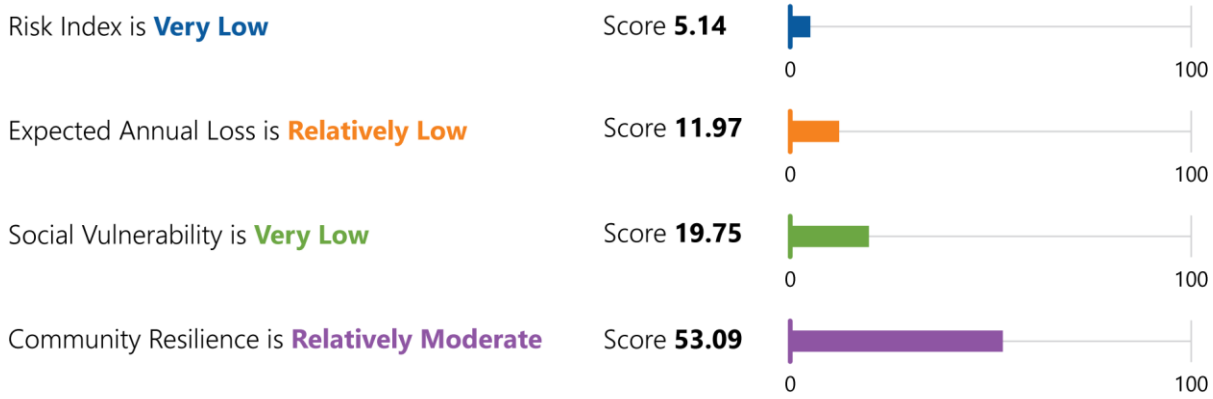
Table 27: Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Capability
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and International building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	• Public education and operational plans address preparedness and response to reduce risk.
Flood/Flash Flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. • Stormwater management program and projects address flood prevention and risk reduction.
High Wind/Severe Storm	• State and International building codes provide for wind load design regulations.
Karst/Sinkhole/Land Subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Winter Storm	• Public education and operational plans address preparedness and response to reduce risk.
Non-Natural Hazards	• Public education and operational plans address preparedness and response to reduce risk. • Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate Change	• Ongoing resilience planning will allow for identification and mitigation of climate change related issues in future planning cycles.

7. Resilience to Hazards

7.1. National Risk Index

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of "low risk" is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience. The levels of risk are described in Figure 8.



Community Report – Alexandria City, Virginia | National Risk Index (fema.gov)

Figure 8: Summary of National Risk Index Findings, City of Alexandria[17]

Table 28: Comparison of City of Alexandria Scores with Virginia and National Average[18]

Index	City of Alexandria	Virginia Average	National Average
Risk	5.14	6.50	10.60
Expected Annual Loss	11.97	9.22	13.33
Social Vulnerability	19.75	35.32	38.35
Community Resilience	53.09	54.92	54.59

Table 29: City of Alexandria Risk Ranking[19]

Index	Rank
Risk	Very Low
Expected Annual Loss	Relatively Low
Social Vulnerability	Very Low
Community Resilience	Relatively Moderate

[17] National Risk Index. Retrieved at: Community Report - Alexandria City, Virginia | National Risk Index (fema.gov)
[18] Ibid.
[19] Ibid.

The National Risk Index (NRI) is a dataset and online tool developed by the Federal Emergency Management Agency (FEMA) and other partners to help identify communities in the United States at risk for 18 types of natural hazards. Hazard risk is calculated based on data for a single hazard type and reflects the relative risk for that hazard type. However, it should be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently from the hazards in this plan, so a direct hazard-to-hazard comparison of risk cannot be determined.

Based on the NRI findings, the highest five hazards by risk rating for the City of Alexandria are as follows: Winter Weather, Strong Wind, Tornado, Cold Wave (known within this plan as Extreme Cold), and Heat Wave (known within this plan as Extreme Heat). Lightning, Ice Storm, Hail, and Riverine Flooding received lower risk ratings; however, 14 of the 15 hazards rated for risk were all determined to be “very low,” with one hazard (Heat Wave) determined as “relatively low.”

Hazard Types	Risk Index Rating	Risk Index Score	
Avalanche	Not Applicable	--	
Coastal Flooding	Very Low	3.23	0 100
Cold Wave	No Rating	0.00	0 100
Drought	No Rating	0.00	0 100
Earthquake	Very Low	2.09	0 100
Hail	Very Low	3.65	0 100
Heat Wave	Relatively Low	7.62	0 100
Hurricane	Very Low	3.99	0 100
Ice Storm	Very Low	4.42	0 100
Landslide	Very Low	7.47	0 100
Lightning	Relatively Low	10.37	0 100
Riverine Flooding	Very Low	5.13	0 100
Strong Wind	Relatively Low	9.75	0 100
Tornado	Relatively Low	9.83	0 100
Tsunami	Not Applicable	--	
Volcanic Activity	Not Applicable	--	
Wildfire	No Rating	0.00	0 100
Winter Weather	Very Low	7.44	0 100

Figure 9: Hazard Type Risk Index, National Risk Index[20]

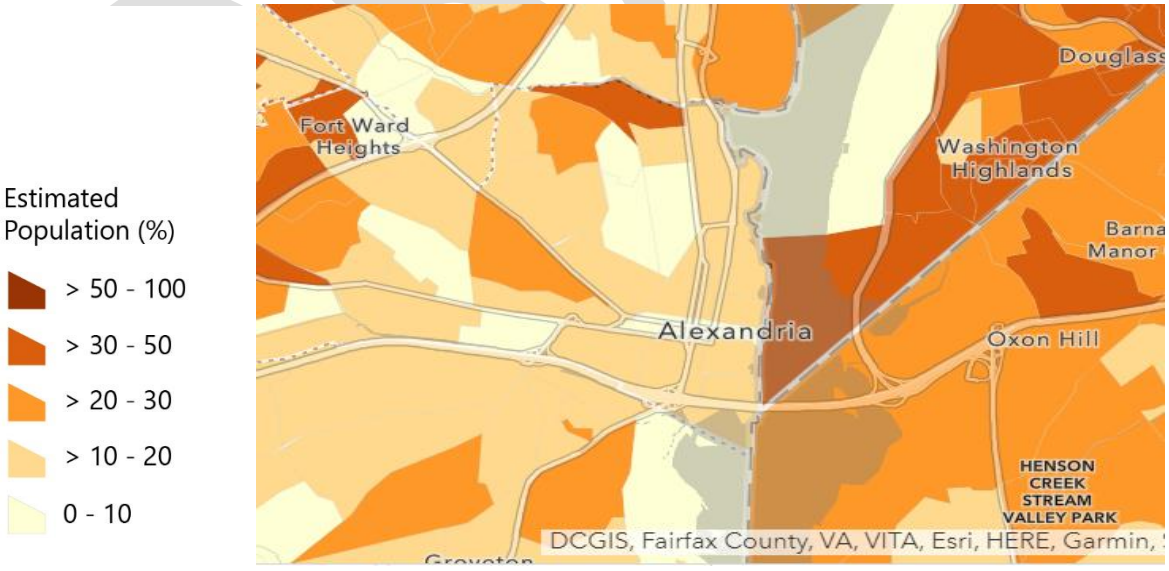
The NRI calculation does not follow the same criteria and formulas used in the hazard risk ranking methodology for this plan but is provided as a comparative measurement tool.

7.2. Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household level risk factors.

The index produces aggregate-level (Census tract, county, and state) small area estimates, thus providing a tool for evaluating how at-risk specific neighborhoods might be to disasters due to characteristics that potentially make specific segments of the population more vulnerable to the impacts and consequences of disasters. The ten risk factors[21] include the following:

1. Income-to-poverty ratio
2. Single or zero caregiver household
3. Unit-level crowding
4. Communication barriers
5. Aged 65 years or older
6. Lack of full-time or year-round employment (household)
7. Disability
8. No health insurance coverage
9. No vehicle access (household)
10. No broadband internet access (household)



[20] National Risk Index, Community Report – Alexandria City, Virginia. Retrieved at: Community Report - Alexandria City, Virginia | National Risk Index (fema.gov)

Figure 10: Community Resilience Estimate, City of Alexandria[22]

The estimate is categorized into three groups: zero risks, one or two risks, and three or more risks. The combination of data and analysis described in this section provides a comprehensive representation of the City's risk, vulnerability, and resilience to all hazards.

7.3. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

- The risk of cyber-related incidents on critical infrastructure and key resource sites
- Impacts of climate change
- Increases in the number of excessive rainfall events that impact new areas with flooding

8. Mitigation Actions

8.1. Goals and Objectives

The City of Alexandria Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

The comprehensive list of previous mitigation actions, including descriptions of progress made and the current status, is presented in **Attachment 3** of this annex.

8.3. New Mitigation Actions

In addition to the actions carried forward from previous plans, the City of Alexandria Planning Team identified two new mitigation actions to include in this plan to address expansion and strengthening of the Office of Emergency Management and Homeland Security's continuity program by increasing the resilience of City operations and coordinating with FEMA to re-evaluate flood zones and update Flood Insurance Rate Maps (FIRMs) as a basis for future National Flood Insurance Program Activities. **Attachment 3** of this annex includes a table that summarizes each new and continued action, describing the proposed activity, priority level, estimated cost, and lead agency.

8.4. Action Plan for Implementation and Integration

The Action Plan for Implementation and Integration describes how the City's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 30: Action Plan for Implementation and Integration, City of Alexandria

[22] Community Resilience Estimate, 2019. Retrieved at: 2019 Community Resilience Estimates (arcgis.com)

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plan.	When the City's comprehensive emergency operations plan undergoes updates, add mitigation action goals and action items into the plan, as applicable.
Review/update land development regulations for consistency with mitigation goals.	Ensure Mitigation Goals are accounted for during annual building development review. Additionally, ensure input to the Commonwealth building code updating process reflects mitigation goals.
Review/update building/zoning codes for consistency with mitigation goals.	Ensure Mitigation Goals are accounted for during annual building development review. Additionally, ensure input to the commonwealth building code updating process reflects mitigation goals.
Maintain regulatory requirements of floodplain management program (NFIP).	This is maintained in the floodplain ordinance that has higher standards than the NFIP minimum requirements.
Enhance floodplain management through Community Rating System (CRS).	Ensure annual CRS report includes progress with mitigation goals.
Review/Update economic development plan and policies for consistency with mitigation goals.	
Continue public engagement in mitigation planning.	Continue holding events to educate the public about mitigation planning efforts during National Preparedness Month.
Identify opportunities for mitigation education and outreach.	Reach out to local NGOs to learn about potential community outreach opportunities that we can join.
Review/update stormwater plans and procedures for consistency with mitigation goals.	Mitigation goals are a review point when stormwater plans and procedures are updated.
Review/update emergency plans to address evacuation and sheltering plans.	
Maintain ongoing enforcement of existing policies.	All departments with mitigation goals consistently enforce existing policies.
Monitor funding opportunities.	Monitor for grant funding opportunities and complete budget-building process for longer term projects.
Incorporate goals and objectives into day-to-day government functions.	
Incorporate goals into day-to-day development policies, reviews, and priorities.	All departments include awareness of mitigating risks in the development of policies, reviews, and priorities.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 31: City of Alexandria Plan Maintenance Responsibilities for the Northern Virginia Hazard Mitigation Plan (Base Plan)

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP Base Plan**, the City of Alexandria Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in the fifth year

Table 32: City of Alexandria Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with jurisdiction planning team. 2. Review the status of all mitigation actions, using the *Mitigation Action Implementation Worksheet* (**Section 3, Attachment A, NOVA HMP Base Plan**).	• Produce an annual report that includes the following: ▪ Status update of all mitigation actions ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities ▪ Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	1. Schedule the annual plan evaluation with jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the *Planning Considerations Worksheet* (**Section 3, Attachment C, NOVA HMP Base Plan**).	• Submit the annual report to the NOVA HMP Planning Team Point of Contact
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

The City of Alexandria will continue to be a planning partner with multiple jurisdictions and regional entities to identify hazard mitigation opportunities that reduce the risk of the hazards identified in this plan.

10. Annex Adoption

The City of Alexandria Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation Plan*.

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

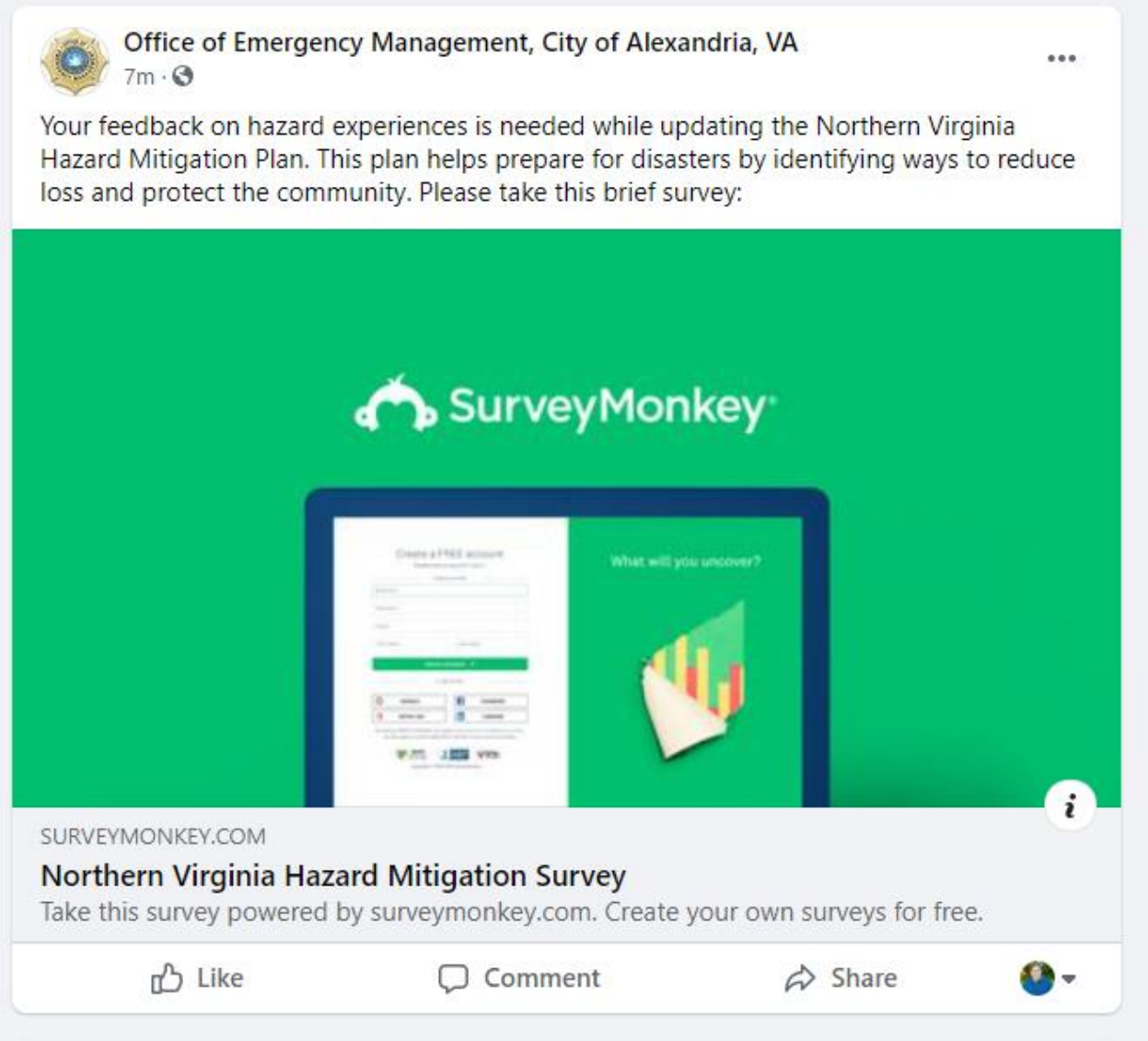
[This page is a placeholder for the Adoption Resolution for this Jurisdiction]

11.2. Attachment 2: Documentation of Public Participation

The participants of the Northern Virginia All Hazards Mitigation Plan Update provided a survey link to the general public using public outreach on social media, county or city websites, and other means of outreach to their citizen for their comments and concerns about the natural and non-natural hazards that affect their area.

The survey was opened on August 8th, 2021, and closed on November 3rd, 2021, with over 1,000 responses coming in over that period of time. The City of Alexandria had 15 responses. A detailed summary of the survey is available in Appendix A of the Base Plan

There were 2 questions that got almost the same answer from everyone that took the survey, and those responses identified the natural hazard of climate change and the non-natural hazard of the pandemic to be the most concerning hazards for those who resided in the Northern Virginia Area.



From: Alexandria eNews
To: Kevin Coleman
Subject: Public Input Wanted on Northern Virginia Hazard Mitigation Plan; Comment Period Open Through October 8
Date: Tuesday, September 13, 2022 12:05:12 PM

Public Input Wanted on Northern Virginia Hazard Mitigation Plan; Comment Period Open Through October 8

For Immediate Release: September 13, 2022

Winter weather, flooding, high wind/severe storms, and human infectious diseases are the natural disasters most likely to cause widespread economic loss and personal hardship in Northern Virginia. Public input on the draft 2022 Northern Virginia Hazard Mitigation Plan (NOVA HMP) will help identify steps needed to minimize damage from natural disasters.

The Federal Disaster Mitigation Act of 2000 requires communities to update their plan every five years to maintain eligibility for FEMA's Hazard Mitigation Assistance (HMA) grant programs. The NOVA HMP aims to minimize the long-term risk to human life and property from known hazards such as floods, winter weather high winds, and other major disasters. Hazard mitigation efforts could include projects such as flood channel clearing, road and bridge design changes, property buy-outs, building code changes, or public alert systems improvements.

The 2022 NOVA HMP is a multi-jurisdictional plan that covers the cities of Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park; the counties of Arlington, Fairfax, Loudoun, and Prince William; and the towns of Clifton, Dumfries, Haymarket, Herndon, Leesburg, Lovettsville, Middleburg, Occoquan, Purcellville, Quantico, Round Hill, and Vienna. The plan update also incorporates the concerns and needs of other stakeholders.

"The City of Alexandria has experienced flooding in various parts of the jurisdiction for years, and it continues to be a hazard for our area," said Acting Emergency Manager Ray Whatley. "The Office of Emergency Management strongly encourages the Alexandria community to provide feedback on the draft NOVA Hazard Mitigation Plan to help guide future preparedness, prevention, and improvement efforts."

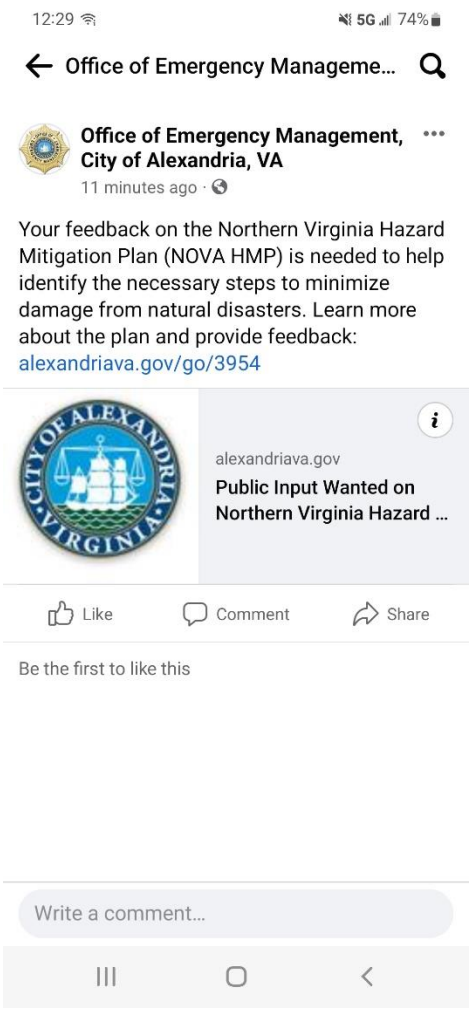
Community feedback and comments are currently being accepted. View the draft plan at https://www.nvers.org/hmp. Comments, questions, and feedback should be submitted no later than 5 p.m. Saturday, October 8, 2022, at NOVA2022PublicComment@iem.com.

For more information about the draft 2022 NOVA HMP, contact Deputy Emergency Manager Kevin Coleman at (703) 746-5267 or kevin.coleman@alexandriava.gov.

For media inquiries only, contact Raytevia Evans, Senior Public Information Officer, at (703) 746-5190 or raytevia.evans@alexandriava.gov.

###

This news release is available at alexandriava.gov/go/3954.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Office of Emergency Management, City of Alexandria, VA
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Your feedback on the Northern Virginia Hazard Mitigation Plan (NOVA HMP) is needed to help identify the necessary steps to minimize damage from natural disasters. Learn more about the plan and provide feedback: alexandriava.gov/go/3954
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11.3. Attachment 3: Mitigation Actions

Table 33: Previous Mitigation Actions

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2006-1	Adopt revised FIRM.	Transportation and Environmental Services	Flood, Wind, Severe Storm	Internal funding	11-May	Complete final adoption public review as prescribed by NFIP.	Critical	Completed
2006-6	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.	Transportation and Environmental Services	Flood, Wind, Severe Storm	FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	Promotion of mitigation is included as part of the City's annual outreach program associated with FEMA's Community Rating System (CRS) annual recertification.
2010-3	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.	Transportation and Environmental Services	Flood, Wind, Severe Storm	Internal funding	Ongoing	Develop outreach materials or identify appropriate outreach materials for dissemination by June 2011.	Medium	Included as part of the City's annual outreach program associated with FEMA's Community Rating System (CRS) annual recertification.

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-4	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	Emergency Management	Flood, Wind, Severe Storm	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Query local government building services staff as to effectiveness of provided information regarding the structural review.	Medium	Submitted LEMPG for generators
2010-5	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.	Transportation and Environmental Services	Flood, Wind, Severe Storm	Local program	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	The City's floodplain ordinance was revised in April 2011 to comply with NFIP minimum standards. The city conducted a Repetitive Loss Area Analysis in 2012. Annual report updates are published as part of the annual CRS recertification.
2010-7	Re-grade section of lower King Street, Union Street and The Strand to improve drainage and minimize flooding.	Project Implementation	Flood, Wind, Severe Storm	Alexandria Capital Improvement Project funding	Ongoing	Integrate into capital improvement budgets; complete design and permitting.	Low	Engineering Feasibility Study completed in 2013. Project now part of the Water Front Plan Implementation.

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-8	Construct an elevated walkway along Potomac riverfront to elevation 6.0 feet (NAVD88) to mitigate flooding.	Project Implementation	Flood, Wind, Severe Storm	Alexandria Capital Improvement Project funding and developer contributions	Ongoing	Integrate into capital improvement budgets; complete design and permitting.	Low	Part of the Waterfront Plan Implementation. Design contract in place February 2016.
2016-1	Build permanent standalone EOC.	Emergency Management	All Hazards	CIP	Dec-18	Entering Phase 2 of construction process.	High	Completed
2016-2	Identify and exploit the most effective tools for communications with the public during emergencies, including leveraging emerging technologies.	Emergency Management	All Hazards	Internal funding	Ongoing	3,000 new subscribers to e-News for receipt of emergency alerts by end of 2018.	Medium	No
2016-3	Four Mile Run Stream Restoration.	Transportation and Environmental Services	Flood, Wind, Severe Storm	Internal funding	Nov-18	Complete final adoption public review as prescribed by NFIP.	High	Project completed.
2016-4	Litter control infrastructure to provide a capture area for debris before it flows into the Potomac River.	Recreation, Parks, Cultural Activities	Flood	Alexandria Capital Improvement Project funding with matching funds from Arlington County	Nov-18		Medium	Approved FY 2017 - FY 2026 CIP. Page 126

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2016-5	Excavate sediment from channel bed of Cameron Run - I495 bridge to upstream, as needed.	Transportation and Environmental Services	Flood	City of Alexandria CIP	Ongoing	Secure funding for project by March 2011	High	The City does excavate sediment from Cameron Run starting at the I495 bridge to upstream as needed.

Table 34: New Mitigation Actions

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2022-1	Identify and exploit the most effective tools for communication and coordination with all internal agencies and stakeholders in the EOC.	Emergency Management	All Hazards	Internal funding	Ongoing		Medium	
2022-2	Alexandria Flood Action Initiative	Transportation and Environmental Services	Flood, Wind, Severe Storm	Alexandria Operating Budget	Ongoing	Communication and engagement of the community for flooding related information, large stormwater capital infrastructure projects, small stormwater spot improvement projects, updates on maintenance activities, grant programs, etc.	High	Initiative to provide improved communications to the community and consolidate improvements to city infrastructure, including maintenance activities, storm sewer capital improvements, and flood early warning. Serves as a portal to stormwater and flooding related activities citywide.
2022-3	Public Flood Watch Rain Gauge Portal	Transportation and Environmental Services	Flood	Alexandria Operating Budget	Ongoing	Publicly available on October 1, 2021	High	Part of the Flood Action initiative for engagement. Allows anyone to view near real-time rainfall and monitor storms as they move through the city, providing residents an early-warning in the case of extreme rainfall.

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2022-4	E Glebe & Commonwealth & Ashby Storm Sewer Capacity Project	Transportation and Environmental Services	Flood	Alexandria Capital Improvement Program funding	25-Mar	When contracts executed for Design & Construction.	High	Major storm sewer infrastructure capacity improvement in the Four Mile Run Watershed.
2022-5	Hooffs Run Timber Branch Bypass.	Transportation and Environmental Services	Flood	Alexandria Capital Improvement Program funding	25-Mar	When contracts executed for Design & Construction.	High	Major storm sewer infrastructure capacity improvement in the Hooffs Run Watershed.
2022-6	Hume Ave Inlets & Check Valve.	Transportation and Environmental Services	Flood	Alexandria Capital Improvement Program funding and ARPA funding	22-May	When contracts executed for Design & Construction.	High	Local storm sewer system spot improvement. Addresses inlet capacity at the curb and installs a check valve to improve local neighborhood drainage in flood prone neighborhood.
2022-7	Hume Ave Storm Sewer Bypass.	Transportation and Environmental Services	Flood	Alexandria Capital Improvement Program funding and ARPA funding	23-Mar	When contracts executed for Design & Construction.	High	Local storm sewer system spot improvement. Addresses storm sewer capacity with a new pipe alignment to improve local neighborhood drainage in flood prone neighborhood.

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2022-8	Mt Vernon Ave cul de sac Storm Sewer Improvements.	Transportation and Environmental Services	Flood	Alexandria Capital Improvement Program funding and ARPA funding	23-Mar	When contracts executed for Design & Construction.	High	Local storm sewer system spot improvement. Addresses inlet capacity with new inlets, storm sewer extension, and check valves to improve local neighborhood drainage in flood prone neighborhood.

Northern Virginia Hazard Mitigation Plan

Annex 3: City of Fairfax

November 2022

City of Fairfax Overview

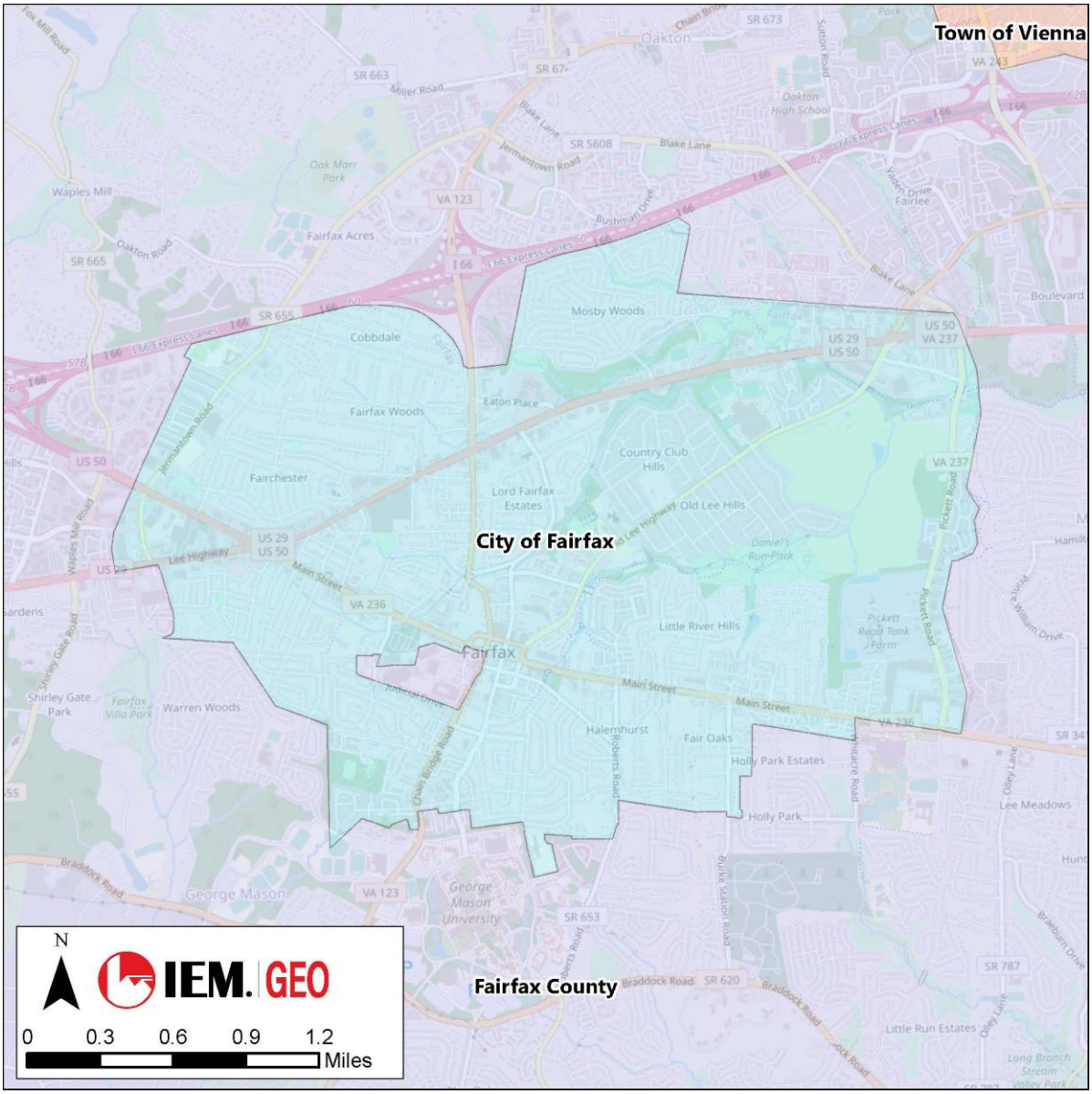

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1961	6.3 sq. mi.	24,146	10455 Armstrong St. Fairfax, VA 22030	8,751	Flood/Flash Flood/Winter Weather

City of Fairfax

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

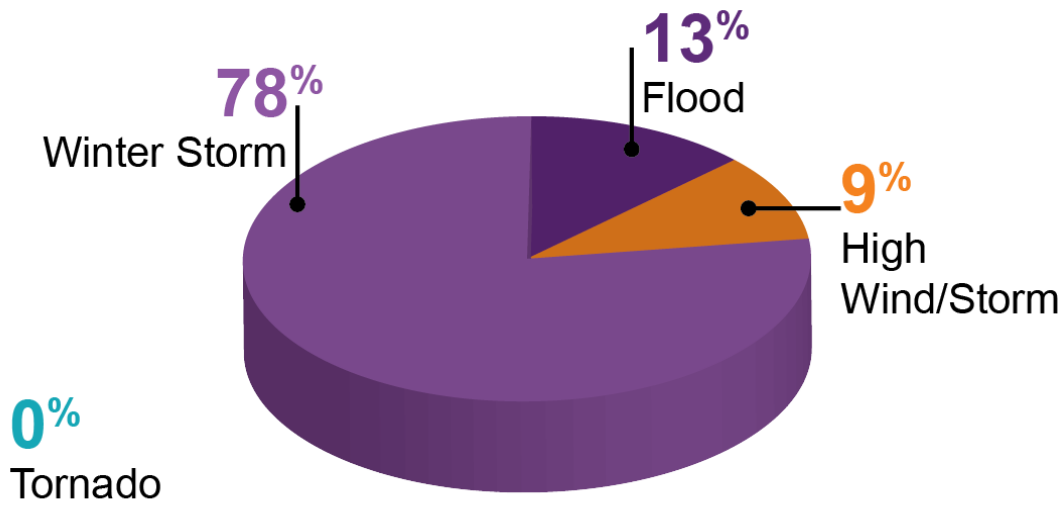

Figure 1: Percentage of Hazards

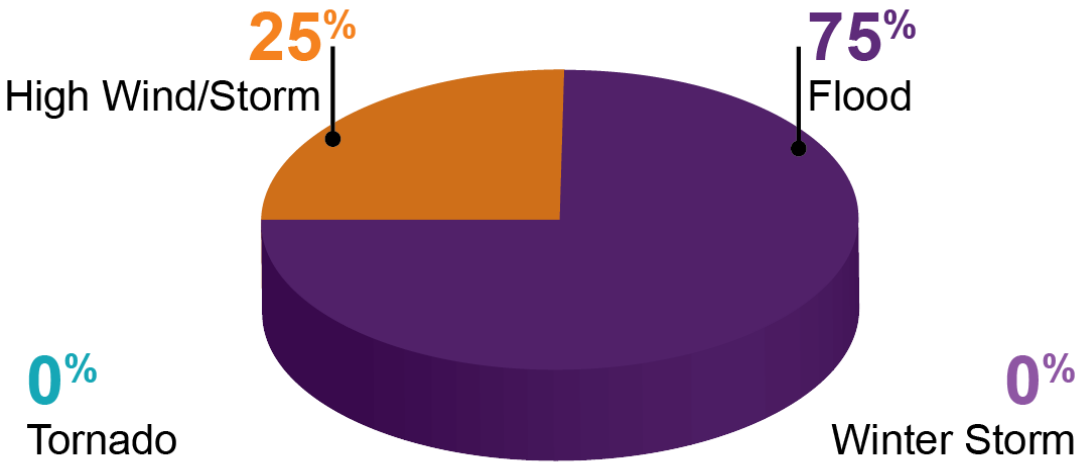

Figure 2: Property Damage Percentages from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Ranking of Natural Hazards by Risk

Hazard	Hazard Ranking
Winter weather	**High**
Flood	**High**
High wind/severe storm	**High**
Dam failure	**Medium**
Tornado	**Medium**
Extreme temperatures	**Medium**
Drought	**Medium**
Earthquake	**Medium**
Wildfire	**Low**
Karst/sinkhole/land subsidence	**Low**
Landslide	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	4
Food, Water, Shelter	0
Health and Medical	0
Energy	0
Communications	1
Transportation	6
Hazardous Materials	1
Education	9
Cultural/Historical	4
High Hazard Dams	0

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for the City of Fairfax

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Contact Type	Contact Information
Point of Contact	Walter English, Deputy Emergency Management Director City of Fairfax 703-934-8427 walter.english@fairfaxva.gov 10455 Armstrong Street Fairfax, VA 22030
Secondary Point of Contact	John O'Neal, Emergency Management Director 4081 University Drive Fairfax, VA 22030

City of Fairfax

This annex presents the following jurisdiction-specific information provided by the City of Fairfax for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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1. Jurisdiction Profile

Established	1961
Incorporated Towns	0
Total Land Area	6.3 square miles
Geographic Region	Piedmont/Coastal Plain
Persons Per Household	2.59
Persons Per Square Mile	3,833
Median Age	38

1.1. Location

The City of Fairfax is an independent city identified by the Commonwealth of Virginia, surrounded by the separate political entity of Fairfax County.

1.2. History

The City derives its name from Thomas Fairfax, Sixth Lord Fairfax of Cameron, who was awarded 5,000,000 acres of land in northern Virginia by King Charles. The area that the City now encompasses was settled in the early eighteenth century by farmers from Virginia's Tidewater region.

1.3. Demographics, Economy, and Governance

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context for the overall plan. The 2020 U.S. census for the City of Fairfax shows an approximately 7.0% population increase since 2010. The City is densely populated with 3,833 residents per square mile.

Table 6: Demographics, Economy, and Governance in the City of Fairfax[1]

Year	Population	Change
1970	22,727	
1980	20,537	-10%
1990	19,945	-3%
2000	21,650	9%
2010	22,565	4%
2020	24,146	7%

[1] *City of Fairfax Fact Book*. Retrieved at: https://www.fairfaxva.gov/government/community-development-planning/demographics-and-statistical-profile; Virginia Employment Commission; United States 2020 Census.

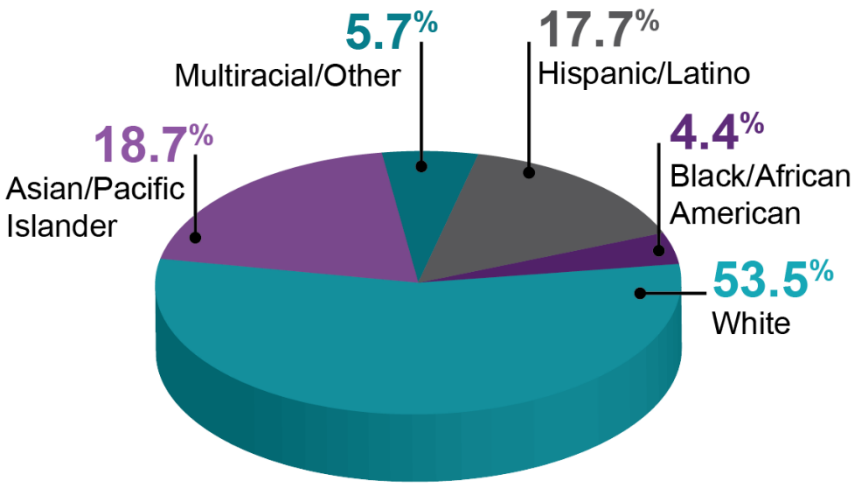


Figure 4: Race and Ethnicity Demographics

Table 7: Economic Data

Economy	Data
Median Household Income (2019)	$109,708
Unemployment Rate (September 2021)	5.6%
Per Capita Income (2019)	$50,029
Median House or Condo Market Value (2019)	$405,800
Percentage Below Poverty (2019)	6.9%

1.4. Built Environment and Community Lifelines

The information related to Community Lifelines and critical assets in the City of Fairfax presented in this section has been collected from multiple sources, including the City of Fairfax Department of Emergency Management and Security, Hazus-MH® software (Version 4.2), and the Census. Data extracted from the Hazus Level 1 assessment indicates that the City of Fairfax has an estimated total of 25 Community Lifelines and critical assets.

This table provides a summary of the number of critical assets by type. The City of Fairfax maintains a detailed list of Community Lifeline facilities, sites, and critical assets.

Table 8: Number of Community Lifelines and Critical Assets in the City of Fairfax

Lifeline/Sector	Number of Assets
Safety and Security	4
Food, Water, Shelter	0
Health and Medical	0
Energy	0
Communications	1

Lifeline/Sector	Number of Assets
Transportation	6
Hazardous Materials	1
Education	9
Cultural/Historical	4
High-Hazard Dams	0

1.4.1. Safety and Security

The City of Fairfax has two fire stations and one district police station as of April 2021. In addition, there is one Emergency Operations Center, which is in the same building as the 911 dispatch center, and an alternate Emergency Operations Center.

1.4.2. Food, Water, Shelter

Food commodities are available throughout the City of Fairfax from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

1.4.3. Health and Medical

The Inova emergency care medical center is identified inside the City of Fairfax. City residents also use Fairfax County, the District of Columbia, or other areas for treatment and care.

1.4.4. Energy

No energy facilities are listed in the City of Fairfax.

1.4.5. Communications

Most communications and information systems and infrastructure in the United States are privately owned; however, the county maintains authority and control over public safety communications for fire, police, and other responding agencies. The City of Fairfax does have one broadcast building, however, that provides services to the City.

1.4.6. Transportation

The maintenance of transportation facilities and systems is the responsibility of the owner or entity with authority, including municipal, county, state, and federal highway departments and agencies; toll and rail authorities; and the military.

The City of Fairfax owns and operates its own transportation system. The Transportation Division oversees all transportations planning and projects and includes roads, trials, sidewalks, City-University Energysaver (CUE) bus system, cycling and dockless mobility program.

The Hazus database notes a total of six transportation structures, facilities, or segments, including the following:

- Highway Bridges – 6

1.4.7. Hazardous Materials

One oil refinery is identified in the Hazus database. The location has four buildings, which are owned by gas companies with contracts to use the site.

1.4.8. Education

The City of Fairfax currently has nine education facilities teaching kindergarten through high school.

1.4.9. Recreational, Cultural and Historic Sites, and Assets

There are 488 acres of public open space[2] within the City that are primarily used for parks, recreation, and athletic fields.

The City of Fairfax maintains a master list of four historic sites and assets of special architectural, historic, archaeological, or cultural value to residents and visitors. These sites are designated by the National Register of Historic Places, Virginia Landmarks Register, and/or the Historic Overlay District.

1.5. Growth and Development Trends

The City of Fairfax, like most other jurisdictions in Northern Virginia, has maintained significant growth in the past decades and faces considerable pressure for future development. Commercial and retail properties are aging and becoming less competitive with other jurisdictions, creating opportunities for redevelopment that could interact with hazard risks in the future.

Transportation corridors provided by Interstate 66 on the northern border, and the Metrorail Orange Line from Washington have increased the overall growth in the City. Population growth projections indicate a continuous and steady increase in residents in the next two decades.

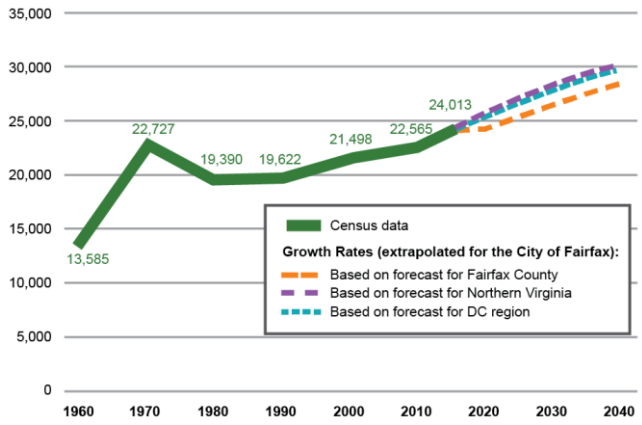


Figure 5: Population History and Forecasts, City of Fairfax, 1960–2040[3]

[2] City of Fairfax Demographics and Statistical Profile. Retrieved at: https://www.fairfaxva.gov/government/community-development-planning/demographics-and-statistical-profile

[3] United State Census and Metropolitan Washington Council of Governments, Cooperative Forecasting. Retrieved at: https://www.fairfaxva.gov/home/showpublisheddocument/12376/636873772980700000

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the City of Fairfax followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the NOVA HMP Planning Team, the City supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction. Participants in the local planning activities are listed in Table 9.

Table 9: Local Planning Group Participants

Name	Position or Title	Agency
Walter English	Deputy Emergency Coordinator	City of Fairfax
John O'Neal	Fire Chief/ Emergency Coordinator	City of Fairfax
Michelle Coleman	Zoning Administrator	City of Fairfax
Brook Hardin	Director of Community Development and Planning	City of Fairfax
Satoshi Eto	Public Works Program Manager	City of Fairfax
Mike Wood	Emergency Management Specialist	City of Fairfax

Fairfax identified its chief hazard mitigation planning responsibility as providing oversight in the planning process and representation in the Emergency Managers Group. The City also identified the following tasks as part of its mitigation planning responsibilities:

- Management support for the planning effort
- Planning Group resource/subject matter expert
- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Public outreach activities
- Implementation of the Plan
- Maintaining the Plan

The City of Fairfax planning participants coordinated primarily with virtual meetings during the planning process. Planning activities were independently carried out as needed using a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the NOVA HMP Planning Team meetings is included in the **Base Plan, Appendix A.**

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a posting of the NOVA hazard mitigation public survey on the City's website and access to the draft plan for review and input.

In addition to the survey, the public was offered the opportunity to review and provide input to the Draft 2022 Plan update. Notification of the release of the Draft Plan was made through the same website. Documentation of the public survey and draft plan review is in **Attachment 2** of this annex.

3. Jurisdiction-Specific Hazard Event History

The City of Fairfax's comprehensive hazard history is described in **Section 5, Base Plan**. The diversity of the landscape increases the vulnerability to a variety of hazards, most notably flooding and severe storms. In addition to snowmelt and rain-related river flooding episodes, low-lying areas of the city along the Potomac River are also subject to tidal and storm surge flooding. As sea levels rise, permanent inundation of low-lying areas along and near the river shoreline is also a threat. Additionally, winter storms pose significant threats, as evidenced during the 2015–2016 winter season, which resulted in a Federal Disaster Declaration.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,478 recorded natural meteorological events that took place in the City between January 1, 1950, and May 2021. The City has been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 10: Federal Disaster and Emergency Declarations (2017–2021), City of Fairfax[4]

Declaration	Date	Hazard	Assistance Type
DR 4512	April 2020	Virginia COVID-19 Pandemic	PA-B
EM 3448	March 2020	Virginia COVID-19 Pandemic	PA-B
EM 3403	September 2018	Virginia Hurricane Florence	PA-B

Table 11: Significant Hazard Events Identified by the City of Fairfax, 2017–2021

Date	Hazard	Event and Description
02/05/2010	Winter Storm	Snowfall amounts between 20 and 28 inches were received across the county. Power outages were reported throughout the county due to the weight of the snow on trees and power lines.
08/27/2011	Tropical Storm	Hurricane Irene tracked up the Mid-Atlantic Coast during the evening hours of the 27th through the early morning hours of the 28th. Irene passed by just to the east of Ocean City, Maryland, during the early morning hours of the 28th. The minimum central pressure was 958 millibars and maximum sustained winds were 80 mph, making Irene a category one hurricane.
06/19/2006	Thunderstorm Wind	A strong cold front moved from the Ohio Valley in the early morning of June 19, then across the Mid Atlantic during the late afternoon and evening. This cold front fired strong to severe thunderstorms as it encountered an atmosphere that was rich in moisture and very unstable. In addition to numerous occurrences of damaging wind gusts of around 60 mph across the Baltimore-Washington corridor, there

[4] FEMA, Federal Disaster Declarations, 2017–2021.

Date	Hazard	Event and Description
		were also several instances of flash flooding. Numerous cars were stuck in flooded roadways across both Northern Virginia and Central and Southern Maryland. Strong winds also occurred on the tidal waters of the Potomac River and the Maryland portion of the Chesapeake Bay.

4. Hazard Risk Ranking

After developing hazard profiles, the City of Fairfax Planning Team conducted a two-step quantitative risk assessment for each hazard considering population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of the following risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4.2, Base Plan**. The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5, Base Plan**, and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II** of this Plan.

Table 12: Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter weather	3.7	3.5	7.2	**High**
Flood	1.7	4.2	5.9	**High**
High wind/severe storm	2.7	3.2	5.8	**High**
Dam failure	1.0	4.5	5.5	**Medium**
Tornado	1.3	4.2	5.5	**Medium**
Extreme temperatures	2.7	2.5	5.2	**Medium**
Drought	2.0	3.2	5.2	**Medium**
Earthquake	1.7	3.2	4.9	**Medium**
Wildfire	1.0	3.0	4.0	**Low**
Karst/sinkhole/land subsidence	1.0	2.5	3.5	**Low**
Landslide	1.0	2.5	3.5	**Low**

Table 13: Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious disease/public health	3.0	5.8	8.8	**High**
Terrorism	1.0	6.4	7.4	**High**
Cyberattack	2.0	4.7	6.7	**High**
Civil unrest	1.3	5.0	6.3	**Medium**
Communication disruption	1.3	3.7	5.0	**Medium**
Hazardous materials	1.0	3.9	4.9	**Low**
Active violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, the City of Fairfax evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Six natural hazards were identified as high- or medium-risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter weather, flood (riverine/flash flood), and high wind/severe storm
- **Medium:** Dam failure, drought, earthquake, extreme temperatures, and tornado

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious disease/public health, terrorism, cyber attack
- **Medium:** Civil unrest, communication disruption

All other hazards are ranked as “low,” signifying a minimal risk to the City of Fairfax.

4.1. Additional Hazard Risk Considerations

4.1.1. Flood/Flash Flood (Hazard Ranking: High)

Table 14: Flood/Flash Flood Events in the City of Fairfax 1950–May 31, 2021

Flood/Flash Flood Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
6	1	0	$2,500,000	0	$2,500,000

4.1.2. High Wind (Hazard Ranking: High)

This table presents the number of severe storm events documented in the NCEI Storm Events Database, including high wind, and impacts on people, property, and crops.

Table 15: High Wind/Severe Storm Events in the City of Fairfax, 1950–May 31, 2021

High Wind and Severe Storm Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
17	0	1	$816,000	30,000	$846,000

4.1.3. Winter Weather (Hazard Ranking: High)

Table 16presents the number of severe winter storm events documented in the NCEI Storm Events Database, including blizzards, heavy snow, winter storm, and winter weather.

Table 16: Severe Winter Storm Events in the City of Fairfax, 1950–May 31, 2021

Winter Weather Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
39	2	4	$5,000	0	$5,000

Other hazard information for the City of Fairfax is presented in the **Base Plan**.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

The City of Fairfax is a participant in the National Flood Insurance Program (NFIP). In addition, the City participates in the voluntary Community Rating System (CRS) program under the NFIP with a CRS Class of 6, which is associated with a 20% flood insurance discount for policyholders.

Table 17: National Flood Insurance Program Status, City of Fairfax[5]

Initial FHBM Identified	Initial FIRM Identified	Current Eff Map Date	Reg-Emer Date	CRS Entry Date	Current Eff Date	CRS Class	% Disc SFHA	% Disc Non-SFHA
5/5/1970	12/23/1971	6/2/2006	12/17/1971	-	10/1/2014	0	0	0

Table 18: NFIP Policy and Claims Status, City of Fairfax[6]

Policy Statistics		Claim Statistics	
Policies In-Force	Premiums Paid	Total Claims	Total Payment
70	$55,705	16	$19,356

Table 19: NFIP Status, as of June 2021

NFIP Topic	Source of Information	Comments
Insurance Summary		
How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (CFM) Estimate from FEMA	245 in the 2006 adopted floodplain 180 in the 2020 preliminary maps pending adoption

[5] National Flood Insurance Program Community Status Book
[6] FEMA NFIP Community Status Report, September 9, 2021

NFIP Topic	Source of Information	Comments
Describe any areas of flood risk with limited NFIP policy coverage	CFM and FEMA Insurance Specialist	From the 2019 Community Assistance Visit: None were identified.
Staff Resources		
Is the Community FPA or NFIP Coordinator certified?	Community FPA	No, completed certification course.
Is floodplain management an auxiliary function?	Community FPA	Yes, the floodplain regulations are contained in the Zoning Ordinance that is administered and enforced by the Zoning Administrator who has been designated as the FPA
Explain NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	Floodplain permit review requirement for development in the floodplain; GIS floodplain mapping.
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	None
Compliance History		
Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Are there any outstanding compliance issues (i.e., current violations)?		Progressively investigating the 17 potential pre- and post-FIRM violations identified in the CAV
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		April 29, 2019

5.2. Population

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations. The CDC SVI depicts the vulnerability of communities at the census tract level, by county, into fifteen census-derived factors grouped into four themes—socioeconomic status, household composition/disability, race/ethnicity/language, and housing type/transportation. *Social vulnerability* refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills.

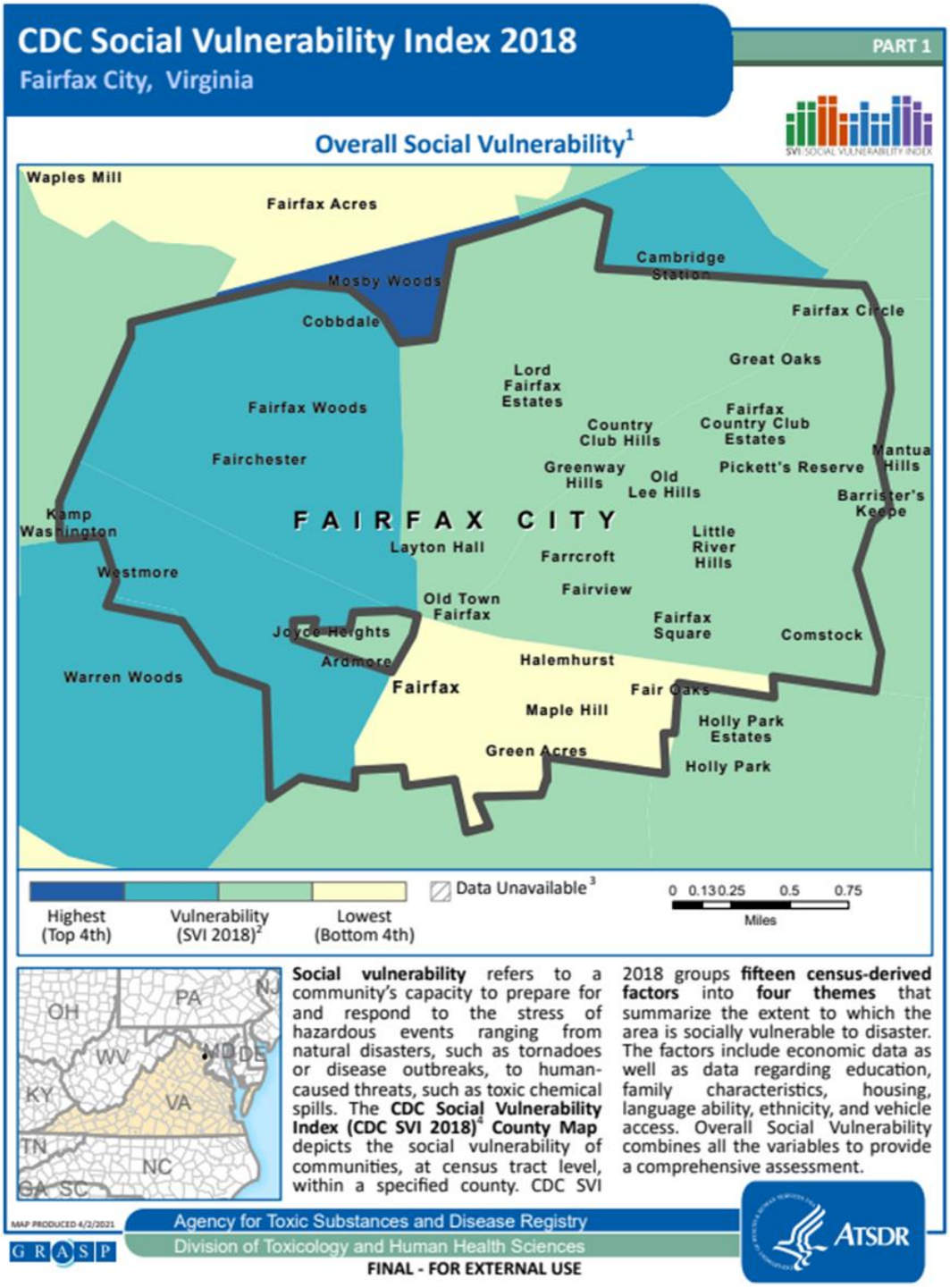


Figure 6: Overall Social Vulnerability (2018), City of Fairfax[7]

[7] Centers for Disease Control and Prevention, Social Vulnerability Index. Retrieved at: Virginia2018_Fairfax city.pdf (cdc.gov)

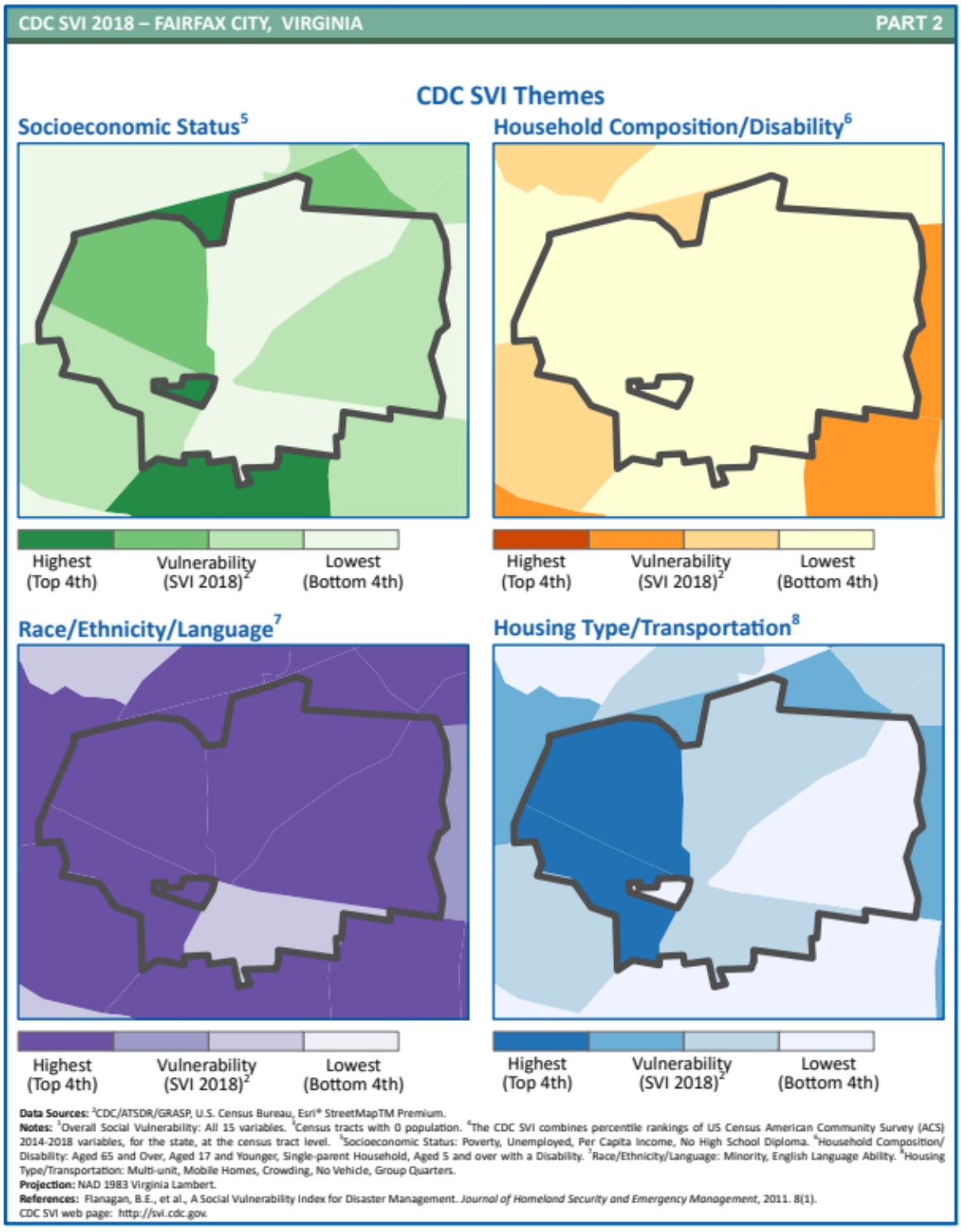


Figure 7: Social Vulnerability, by Theme, City of Fairfax[8]

[8] Ibid.

The themed maps illustrate the City's higher level of vulnerability within the race/ethnicity/language theme, demonstrating the importance of communicating essential hazard mitigation, preparedness, response, and recovery information to the public in alternate formats and multiple languages.

5.3. Built Environment

Based on data currently available through Hazus, the tables presented in this section provide a total number of exposed facilities and properties regarding earthquake, flood, and hurricane wind.

Table 20: Building Stock Exposure by General Occupancy[9]

Type	Amount
Residential	$3,164,151,000
Commercial	$1,210,584,000
Industrial	$135,723,000
Agricultural	$12,501,000
Religion	$110,828,000
Government	$13,954,000
Education	$33,368,000
TOTAL	**$4,681,107,000**

5.4. Community Lifelines and Assets

The City of Fairfax reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA. None listed in the Hazus runs have been compiled.

Table 21: Critical Facilities Exposed to FEMA Floodplains, City of Fairfax

Facility Type	Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
Highway Bridges	6	3	2
Highway Segments	24	6	1

[9] Hazus Building Stock Exposure Report, 2500-Year, 6.5 Magnitude Earthquake. August 3, 2021.

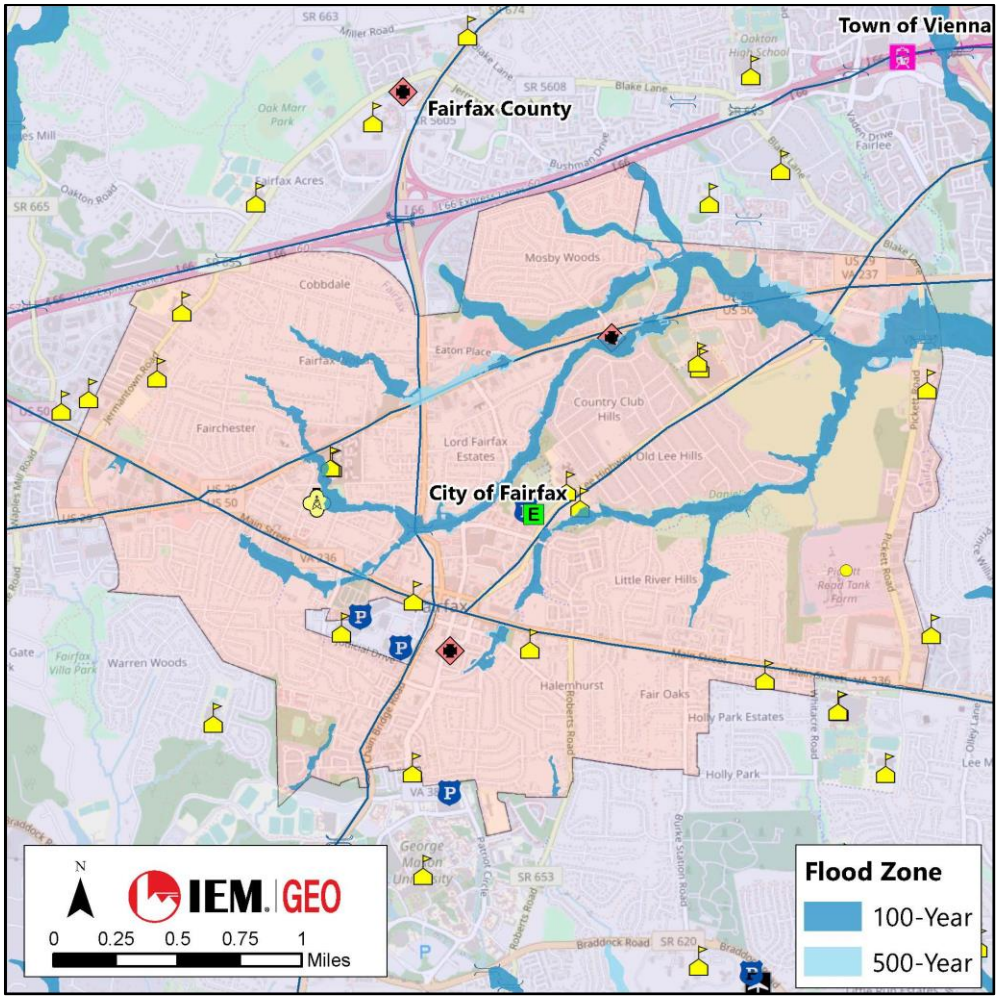


Figure 8: Critical Facilities in Flood Zones

5.5. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

5.6. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses related to a 2,500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets.

Table 22: Direct Economic Losses Related to Earthquake, Flood, and Hurricane Wind

Hazard	Buildings (capital stock and income)	Transportation	Utilities
Earthquake	$67,670,000	$127,000	$88,000
Flood	0	0	0

Hazard	Buildings (capital stock and income)	Transportation	Utilities
Hurricane Wind	$2,584,000	0	0

5.7. Cultural/Historical

Information related to the vulnerability of cultural and historical assets is presented in the hazard-specific sections of the **Base Plan**.

Historic structures and sites are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites.

Table 23: Cultural and Historic Properties Exposed to FEMA Floodplains, City of Fairfax

Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
6	0	0

6. Capability Assessment

The City of Fairfax reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the City of Fairfax completed a Jurisdiction Needs Identification Questionnaire that summarized capability changes and enhancements since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the levels of capability for each assessment category to identify where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans, and/or resources, and it can implement most mitigation actions.

Table 24: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary

The City utilizes the all-hazards approach when developing any jurisdictional plans, including emergency operations, and continuity of operations, as well as the hazard mitigation plan.

The following plans have been newly developed or updated since the 2017 HMP:

- Comprehensive Plan, 2020 and 2035
- Capital Improvement Plan, 2020–2024
- Local Emergency Operations Plan, 2021
- Flood Insurance Rate Map Updates (in progress)
- Continuity of Operations Plan (COOP), 2022
- Council of Governments (COG) Plan, 2022

Capability Analysis: High

Significant planning and regulatory tools are in place within the City of Fairfax and bring to light successes in integrating hazard mitigation planning with existing planning mechanisms. This demonstrates that the jurisdiction recognizes the benefit of incorporating hazard mitigation in local planning and regulatory processes such as the Comprehensive Plan, Capital Improvement Plan, and land development and floodplain regulations, and how to use these to develop and implement mitigation actions. Combining some of the plan into an overall, stormwater or floodplain management plan, etc. Currently, Public Works and Community Development/Zoning have separate plans. Noted areas for improvement include combining some of the plans into an overall, stormwater, or floodplain management plan. Currently, Public Works and Community Development/Zoning have separate plans, which could be combined to condense efforts across divisions.

6.1.2. Administrative and Technical Capabilities Summary

- Planning and Zoning staff include planners, engineers, and a floodplain manager with an understanding of natural and non-natural hazards who are integrated into mitigation planning.
- The City maintains an Information Technology department with GIS personnel.
- City emergency management, health department, fire department, and other staff are familiar with the community's hazards.

The City identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and implementation of the plan:

- Community Development and Planning
- Energy and Environment
- Emergency Management
- Information Technology
- Health Department
- Public Works

Capability Analysis: High

The City of Fairfax has a robust staffing capability that provides a high level of coordination for mitigation planning and action implementation. While enhancements in the City's administrative and technical capabilities were gained through an increase in department and agency positions resulting from the COVID-19 pandemic, the need for continuing education and training as well as funding for positions offer areas for improvement. Capability can be improved through better coordination of staffing and mitigation efforts across Emergency Management, Public Works, and Community Development/Zoning.

6.1.3. Safe Growth Capabilities Summary

- A land map clearly identified natural hazard areas.
- Goals and policies of the comprehensive plan were related to those of the FEMA-approved Local Hazard Mitigation Plan.
- The small areas or corridors plan recognized the need to avoid or mitigate natural hazards.

Capability Analysis: Moderate

The City of Fairfax can benefit from adding staff and funding to enhance the capabilities of the City and ensure appropriate development in areas that will be safe for infrastructure and residents.

6.1.4. Financial Capabilities Summary

- The City's Capital Improvements Plan provides funding for projects outside of the jurisdiction's annual operational budget.
- The City has the authority to incur debt through general obligation bonds and/or special tax bonds, as well as fees for utility services and impact fees for new development.
- The City utilizes a stormwater utility fee for stormwater management.
- The City intends to access BRIC, stormwater management, and flood mitigation funding programs for future mitigation actions.

Capability Analysis: Moderate

Onsite work restrictions imposed during the COVID-19 pandemic beginning in March 2020 and continuing throughout 2021 presented challenges to staff availability and coordination. To address these shortfalls, the jurisdiction may access technical assistance available to potential applicants provided by many grant programs or expand capabilities to develop and manage mitigation actions through contracted services. The City will work with businesses to ensure they meet zoning and floodplain requirements and continue to identify more funding opportunities and leverage existing funds for better mitigation opportunities.

6.1.5. Education and Outreach Capabilities Summary

- Work with local citizen groups and non-profits focusing on environmental protection
- Emergency Management does community outreach for all hazards via Engage Fairfax.
- Natural disaster safety-related school programs
- Community Rating System initiatives within the NFIP program can increase public awareness of and involvement in hazard mitigation.

Capability Analysis: Moderate

Jurisdictions have multiple opportunities to promote hazard mitigation and increase the involvement of stakeholders and the public. There is a critical need to inform the additional stakeholders and the public about the benefits of hazard mitigation planning and implementation. Virginia Department of Emergency Management mitigation staff can provide technical assistance to support increased jurisdictional involvement. The City identified ways to expand education and outreach by increasing public outreach to teach about the hazards in the area and mitigation actions. In addition, increasing outreach opportunities in multiple languages, including the deaf and hard-of-hearing community will extend the reach of hazard mitigation.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, the City of Fairfax identified activities related to each natural hazard that support risk reduction.

Table 25: Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Dam failure (including levees)	• Public education and operational plans address preparedness and response to reduce risk.
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledging the importance of protecting the natural environment.
Earthquake	• State and International building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme temperature	• Public education and operational plans address preparedness and response to reduce risk.
Flood/flash flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited.

Hazard	Activity
	• Stormwater management programs and projects address flood prevention and risk reduction.
High wind/severe storm	• State and international building codes provide for wind-load design regulations.
Karst/sinkhole/land subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Winter weather	• Public education and operational plans address preparedness and response to reduce risk.
Non-natural hazards	• Public education and operational plans address preparedness and response to reduce risk. • Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate change	• Ongoing resilience planning and utilizing the Fairfax County *Community-wide Energy and Climate Action Plan* will allow for the identification and mitigation of climate change related issues in future planning cycles.

7. Resilience to Hazards

7.1. National Risk Index

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of "low risk" is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

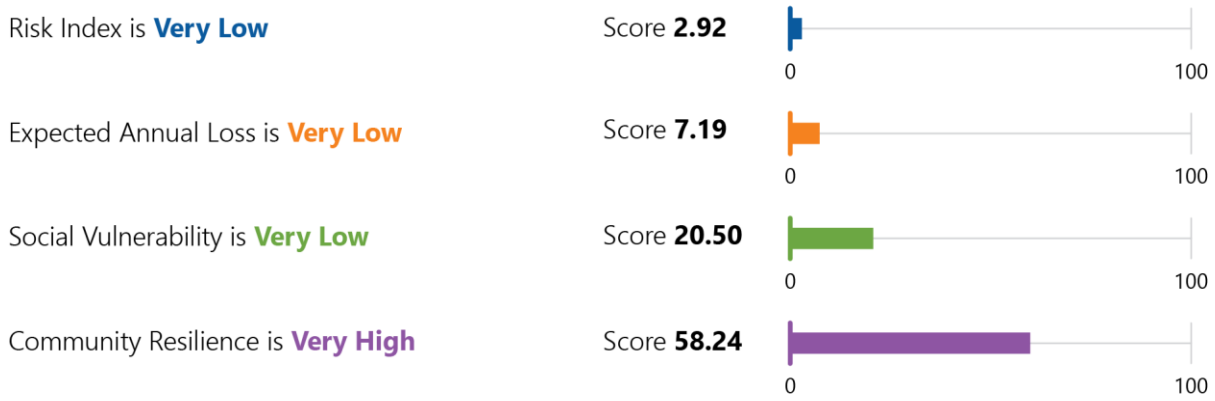


Figure 9: Summary of National Risk Index Findings, City of Fairfax[10]

The National Risk Index (NRI) is a dataset and online tool developed by the Federal Emergency Management Agency (FEMA) and other partners to help illustrate communities in the United States at risk for 18 natural hazards. Hazard risk is calculated on data for a single hazard type and reflects its relative risk. The relative risk measurement should be considered only as a baseline for a general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently from the hazards in this plan; therefore, a direct hazard-to-hazard comparison of risk is indeterminable.

Based on the NRI findings, the highest five hazards by risk rating for the City of Fairfax are winter weather, strong wind, tornado, cold wave (known within this plan as extreme cold), and heat wave (known within this plan as extreme heat). Lightning, ice storm, hail, and riverine flooding received lower risk ratings; however, 14 of the 15 hazards rated for risk were all determined to be "very low," with one hazard (heat wave) determined as "relatively low."

[10] National Risk Index, Community Report for City of Fairfax.

Hazard Types	Risk Index Rating	Risk Index Score	
Avalanche	Not Applicable	--	
Coastal Flooding	Not Applicable	--	
Cold Wave	Very Low	4.68	0 100
Drought	No Rating	0.00	0 100
Earthquake	Very Low	1.09	0 100
Hail	Very Low	5.24	0 100
Heat Wave	Relatively Low	4.08	0 100
Hurricane	Very Low	1.89	0 100
Ice Storm	Very Low	2.35	0 100
Landslide	Very Low	5.23	0 100
Lightning	Very Low	5.76	0 100
Riverine Flooding	Very Low	2.68	0 100
Strong Wind	Very Low	6.09	0 100
Tornado	Very Low	6.36	0 100
Tsunami	Not Applicable	--	
Volcanic Activity	Not Applicable	--	
Wildfire	No Rating	0.00	0 100
Winter Weather	Very Low	4.80	0 100

Figure 10: Hazard Type Risk Index, National Risk Index

The NRI calculation does not follow the same criteria and formulas used in the hazard risk ranking methodology for this plan but is provided as a comparative measurement tool.

Table 26: City of Fairfax Risk Ranking

Index	Rank
Risk	2.92
Expected Annual Loss	7.19
Social Vulnerability	20.50
Community Resilience	58.24

Table 27: Comparison of City of Fairfax Risk Index Scores with Virginia and National Averages

Index	City of Fairfax	Virginia Average	National Average
Risk	2.92	6.50	10.60
Expected Annual Loss	7.19	9.22	13.33
Social Vulnerability	20.50	35.32	38.35
Community Resilience	58.24	54.92	54.59

7.2. Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household level risk factors.

The index produces aggregate-level (census tract, county, and state) small area estimates providing a tool for understanding how at-risk specific neighborhoods might be to disasters due to characteristics that may make specific segments of the population more vulnerable to the impacts and consequences of disasters. The 10 risk factors include the following:

1. Income-to-poverty ratio
2. Single or zero caregiver household
3. Unit-level crowding
4. Communication barrier
5. Aged 65 years or older
6. Lack of full-time or year-round employment (household)
7. Disability
8. No health insurance coverage
9. No vehicle access (household)
10. No broadband internet access (household)

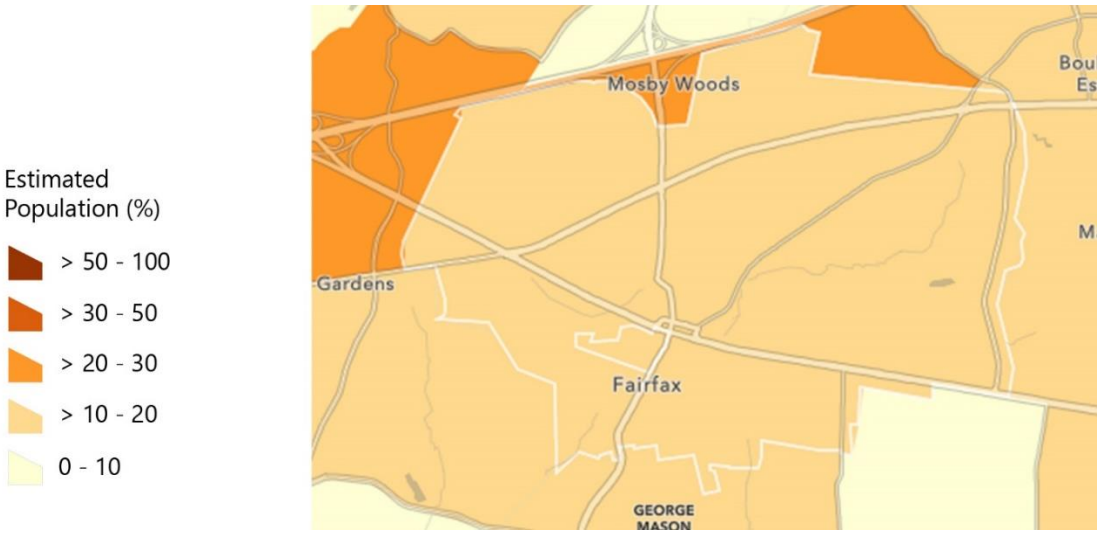


Figure 11: Community Resilience Estimate[11]

The estimate is categorized into these three groups:

- Zero risks,
- One to two risks, and
- Three or more risks

The combination of data and analysis described in this section provides a comprehensive representation of the City's risk, vulnerability, and resilience to all hazards.

7.3. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

The City of Fairfax Planning Team identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- The risk of cyber-related incidents on critical infrastructure and key resource sites
- Impacts of climate change
- Increases in the number of excessive rainfall events that impact new areas with flooding

[11] Community Resilience Estimates, U.S. Census. Retrieved at: 2019 Community Resilience Estimates (arcgis.com)

8. Mitigation Actions

8.1. Goals and Objectives

The City of Fairfax Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

The comprehensive list of previous mitigation actions, including descriptions of progress made and current status, is presented in **Attachment 3** of this annex.

8.3. New Mitigation Actions

In addition to the actions carried forward from previous plans, the City of Fairfax Planning Team identified two new mitigation actions to include in this plan to address the expansion and strengthening the of the Office of Emergency Management and Security's continuity program by increasing the resilience of county operations, and to coordinate with FEMA to re-evaluate flood zones and update Flood Insurance Rate Maps (FIRMs) as a basis for future National Flood Insurance Program Activities. **Attachment 3** of this annex includes a table that summarizes each new and continued action, describing the proposed activity, priority level, estimated cost, and lead agency.

8.4. Action Plan for Implementation and Integration

The Plan for Implementation and Integration describes how the City's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 28: Action Plan for Implementation and Integration, City of Fairfax

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into a local comprehensive plan.	When the City's comprehensive plan undergoes 5-year update, add mitigation action goals and action items into the plan, as applicable.
Review/update land development regulations for consistency with mitigation goals.	When the City's land development regulations undergo an update, add mitigation actions goals and action items into the plan, as applicable.
Review/update building/zoning codes for consistency with mitigation goals.	Current fire marshal is looking to include mitigation into the building codes.
Maintain regulatory requirements of floodplain management program (NFIP).	Continue to do this using the floodplain manager.
Enhance floodplain management through Community Rating System (CRS).	Become a CRS community
Review/Update economic development plan and policies for consistency with mitigation goals.	Office to ensure that when plan updates occur, they are coordinating with mitigation goals.

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Continue public engagement in mitigation planning.	Continue holding events to educate the public about mitigation planning efforts during National Preparedness Month, and other appropriate times, including Flood Safety Awareness Week.
Identify opportunities for mitigation education and outreach.	Look into partnership with local NGOs.
Review/update stormwater plans and procedures for consistency with mitigation goals.	Currently being revised to include mitigation goals and objectives.
Review/update emergency plans to address evacuation and sheltering.	Ensure timely review and update as needed.
Monitor funding opportunities.	Continue to investigate and apply for funding sources to use for mitigation planning and actions.
Incorporate goals and objectives into day-to-day government functions.	Increase frequency of tree-trimming operations to minimize or eliminate the effect of ice weighing down tree limbs and downing power lines, especially along Old Lee Highway.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the NOVA HMP Planning Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan** and is responsible for initiating the annual activities, convening the Planning Team, and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 29: City of Fairfax Plan Maintenance Responsibilities for the Northern Virginia Hazard Mitigation Plan, Base Plan

Activity	Responsibilities
Monitoring the plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP, Base Plan**, the City of Fairfax Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in the fifth year

Table 30: City of Fairfax Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the annex	1. Schedule the annual plan review with the jurisdiction planning team. 2. Review the status of all mitigation actions, using the Mitigation Action Implementation Worksheet **(NOVA HMP Base Plan, Section 3, Attachment A)**.	Produce an annual report that includes the following: • Status update of all mitigation actions • Summary of any changes in hazard risk or vulnerabilities and capabilities • Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the annex	1. Schedule the annual plan evaluation with the jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the Planning Considerations Worksheet **(NOVA HMP Base Plan, Section 3, Attachment C)**.	Submit the annual report to the NOVA HMP Project Team Point of Contact
Updating the annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Adopt the updated plan while following the FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

The City of Fairfax will continue to be a planning partner with multiple jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan.

10. Annex Adoption

The City of Fairfax Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation Plan*.

11. City of Fairfax Attachments

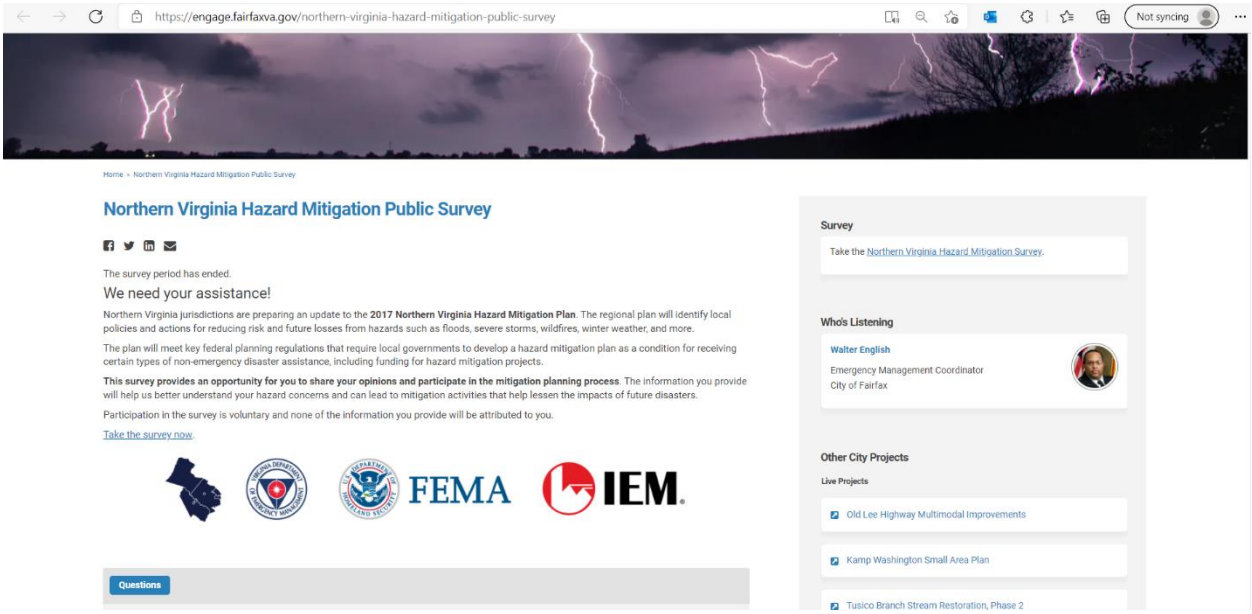
- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Actions

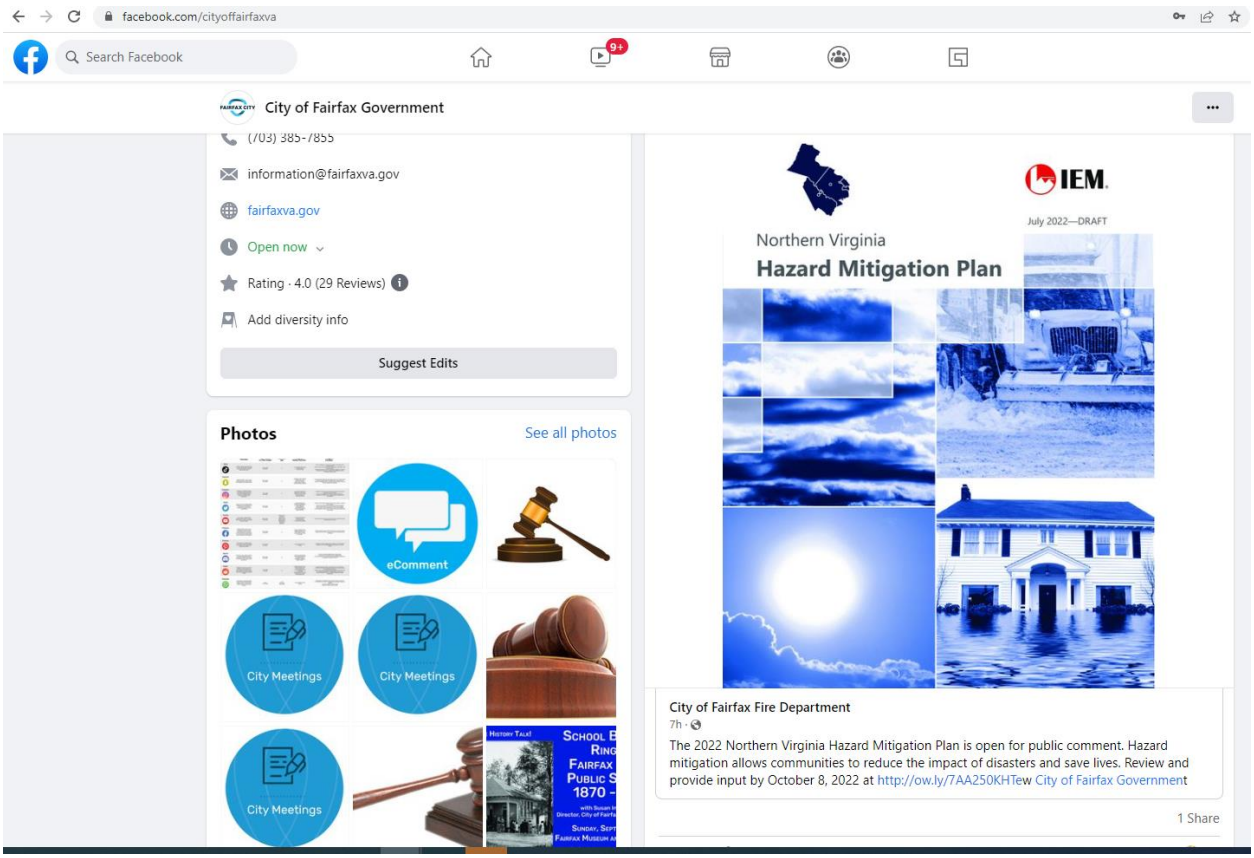
11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Documentation of Public Participation

The following social media post reflects the advertisement of the public hazard mitigation survey and final draft public comments. The survey and results are captured in **Appendix A** of the **Base Plan**.

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IEM
July 2022—DRAFT
Northern Virginia
Hazard Mitigation Plan
City of Fairfax Fire Department
7h ·
The 2022 Northern Virginia Hazard Mitigation Plan is open for public comment. Hazard mitigation allows communities to reduce the impact of disasters and save lives. Review and provide input by October 8, 2022 at http://ow.ly/7AA250KHTew City of Fairfax Government
1 Share

11.3. Attachment 3: Mitigation Actions

Table 31: Previous Mitigation Actions

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2006-7	Consider becoming members of the Community Rating System.	Public Works	• Flood • High wind/ severe storm	FEMA Unified Hazard Mitigation Assistance Grants	2019	Secure funding by January 2018	High	Action carried over from previous plan; still relevant and necessary
2010-1	Secure funding and conduct a safety analysis of the gas tank farm within the City. Consider hardening the facility.	Fire Department	• All hazards	UASI funding, FEMA Unified Hazard Mitigation Assistance Grants, Hazard Mitigation Grant Program	Target completion date 2025	Secure funding by 2023	High	Action carried over from previous plan; still relevant and necessary
2010-5	Identify and secure funding to conduct a generator cost estimate for city shelters.	Office of Emergency Management	• All hazards	FEMA Unified Hazard Mitigation Assistance Grants	December 2018	Secure funding as available by HMPG	Medium	Action carried over from previous plan; still relevant and necessary; some progress has been accomplished since previous, but work remains to be done
2010-6	Consider posting permanent evacuation signs on City-operated evacuation routes.	Office of Emergency Management	• Damn failure • Earthquake • Flood	FEMA Unified Hazard Mitigation	2023	Have identified where and how many signs will be needed. Create and put	Medium	Action carried over from previous plan;

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
			• High wind/ severe storm • Landslides • Tornado • Wildfire • Winter storm	Assistance Grants		up signs once funding secured		still relevant and necessary
2010-10	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risks.	Public Works	• Flood • High wind/ severe storm	FEMA Unified Hazard Mitigation Assistance Funding	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by 2023	Medium	Action carried over from previous plan; still relevant and necessary
2010-11	Support mitigation of priority flood-prone structures through the promotion of acquisition and demolition, elevation, flood-proofing, minor localized flood control projects, mitigation reconstruction, and where appropriate and feasible, using FEMA HMA programs.	Public Works	• Flood • High wind/ severe storm	FEMA Unified Hazard Mitigation Assistance Funding	2025	Identify all priority flood-prone structures by 2023	Medium	Action carried over from previous plan; still relevant and necessary
2010-12	Promote structural mitigation to assure redundancy of critical	Office of Emergency Management	• Flood	FEMA Unified Hazard Mitigation	Ongoing	Query local government building	Medium	Action carried over from previous plan;

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, and more.		• High wind/ severe storm	Assistance Funding		services staffs as to the effectiveness of provided information regarding the structural review		still relevant and necessary
2010-13	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct an annual review of repetitive loss and severe repetitive loss property list requested by VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and a determination whether that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.	Public Works	• Flood • High wind/ severe storm	City funding	Ongoing	Establish a schedule of review and review committee, if necessary, by 2022. Review and update yearly, as needed	Medium	Action carried over from previous plan; still relevant and necessary

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-1	Increase departmental awareness regarding funding opportunities for mitigation.	Office of Emergency Management	All hazards	City funding	Ongoing	Conduct yearly outreach to interested parties related to FEMA hazard mitigation grant programs	Low	
2017-2	Conduct a building assessment and analysis to identify vulnerability to extreme heat.	Public Works	Flood	City funding	September 2019	Prioritize City building for assessment, completing one every 3 months	Low	
2017-3	Develop repository for storage and access of hazard, risk, and vulnerability data for all city assets.	Office of Emergency Management/ Information Technology	All hazards	City funding	2023	Implement a repository for needed access by city employees	Low	
2017-4	Prioritize critical facilities and complete site surveys to identify vulnerabilities.	Office of Emergency Management/ Public Works	All hazards	City funding	Ongoing	Implement a strategy to help identify critical facilities	Medium	
2017-5	Provide grants information, planning tools, training, and technical assistance to increase the number of hazard mitigation projects.	Office of Emergency Management	All hazards	City funding	Ongoing	Continue support of hazard mitigation planning, project identification, and implementation	Medium	

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-6	Offer user-friendly hazard-data accessibility for mitigation and other planning efforts and for private citizens.	Information Technology	All hazards	City funding	Complete by 2025	Update and maintain GIS information and maps of critical facilities inventories and information about hazards	Low	
2017-7	Implement mitigation projects and programs intended to reduce risk to critical facilities and critical infrastructure.	Public Works	All hazards	Hazard Mitigation Grants	Ongoing	Monitor the need for mitigation projects	High	
2017-8	Integrate hazard mitigation and notification system training into existing employed training.	Information Technology	All hazards	City funding	Ongoing	Add program to new employee orientation	Medium	
2017-9	Prioritize servers to ensure that critical data remains available during and after hazard events.	Information Technology	All hazards	City funding	October 2017	Identify all City-owned servers by 2017	Medium	
2017-10	Determine necessary equipment/ hardening to maintain administrative services during and after a hazard event.	Information Technology	All hazards	City funding/HMGP	January 2018	Develop a list of services needed to be maintained	Medium	
2017-11	Ensure all critical facilities have a storage location for generators or fuel or quick connects for temporary generator use.	Public Works	All hazards	City funding/HMGP	2023	Identify all City-owned facilities with and without generators	High	

Table 32: New Mitigation Actions

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority
2022-1	Increase public awareness of all hazards, specifically by providing outreach in multiple languages, including to the deaf and hard-of-hearing community.	Emergency Management	• All hazards	State Homeland Security Grant Program	2025	Continue or implement public awareness opportunities, including presentations	Low
2022-2	Identify vulnerable populations within the city.	Human Services	• All hazards	City budget	2023	Survey residents to identify those who are vulnerable	Medium
2022-3	Reduce public infrastructure in high hazard areas.	Zoning	• All hazards	City budget	2025	Ensure zoning and building plans include high-risk areas, especially areas that flood	Medium
2022-4	Ensure building code enforcement, which a specific focus on tall wooden buildings.	Fire Marshal, Code Enforcement	• High wind/severe storm • Tornado • Winter weather	City budget	2025	Establish a review schedule to ensure building codes are being enforced	Low

Northern Virginia Hazard Mitigation Plan

Annex 4: City of Falls Church

November 2022

City of Falls Church Overview

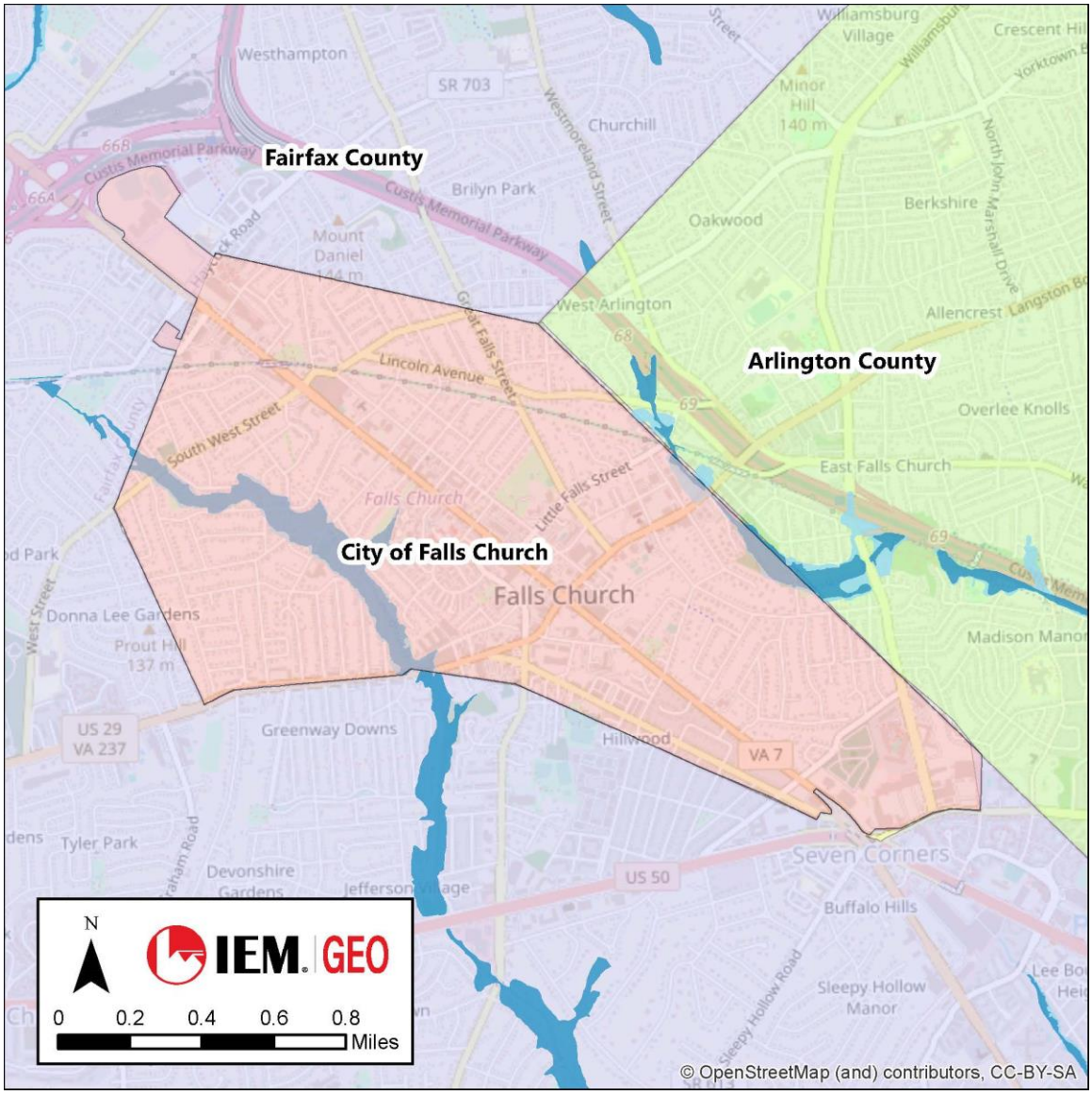

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1875 Incorporated 1948	2.2 sq. mi.	14,658	300 Park Ave. Falls Church, VA 22046	5,631	Flood/Flash Flood/High Wind/Severe Storms

City of Falls Church Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI), 1950–June 2021

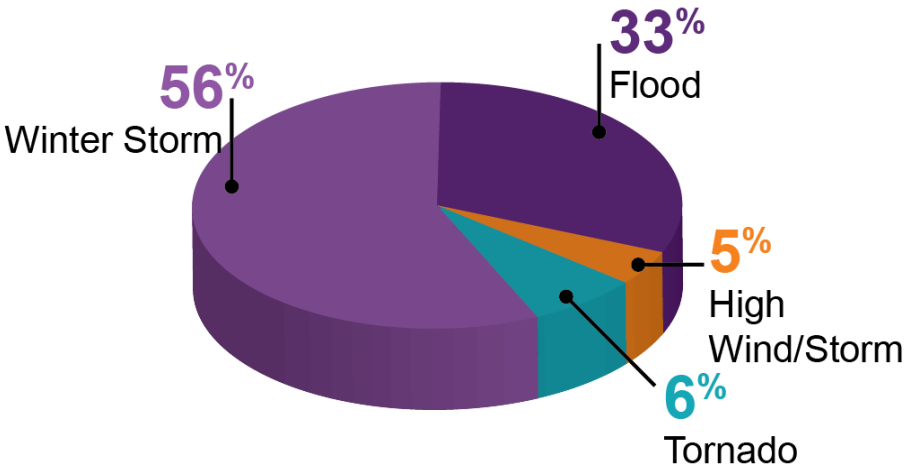

Figure 1: Percentage of Hazards

Natural Hazard Risk Ranking

Table 2: Ranking of Natural Hazards by Risk

Hazard	Hazard Ranking
Winter Weather	**High**
Flood	**High**
High Wind/Severe Storm	**High**
Dam Failure	**Medium**
Tornado	**Medium**
Extreme Temperatures	**Medium**
Drought	**Medium**
Earthquake	**Medium**
Wildfire	**Low**
Karst/Sinkhole/Land Subsidence	**Low**
Landslide	**Low**

Community Lifelines and Respective Critical Assets

Table 33: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	5
Food, Water, Shelter	2
Health and Medical	3
Energy	0
Communications	6
Transportation	3
Hazardous Materials	0
Education	19
Cultural/Historical	21
High Hazard Dams	0

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, service(s), or entity.

Figure 2: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for the City of Falls Church

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Mihai-Cristian Statie, Deputy Emergency Management Coordinator 703-248-5071 mstatie@fallschurchva.gov 7100 Gordons Road Falls Church, VA 22046
Secondary Point of Contact	Joe Carter, Emergency Management Coordinator 703-248-5061 jcarter@fallschurchva.gov 7100 Gordons Road Falls Church, VA 22046

City of Falls Church

This annex presents the following jurisdiction-specific information provided by the City of Falls Church for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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List of Tables

List of Figures

1. Jurisdiction Profile

Total Land Area	2.2 sq. mi.
Persons Per Household	2.53
Persons Per Square Mile	7,289
Elevations	Near sea level: 328 ft

1.1. Location

The City of Falls Church is a 2.2 square mile City located on the Mid-Atlantic Seaboard of the United States in the State of Virginia at Latitude: 38.886962 and Longitude: -77.172565. It is part of the Chesapeake Bay/Potomac River Watershed and even though it generally sits at an elevation of 300 feet above sea level, it is included in Virginia's Tidewater Zone. Jurisdictionally, the City is bounded by Fairfax County on the north and south and Arlington County on the East.

The City is located just miles from Washington, DC (City Hall is nine miles from the White House). Falls Church is access by Routes 66 and 50, the East and West Falls Church Metro Stations (Orange Line), and by a number of bus routes. Neither Metro station lies within the City's boundary.

The City's corporate boundaries do not include all of the area historically known as Falls Church; that area includes portions of Seven Corners and portions of the current Falls Church postal districts of Fairfax County, as well as the area of Arlington County known as East Falls Church, which was part of the town of Falls Church from 1875 to 1936. For statistical purposes, the U.S. Department of Commerce's Bureau of Economic Analysis combines the City of Falls Church with Fairfax City and Fairfax County.

1.2. History

Falls Church dates back to the late 1600s as an early colonial settlement shared with Native Americans. The community was established around The Falls Church (Episcopal) that was founded in 1734. Falls Church became a township in 1875, and an independent city in 1948.

1.3. Demographics, Economy, and Governance

1.3.1. Demographics

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context for the entire plan. The 2020 U.S. census population estimate for the City of Falls Church is 14,658, an increase of approximately 20.96% since 2010. The City is densely populated, with 7,289 residents per square mile. It is known as an urban village community, with many residents working in surrounding jurisdictions.

Table 6: Population and Growth Rate[1]

Year	Population	Change
1970	10,772	-

[1] United States Census, City of Falls Church website. Retrieved at: https://www.census.gov/quickfacts/fact/table/fallschurchcityvirginia/PST045221

Year	Population	Change
1980	9,515	-11.7%
1990	9,578	0.7%
2000	10,377	8.3%
2010	12,332	19.5%
2020	14,658	20.3%

As shown in Table 6, The City has been experiencing 20% growth over the last two decades. As of 2019 there were approximately 14,617 people living in the City. Between 2010 and 2019 the City's population grew by an estimated 2,285 people. If the current pace of growth continues in the City of Falls Church, more population growth will have occurred the decade between 2010 and 2020, than the two previous decades combined (1990 to 2010). Beyond just the number of new City residents, this population growth is changing the demographic landscape in the City.

The racial and ethnic makeup of the City is changing over time, with an increase in those identifying as Asian and two or more races, and in those identifying as white or African American since the 2000 census. The percentage of population identifying as Hispanic has increased from 8% in 2000 to 12.6% in 2019.

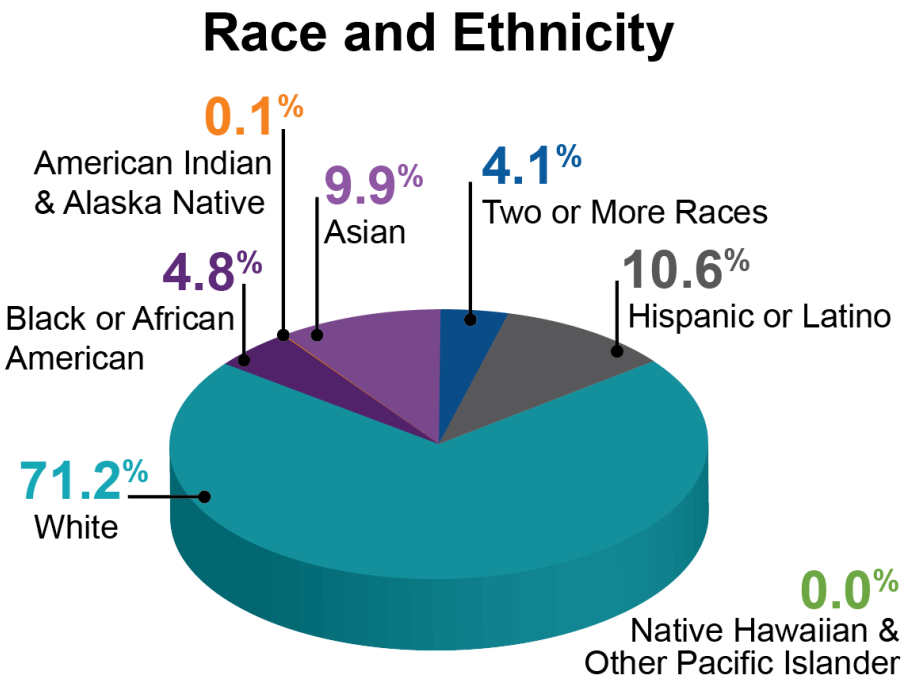


Figure 3: Race and Ethnicity Demographics from 2020 US Census

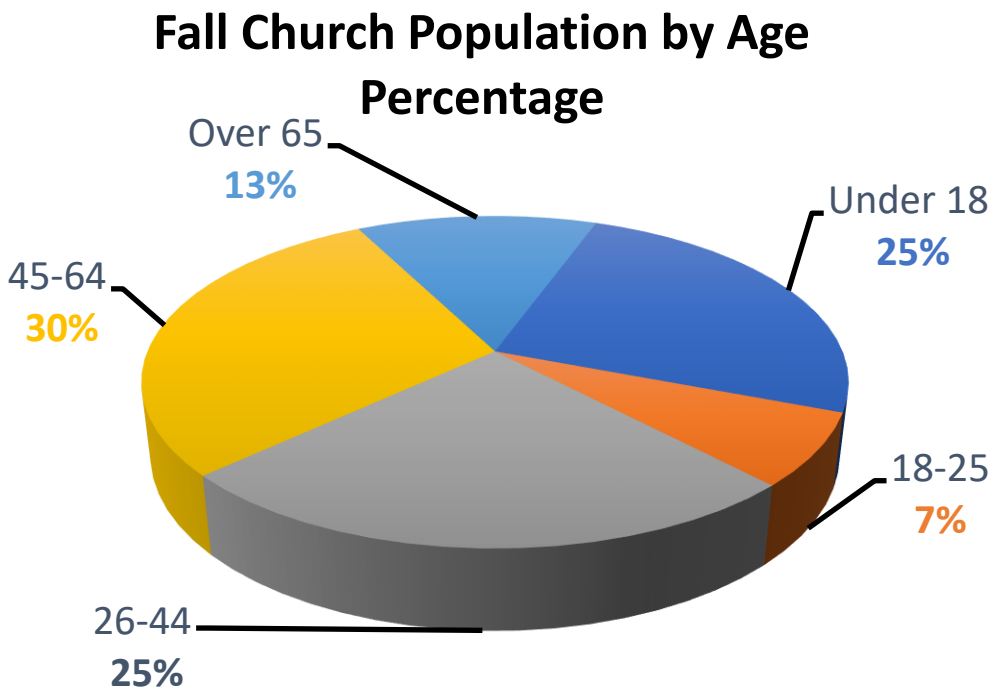


Figure 4: Population by Age Percentage

As can be seen in the table above, approximately 75% of the population is ether under the age of 18 of between the ages of 26 and 44. Seniors make up 13% and 18 – 25-year old's being the smallest group at 7%. These percentages have remained steady over the last 20 years.

1.3.2. Economy

The City's expanding tax base supports a high quality of life for residents, workers, and visitors. The City has a diverse economy that builds on the core niches of professional medical services, professional offices, and government services. The overall real estate tax base has risen by about 50 percent over the last decade. The current total real estate assessed value is $3,023,853,300*. Single-family residential property continues to provide the bulk of assessed value, approximately 70 percent.

City of Falls Church households earn more than surrounding jurisdictions. City residents are more likely to earn $150,000 or more than residents in Alexandria, Arlington, or Fairfax City. Of families in the City, 26% make over $200,000. In neighboring jurisdictions this percentage is 20%.

Table 7: Economic Data

Economy	Data
Median Household Income (2020)	$146,922
Unemployment Rate (September 2021)	3.9%
Per Capita Income (2020)	$73,288
Percentage Below Poverty (2020)	2.0%

1.3.3. Governance

The City of Falls Church is an independent city with county-level governance status, although it is not a county. The governance system is a Council Manager system, where the City Manager is responsible for the day-to-day operation of the City. Political authority is vested in the seven-member City Council, which enacts ordinances and resolutions, approves City budgets, sets tax rates, and establishes policy.

1.4. Built Environment and Community Lifelines

The information related to Community Lifelines and critical assets in the City of Falls Church presented in this section has been collected from multiple sources, including Hazus (Version 4.2) and city government websites. The current inventory maintained by the City of Falls Church indicates a total of 84 Community Lifelines and critical assets.

Table 8 provides a summary of the number of critical assets, by type. The City of Falls Church maintains a detailed list of Community Lifeline facilities, sites, and critical assets.

Table 8: Number of Community Lifelines and Critical Assets in the City of Falls Church

Lifelines	Number of Assets
Safety and Security	5
Food, Water, Shelter	2
Health and Medical	19
Energy	7
Communications	8
Transportation	3
Hazardous Materials	0
Education	19
Cultural/Historical	21
High Hazard Dams	0

1.4.1. Safety and Security

1.4.1.1. Law Enforcement/Security

As of July 2022, The City of Falls Church has one Public Safety Station, one sub-Station, and a Sheriff's Office. The Police Department and Sheriff's Office have the primary responsibility regarding safety and security. The cybersecurity domain is handled by the Information and Technology Department, under the coordination of Deputy City Manager.

1.4.1.2. Office of Emergency Management

The City has an Office of Emergency Management (OEM) also designated as Emergency Operations Center (EOC). The OEM is actively working and cooperating with the City Manager's Office, with all the

departments and offices that compose the City Government, as well as with the City Public Schools System to implement and fulfill the Government Functions, from its area of responsibility, regarding safety and security. The City has one primary office located at City Hall and there is also a City Maintenance Yard facility. The OEM has a designated EOC in both locations.

1.4.1.3. Fire Service/Search and Rescue

One Fire Station - the building belongs to the City of Falls Church, and the services are provided by the Arlington County and supported by Falls Church Volunteer Fire Department; Search and Rescue would also fall to these fire resources along with City Police.

1.4.2 Food, Water, and Shelter

Food and potable water commodities are available throughout the City of Falls Church from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs. The Gymnasium at the City's Community Center can shelter up to 162 persons. Also, the City has available a winter-only shelter for a maximum of 10 persons, located on Gordon Road, by the Property Yard.

1.4.2.1 Food

There are no permanent food distribution sites, Commercial Food Supply Programs or Food Banks located within the city limits of Falls Church. However, due to the metropolitan nature of the area, all of these things can be found in neighboring communities without traveling too far.

1.4.2.2 Water

The City of Falls Church drinking water comes from the Potomac River by way of the Washington Aqueduct which is managed by the Army Corps of Engineers. The City is directly serviced by a public nonprofit water utility named Fairfax Water. Fairfax Water has hundreds of miles of major pipelines and service lines within the City. However, there are no treatment facilities of any type within the City.
The City's manages the wastewater sewer system with over 100 miles of pipe. The water is treated at locations in Fairfax and Arlington Counties for which the City pays for.

1.4.2.3 Shelter

The Gymnasium at the City's Community Center can shelter up to 162 persons. Also, the City has available a winter-only shelter for a maximum of 10 persons, located on Gordon Road, by the Property Yard. There are a number of private resident homes in Falls Church. There are at least 6 hotels within the City Limits or just outside the city limits.

1.4.3 Health and Medical

The City of Falls Church has the following Heath and Medical Lifelines:
Hospitals with Emergency Rooms:

- Dominion Hospital (immediately outside City limits)
- Nova Fairfax Hospital Trauma 1 Center (immediately outside City limits)

Dialysis:

- Somatus of Falls Church
- US Renal Care of Falls Church

Pharmacies:

- Falls Church Pharmacy 6795 Wilson Blvd
- CVS 134 W. Broad Street
- CVS 1150 W. Broad Street

There are three health and medical buildings in the City of Falls Church. These facilities are not hospitals and they have limited capacities.

Long-term Care:

- The Kensington Falls Church
- Elder Options Senior Care
- Sunrise of Falls Church

In Home Care:

- Avalon In-Home Nursing
- Home Instead
- Human Touch
- Infinity Care

Veterinarians:

- Falls Church Animal Hospital
- Value Vet by Appointment
- Feline Veterinarian Clinic

Funeral Homes:

- Murphy Funeral Home
- Advent Funeral and Cremation Services

1.4.4 Energy

There are two energy companies with infrastructure is Falls Church:

- Dominion Power is responsible for the power distribution in the City. They have two large transmission lines that run through the City, each having 230,000 Volts being carried. Dominion also has over 80 miles of service lines within the City. There are no power plants or major sub-stations with the City.
- Washington Gas is responsible for distribution of natural gas with in the City. They have over 150 miles of gas lines that service the City. There are no major junctions or service areas within the City.

City of Falls Church has 4 fuel stations:

- Liberty Gas Station 702 S. Washington Street
- Citgo Gas Station 1200 W. Broad Street
- Allan's Hillwood Mart 100 Hillwood Ave
- Exxon 400 W. Broad Street

The City has its own fuel station, with a total capacity of 6,000 gallons of gasoline and 6,000 gallons of diesel, which serves the City's fleet (to include the school buses and vehicles).

1.4.5 Communications

The City government communicates with City residents through the Falls Church Alert system, Everbridge system, City of Falls Church website, and two social media platforms, Facebook and Twitter. In addition, there is a weekly newspaper in the City that covers all important aspects of the social life of the community. In addition, the City provides two emergency phone numbers for its residents, respectively 911 and 703-241-5050.

Most communications and information systems and infrastructure in the United States are privately owned; however, the City maintains authority and control over public safety communications for fire, police, and other responding agencies. In recent years, the federal government has assumed a stronger role in protecting information and communications infrastructure, which may also present a challenge in relation to disaster impacts. Increasing reliance on this infrastructure by individuals, businesses, and government could cause vulnerabilities. OEM is taking and will take into consideration these aspects in the pre- and post-incident planning and operations.

1.4.6 Transportation

The Hazus database notes a total of three transportation structures, facilities, or segments, including the following:

- Highway Bridges: 3

Major transportation corridors in and out of the City include:

- U.S. Highway 50, and US Interstate 66.
- Metrorail: Orange Line and Silver Line

In addition to Hazus Falls Church counts the following as lifelines
40 miles of roads. They are as follows:

- Collector – 6 miles
- Major Arterial – 5 miles
- Minor Arterial – 4 miles
- Residential – 25 miles

Falls Church is also close to US Interstate 495 to the west and US interstate 95 to the south. 495 is the metro region's beltway around Washington, DC. 95 is the East Coast's major north-south freeway.
In addition to the bridges shown in Hazus, the City has approximately 25 stormwater culverts greater than 3 feet in diameter that could be subject to flooding during intense storms.
Metrobus: Routes that run through the City of Falls Church:

- 2A Washington Boulevard – Dunn Loring
- 3A Annandale Road Line
- 26A Annandale – East Falls Church
- 28A Leesburg Pike
- 15K Chain Bridge Road
- 3Y Lee Highway – Farragut Square
- 3T West Falls Church – East Falls Church (The 3T bus route was restored in 2019 thanks to I-66 toll funds allocated by the Northern Virginia Transportation Commission.)

1.4.7 Hazardous Materials

There are no hazardous materials facilities or storage sites in the City of Falls Church.

1.4.8 Education

There are nineteen educational (school Type) facilities within Falls Church within the City Limits, five of them being public. The City's independent school system is among the top-most ranked in the Commonwealth of Virginia, and the City strives to maintain the highest level of education for all students.

- K through 12:

Falls Church has five schools Jessie Thackrey Preschool, Mount Daniel Elementary School, Thomas Jefferson Elementary School, Mary Ellen Henderson Middle School, and George Mason High School. The City's overall high school graduation rate is 99.5 percent, and the graduation rate for students with

disabilities, economically disadvantaged students, and English learners are all 100 percent. The annual expenditure per pupil is $18,418. This compares with $14,432 in Fairfax County and $18,957 in Arlington County. In June 2019, FCCPS held a groundbreaking event for the new George Mason High School. A virtual ribbon cutting took place in December 2020 and opened to students for Spring 2021.

- Post-Secondary Education City:

Residents have the highest educational attainment in the United State, as reported in the Censuses of 1980, 1990, 2000, and 2010. Nearly 80 percent of City residents have a bachelor's degree or higher. This compares dramatically with the national figure of 33 percent. Nearly 45 percent of City residents have a graduate or professional degree. This is nearly four times the national figure of 12 percent of adults with a graduate or professional degree.

1.4.9 Recreational, Cultural and Historic Sites, and Assets

The City of Falls Church currently shows a list of 21 historic sites and assets of special architectural, historic, archaeological, or cultural value to residents and visitors. These sites are designated by the National Register of Historic Places. There is a public library that hold the City's cultural and historic and cultural resources. The City has five public schools and a recreation center. Public Records are kept at City Hall.

1.5 Growth and Development Trends

Falls Church is currently growing at a rate of 1.02% annually, and its population has increased by 20.96% since the most recent census. The City's Comprehensive Plan has made forecasts for growth in housing, population, and employment for the city through 2045. The projected growth areas reflect new opportunities for jobs, which directly relate to residential and commercial development.

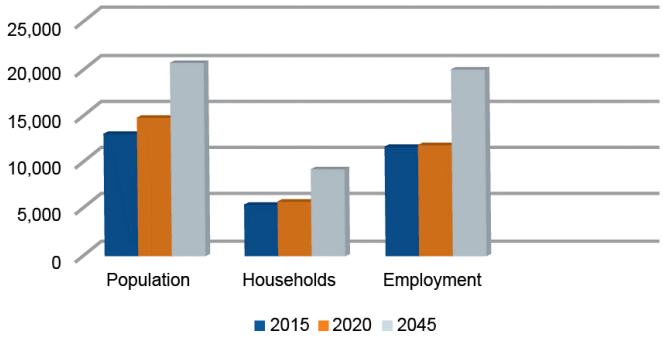


Figure 5: Projections of Population, Households, and Employment, City of Falls Church, 2015-2045[2]

[2] People, Housing, and Jobs, Demographics Chapter of the City's Comprehensive Plan. April 10, 2017. Retrieved at: https://www.fallschurchva.gov/DocumentCenter/View/11711/Chapter2---Demographics?bidId=

2 Jurisdiction Planning Process

For the 2022 NOVA HMP update, the City of Falls Church followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Team, the City supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction.

Table 9: Local Planning Group Participants

Name	Position/Title	Department/Agency
Edward Saltzberg	Member	Economic Development Authority
Ross Litkenhous	Member	Economic Development Authority
Brian Williams	Vice Chair	Economic Development Authority
Jim Coyle	Member	Economic Development Authority
Matthew Quinn	Member	Economic Development Authority
Sandra Kiersz	Member	Economic Development Authority
Robert Young	Chair	Economic Development Authority

The jurisdiction identified its chief hazard mitigation planning responsibility as providing oversight in the planning process and representation in the Emergency Managers Group. The City also identified the following tasks as part of its mitigation planning responsibilities:

- Management support for the planning effort
- Planning Group resource/subject matter expert
- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Public outreach activities
- Implementation of the Plan
- Maintaining the Plan

The City of Falls Church planning participants coordinated primarily through virtual meetings during the planning process—and, as needed, independently—to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A**.

2.4 Public Participation

Several opportunities for public involvement were provided during the planning process, including a NOVA hazard mitigation public survey[3] and access to the draft plan for review and input.

Notification of the Draft Plan release was made through the same City web link. Documentation of the public survey and draft plan review is included in **Attachment 2** of this annex.

3 Jurisdiction-Specific Hazard Event History

The City of Falls Church's comprehensive hazard history is described in **Section 5, Base Plan**. The diversity of the landscape increases the vulnerability to a variety of hazards, most notably flooding and severe storms. In addition to snowmelt and rain-related river flooding episodes, low-lying areas along waterways are also subject to flooding, especially in highly urbanized areas with more paving. Additionally, winter weather poses significant threats, as evidenced during the 2015–2016 winter season, which resulted in a Federal Disaster Declaration.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 369 recorded natural meteorological events that took place in the City between January 1, 1950, and May 2021. The city has been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 10: Federal Disaster and Emergency Declarations (2017–2021), City of Falls Church[4]

Declaration	Date	Hazard	Assistance Type
DR 4512	Apr. 2020	Virginia COVID-19 Pandemic	PA-B
EM 3448	Mar. 2020	Virginia COVID-19 Pandemic	PA-B
EM 3403	Sep. 2018	Virginia Hurricane Florence	PA-B

Table 11: Significant Hazard Events Identified by the City of Falls Church, 2017–2021

Date	Hazard	Event and Description
08/10/2021	Thunderstorm Wind	Wind gusts and heavy rain led to numerous trees and large branches being blown down along Oak Street and Lincoln Avenue in the city. Thousands of power outages were reported for the Falls Church area.
07/28/2021	Thunderstorm Wind	A severe thunderstorm impacted the city, bringing downed trees and wires as well as power outages. Around 1,700 people remained

[3] "F.C. Plans Hazard Mitigation Update." *Falls Church News Press*. August 17, 2021. Retrieved from: https://www.fcnp.com/2021/08/17/f-c-plans-hazard-mitigation-update/
[4] FEMA, Federal Disaster Declarations, 2017–2021.

Date	Hazard	Event and Description
		without power in the Falls Church area, north and south of Broad Street.
07/01/2021	Thunderstorm Wind	Nearly a dozen trees and large branches were blown down in Falls Church, primarily north of VA-7 Broad Street. A 4-foot diameter oak tree was uprooted in a yard near the intersection of North Four Mile Run Drive and 26th Street North, adjacent to the Washington and Old Dominion Trail. A tree blew down onto wires and a car near the intersection of North Roosevelt Street and North Tuckahoe Street, briefly trapping the occupant, who was uninjured.
02/18/2021	Winter Storm	Long duration winter storm brought dense accumulation of snow, sleet and freezing rain on February 18-19, which impeded traffic and delayed services.
07/08/2019	Severe Storm/Flash Flood	The City witnessed the highest two-hour rainfall for our region since records have been kept (1870). Up to 5 inches of rain was reported to have fallen.
08/21/2018	Thunderstorm/Heavy Rain and Flooding	Thunderstorms rocked NCR and brought quick bouts of rain. Falls Church area was particularly hit hard with flooding and road closures. The city witnessed flooding on S. Spring Street at Lea Court.

Additional hazards of high concern were highlighted by the jurisdiction.

4 Hazard Risk Ranking

After developing hazard profiles, the City of Falls Church Planning Committee conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of the following risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4.2, Base Plan**. The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5, Base Plan**, and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II** of this Plan.

Table 12: Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.7	3.5	7.2	**High**
Flood	1.7	4.2	5.9	**High**
High Wind/Severe Storm	2.7	3.2	5.8	**High**
Dam Failure	1.0	4.5	5.5	**Medium**
Tornado	1.3	4.2	5.5	**Medium**
Extreme Temperatures	2.7	2.5	5.2	**Medium**
Drought	2.0	3.2	5.2	**Medium**
Earthquake	1.7	3.2	4.9	**Medium**
Wildfire	1.0	3.0	4.0	**Low**
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	**Low**
Landslide	1.0	2.5	3.5	**Low**

Table 13: Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	3.7	6.4	10.0	**High**
Terrorism	2.0	6.4	8.4	**High**
Cyberattack	2.3	4.7	7.0	**High**
Civil Unrest	1.3	5.0	6.3	**Medium**
Communication Disruption	1.3	4.0	5.4	**Medium**
Hazardous Materials	1.0	3.9	4.9	**Low**
Active Violence	1.0	3.7	4.7	**Low**

Based on the hazard risk scores, the City of Falls Church evaluated the level of risk for 18 hazards (11 natural and 7 non-natural).

Eight natural hazards were identified as high- or medium-risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter Weather, Flood (riverine/flash flood), and High Wind/Severe Storm
- **Medium:** Dam Failure, Drought, Earthquake, Extreme temperatures, Tornado

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, Cyber Attack
- **Medium:** Civil Unrest, Communication Disruption

All other hazards are ranked as “low,” signifying a minimal risk to the City.

4.4 Additional Hazard Risk Considerations

4.4.2 Flood/Flash Flood

Table 14: Flood/Flash Flood Events in the City of Falls Church, 1950–June 30, 2021

Impact	Data
Flood/Flash flood event	13
Direct deaths	0
Direct injuries	0
Property damage	$600,000
Crop damage	$0
Total property and crop damage	$600,000

4.4.3 High Wind

Table 15: High Wind/Severe Storm Events in the City of Falls Church, 1950–June 30, 2021

presents the number of severe storm events documented in the NCEI Storm Events Database, including high wind, hurricane, tropical storm, strong wind, and thunderstorm wind, and their impacts on people, property, and crops.

Table 15: High Wind/Severe Storm Events in the City of Falls Church, 1950–June 30, 2021

High Wind and Severe Storm Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
58	0	3	$5,091,000	0	$5,091,000

4.4.4 Winter Weather

Table 16 presents the number of severe winter storm events documented in the NCEI Storm Events Database, including blizzard, heavy snow, winter storm, and winter weather.

Table 16: Severe Winter Storm Events in the City of Falls Church 1950–May 31, 2021

Winter Weather	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
120	1	0	$440,000	0	$440,000

Extreme temperature events in Falls Church have had a significant impact on the population, especially excessive heat and heat events. The NCEI database search included excessive heat, extreme cold/wind chill, and heat events.

Table 17: Extreme Temperature Events in the City of Falls Church 1950–May 31, 2021

Winter Weather	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
63	1	39	0	0	0

5 Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.4 National Flood Insurance Program

The City of Falls Church participates in the National Flood Insurance Program (NFIP). In addition, the city participates in the voluntary Community Rating System (CRS) program under the NFIP with a CRS Class of 6, which is associated with a 20% discount on flood insurance for policyholders. The *Floodplain Management Plan, Progress Report*, September 2019, describes the 24 mitigation actions related to floods developed since 2006 that were presented in the 2017 NOVA HMP. These actions cover a broad range of project types, including planning and regulatory, structural, natural system protection, and public outreach and education. The Progress Report provides an update as of September 2019 for maintenance of the city's CRS program, which documents continuing progress on implementing these actions.

Table 18: NFIP Status, City of Falls Church[5]

Initial FHBM[6] Identified	Initial FIRM Identified	Current Eff FIRM Date	Reg-Emer Date	CRS Entry Date	Current Eff CRS Date	CRS Class	% Disc SFHA	% Disc Non-SFHA
9/6/1974	2/3/1982	7/16/2004	2/3/1982	5./1/2007	10/1/2016	6	20	10

Table 19: NFIP Policy Status as of 04-30-2022, City of Falls Church[7]

Policies In-Force	Total Written Premium and FPF	Total Coverage
165	$216,781	$44,653,000

Table 20: NFIP Status, as of September 14, 2021

NFIP Topic	Source of Information	Comments
Insurance Summary		
How many claims have been paid in the community? What is	FEMA NFIP or Insurance Specialist	74 paid claims $656,983 paid losses

[5] FEMA NFIP Community Status Report, April 20, 2022.
[6] Flood Hazard Boundary Map
[7] nfip_policy-information-by-state_20220430.xlsx (live.com)

NFIP Topic	Source of Information	Comments
the total amount of paid claims? How many of the claims were for substantial damage?	Community Information System Database	2 substantial damage losses
How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA) Estimate from FEMA	68 structures in the A and AE zones
Describe any areas of flood risk with limited NFIP policy coverage.	Community FPA and FEMA Insurance Specialist	Zone A has significantly less coverage on average than other zones
Staff Resources		
Is the Community FPA or NFIP Coordinator certified?	Community FPA	Yes
Is floodplain management an auxiliary function?	Community FPA	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	Permit review; floodproofing advice (over the phone, via email, or in person); flyers about flood preparedness, mitigation, and recovery available to public at permit counter and in library; mailers are sent out annually to all in SFHA regarding flood preparedness, and separate mailers are sent to real estate agents/insurance agents/loan companies quarterly about flood insurance
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	Staffing and funding to manage and expand stormwater programs
Compliance History		
Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Are there any outstanding compliance issues (i.e., current violations)?		Yes, three violations were recently submitted to the state regarding elevation of substantially improved structures in the SFHA
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		We are unaware of a CAV or a CAC in the past, though we believe we will be having one soon, given the aforementioned violations.

5.5 Population

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations. Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills. The CDC SVI

categorizes the vulnerability of communities at census-tract level, by city, into fifteen census-derived factors grouped under four themes—socioeconomic status, household composition/disability, race/ethnicity/language, and housing type/transportation.

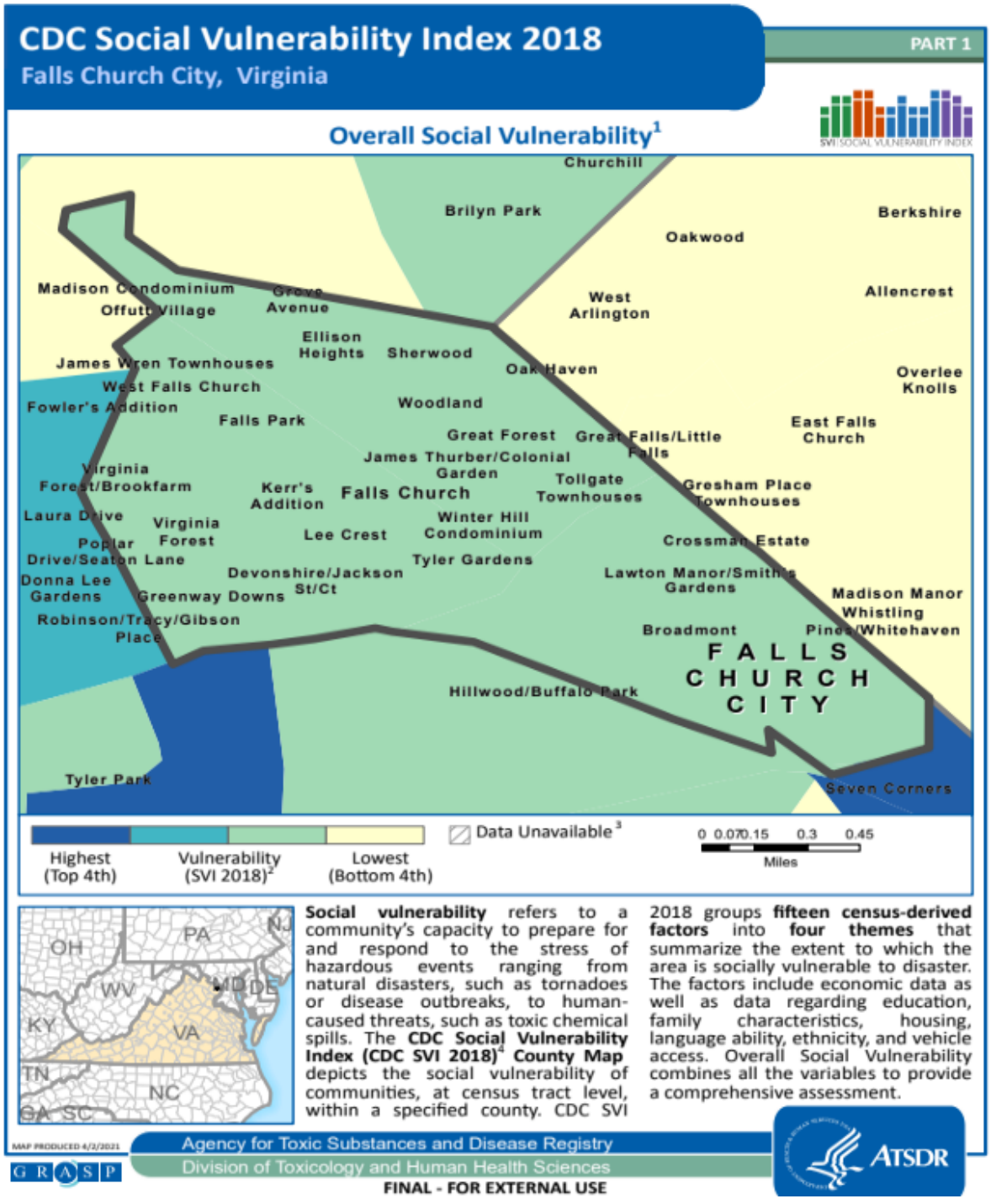
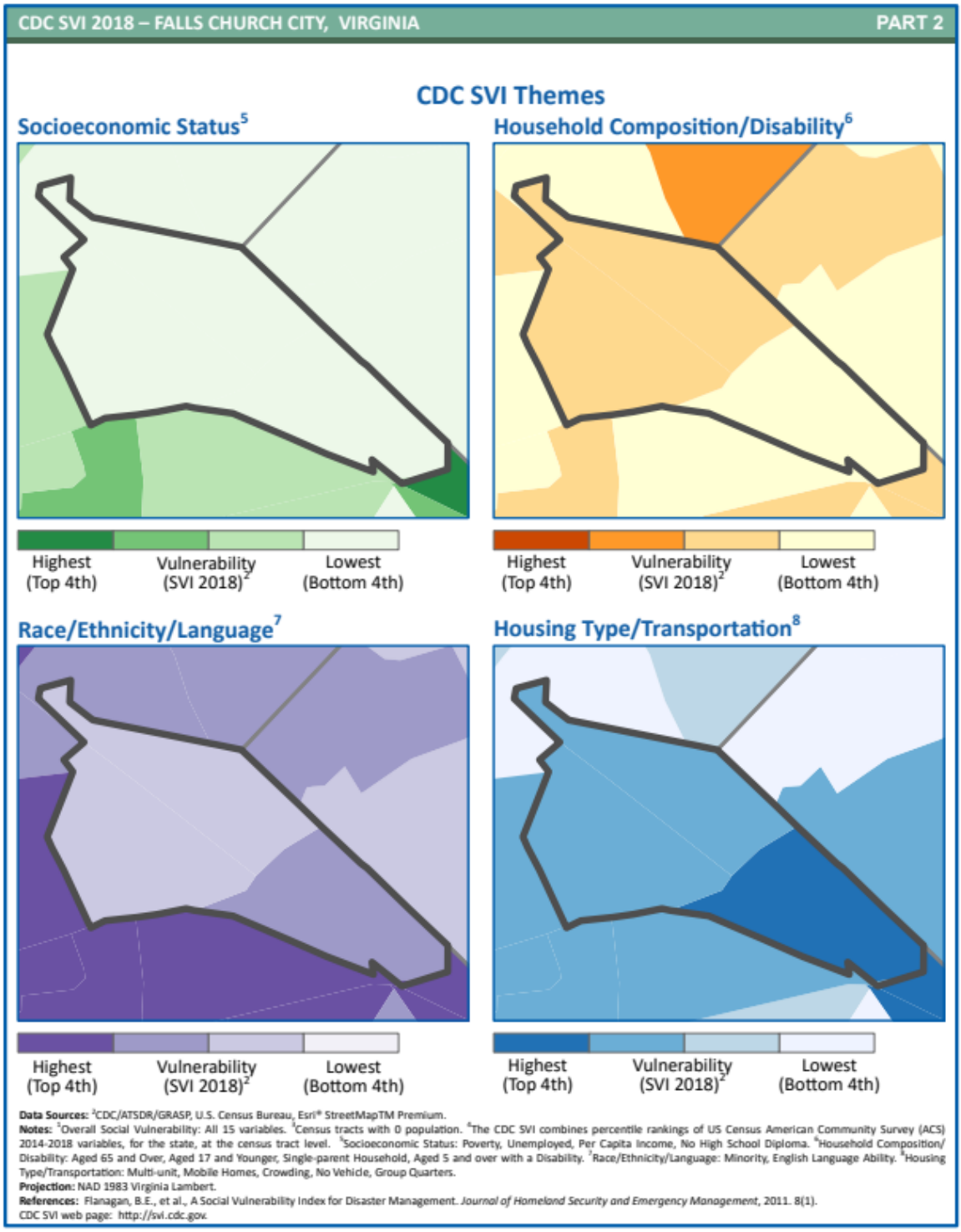


Figure 6: Overall Social Vulnerability (2018), City of Falls Church[8]



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[8] Centers for Disease Control and Prevention, Social Vulnerability Index, 2018. Retrieved at: Virginia2018_Falls Church city.pdf (cdc.gov)

Figure 7: Social Vulnerability, by Theme, City of Falls Church[9]

The themed maps illustrate the City's higher level of vulnerability within the race/ethnicity/language theme, demonstrating the importance of communicating essential hazard mitigation, preparedness, response, and recovery information to the public in alternate formats and multiple languages.

5.6 Built Environment

Based on data currently available through Hazus, the tables presented in this section provide a total number of exposed facilities and properties in relation to earthquake, flood, and hurricane wind.

Table 21: Building Stock Exposure by General Occupancy

Type	Amount
Residential	$1,766,161,000
Commercial	$461,373,000
Industrial	$39,966,000
Agricultural	$7,392,000
Religion	$58,626,000
Government	$11,611,000
Education	$20,673,000
TOTAL	**$2,365,8021,000**

5.7 Community Lifelines and Assets

The City of Falls Church reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events. The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA. None listed in the Hazus run.

Table 22: Critical Facilities Exposed to FEMA Floodplains, City of Falls Church

Facility Type	Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
Highway Bridges	3	3	0
Highway Segments	6	6	0

[9] Ibid.

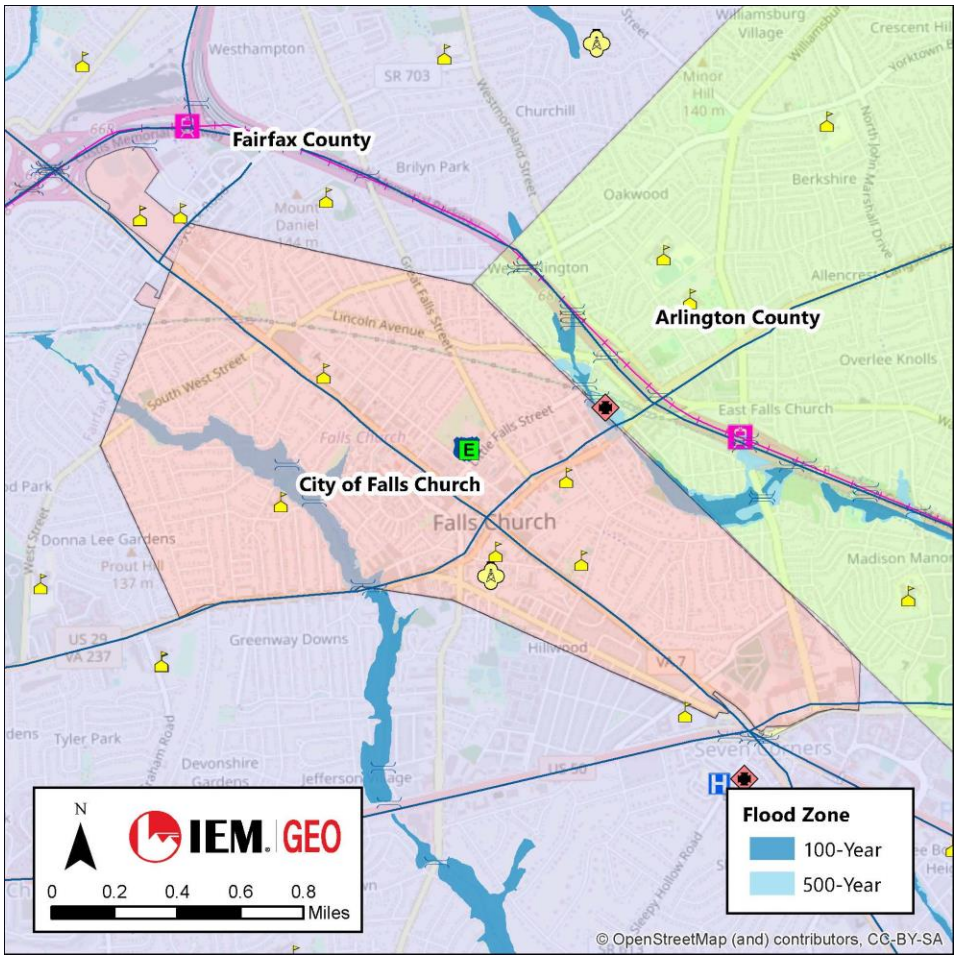

Figure 8: Critical Facilities in Flood Zones[10]

5.8 Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

5.9 Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2,500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets.

[10] FEMA, NFIP Flood Insurance Rate Maps; Hazus Critical Facility Inventory.

Table 23: Direct Economic Losses Related to Earthquake, Flood, and Hurricane Wind

Hazard	Buildings (capital stock and income)	Transportation	Utilities
Earthquake	$28,674,000	$1,000	$35,000
Flood	0	0	0
Hurricane Wind	$1,755,000	0	0

5.10 Cultural/Historical

Information related to vulnerability of cultural and historical assets is presented in the hazard-specific sections of the **Base Plan**.

Historic structures and sites are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites.

Table 24: Cultural and Historic Properties Exposed to FEMA Floodplains, City of Falls Church

Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
4	0	0

6 Capability Assessment

The City of Falls Church reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - City staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the City of Falls Church completed a Jurisdiction Needs Identification Questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.4 Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the levels of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans, and/or resources, and it can implement most mitigation actions.

Table 25: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

6.4.2 Planning and Regulatory Capabilities Summary

The City utilizes the all-hazards approach when developing any jurisdictional plans, including emergency operations and continuity of operations, as well as the hazard mitigation plan.

The following plans have been newly developed or updated since the 2017 HMP:

- Comprehensive Plan, 2017
- Capital Improvement Plan, 2021
- Transportation Plan, 2017
- Local Emergency Operations Plan, 2020
- Historic Preservation Plan, 2017
- Building Code, Effective Date 2021
- Floodplain – City website 2021

Capability Analysis: High

Significant planning and regulatory tools are in place within the City of Falls Church and illustrate successful integration of hazard mitigation planning with existing planning mechanisms. This demonstrates that the jurisdiction recognizes the benefit of incorporating hazard mitigation in local planning and regulatory processes such as the Emergency Operations Plan, Comprehensive Plan, Capital Improvement Plan, and land development and floodplain regulations, as well as how to use these to develop and implement mitigation actions. The City of Falls Church identified the following items to improve their capability to mitigate disasters:

For the Office of Emergency Management:

- With the continuous development/growing of the city and its population, it is imperative to solidify the position of Deputy Emergency Management Coordinator in order to comply with regional standards, to have an enhanced response to all type of hazards, and to ensure the COOP within the office and at the city leadership level.
- Additional staff that will have exclusively planning responsibilities.

For the Department of Public Works:

- Additional staff in Operations to run 24/7 (12-hour shifts), specifically an assistant.
- Additional staff to oversee the CFM program will increase CRS level and have greater impact on the community.

- Additional engineer to implement and construct non-CIP projects.
- Expand scope and increase budget for non-CIP projects. For example, instead of just milling and repaving a road, we could perform repairs on road base, curbs, sidewalks, catch basins, and pipes. This will replace infrastructure that is past its life expectancy (i.e., can fail/collapse any time), make maintenance easier, enable better direction of water, and lead to fewer failures/collapses of catch basins. Relieving the need to perform maintenance on the system will allow us to redirect resources to improving stormwater runoff (i.e., in-house pipe replacement); we will also experience fewer emergency call-outs, and the new infrastructure will have improved capacity and resiliency when large events come through the city. This is one example of many.

At the interdepartmental level:

- Better interdepartmental communication systems. Newer, up-to-date software lessens stress on staff. For example, a payroll system that employees log into that auto-populates the data in MUNIS takes less time for many staff, allowing them to spend more time on other projects.
    - To maintain program eligibility, interdepartmental cooperation and conformity with ordinances are crucial.

6.4.3 Administrative and Technical Capabilities Summary

The City's Office of Emergency Management and other departments' staff are familiar with the community's hazards.

- The Department of Public Works staff include planners, engineers, and a GIS Manager & Floodplain Manager with an understanding of natural and non-natural hazards who are integrated into mitigation planning. The City maintains an Information Technology Division and an Office of Communications and Public Information.
- The City identified the following departments and entities as key stakeholders in its hazard mitigation planning process and implementation of the plan:
    - Office of Emergency Management
    - Department of Public Works
    - Community Planning and Economic Development Services
    - Office of Communications and Public Information
    - Information Technology Division
    - Housing and Human Services Department
    - Police Department
    - Sheriff's Office
    - Falls Church Volunteer Fire Department
    - Recreation and Parks Department
    - Environmental Programs Coordinator / Office of the City Manager
    - Fairfax County Health Department (external stakeholder)

Capability Analysis: High

The City of Falls Church has a robust staffing capability that provides for a high level of coordination for mitigation planning and action implementation. While enhancements in its administrative and technical

capabilities were gained through the increase in department and agency positions that have resulted from the COVID-19 pandemic, the need for continuing funding for positions and for ongoing education and training offers an area for improvement. The Department of Public Works (DPW) is looking into acquiring rain and flood gauges for both Tripps Run and Four Mile Run; the approximate yearly cost is $55K. Currently, there are no funds designated for this. If funding is secured, it could become possible to receive alerts based on amount of rainfall in a certain time or height of water in a stream.

6.4.4 Safe Growth Capabilities Summary

- The Comprehensive Plan includes a Transportation Element that addresses appropriate placement and utilization of transportation systems.
- Public Safety plans and procedures address emergency evacuation and other safety measures associated with safe growth.
- The Capital Improvement Program integrates hazard mitigation projects identified in the hazard mitigation plan.

Capability Analysis: Moderate

The City of Falls Church addresses safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment.

6.4.5 Financial Capabilities Summary

- The Capital Improvements Plan provides funding for projects outside of the jurisdiction's annual operating budget.
- The City has the authority to incur debt through general obligation bonds and/or special tax bonds, as well as fees for utility services and impact fees for new development.

Capability Analysis: Moderate

Onsite work restrictions imposed during the COVID-19 pandemic between March 2020 and continuing throughout 2021 have presented challenges in staff availability and coordination. To address these shortfalls, the jurisdiction may access technical assistance available to potential applicants provided by many grant programs or expand its capabilities to develop and manage mitigation actions through contracted services.

6.4.6 Education and Outreach Capabilities Summary

The City of Falls Church has identified the following programs or organizations that can help integrate hazard mitigation into community programs to increase public involvement:

- Environmental Sustainability Council
- Climate, Air, and Energy
- Forestry and Biodiversity
- ALICE program (OEM/Police Department)

Capability Analysis: Moderate

The City of Falls Church has multiple opportunities to promote hazard mitigation and increase involvement of stakeholders and the public. There is a critical need to inform the additional stakeholders and the public about the benefits of hazard mitigation planning and implementation.

There is a need for more staff to initiate, oversee and grow the programs.

6.5 Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, the City of Falls Church identified activities related to each natural hazard that support risk reduction.

Table 26: Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and international building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	• Public education and operational plans address preparedness and response to reduce risk.
Flood/Flash Flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. • Stormwater management program and projects address flood prevention and risk reduction.
High Wind/Severe Storm	• State and international building codes provide for wind load design regulations.
Karst/Sinkhole/Land Subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Winter Weather	• Public education and operational plans address preparedness and response to reduce risk.

Hazard	Activity
Non-Natural Hazards	• Public education and operational plans address preparedness and response to reduce risk. • Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate Change	• Ongoing resilience planning and utilizing the Fairfax County *Community-wide Energy and Climate Action Plan* will allow for identification and mitigation of climate change-related issues in future planning cycles.

7 Resilience to Hazards

7.4 National Risk Index

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of "low risk" is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

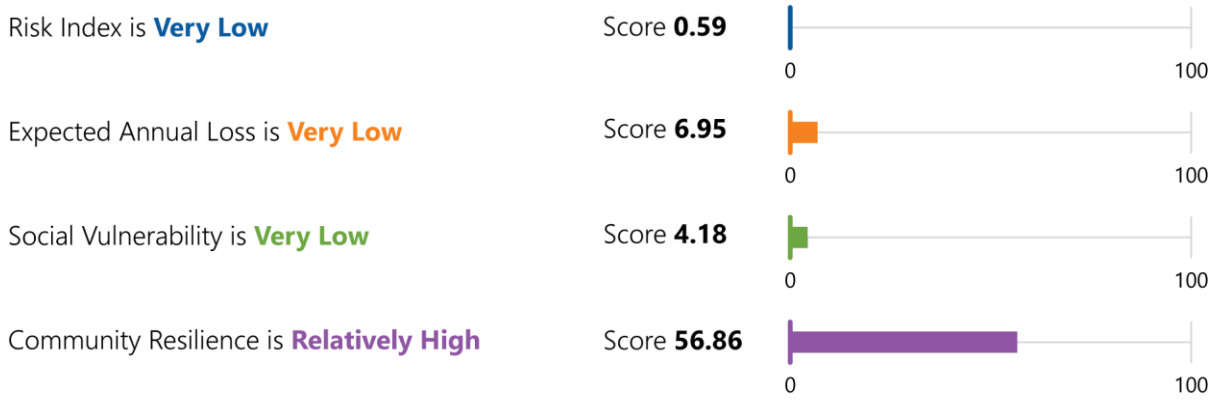

Figure 9: Summary of National Risk Index Findings, City of Falls Church[11]

The National Risk Index (NRI) is a dataset and online tool developed by the Federal Emergency Management Agency (FEMA) and other partners to help illustrate communities in the United States at risk for 18 natural hazards. Hazard risk is calculated on data for a single hazard type and reflects the relative risk for that hazard type; it should be considered only as a baseline relative risk measurement for a general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently in the NRI than the hazards in this plan, so a direct hazard-to-hazard comparison of risk is not able to be determined.

Based on the NRI findings, the highest five hazards by risk rating for the City of Falls Church are Winter Weather, Strong Wind, Tornado, Cold Wave (known within this plan as Extreme Cold), and Heat Wave (known within this plan as Extreme Heat). Lightning, Ice Storm, Hail, and Riverine Flooding received lower risk ratings; however, 14 of the 15 hazards rated for risk were all determined to be "very low," with one hazard (Heat Wave) determined as "relatively low."

[11] National Risk Index, Community Report. Retrieved at: Community Report - Falls Church City, Virginia | National Risk Index (fema.gov)

Hazard Types	Risk Index Rating	Risk Index Score	
Avalanche	Not Applicable	--	
Coastal Flooding	Not Applicable	--	
Cold Wave	Very Low	0.80	0 100
Drought	No Rating	0.00	0 100
Earthquake	Very Low	0.16	0 100
Hail	Very Low	0.27	0 100
Heat Wave	Very Low	0.47	0 100
Hurricane	Very Low	0.50	0 100
Ice Storm	Very Low	0.45	0 100
Landslide	Very Low	0.95	0 100
Lightning	Very Low	1.07	0 100
Riverine Flooding	Very Low	0.79	0 100
Strong Wind	Very Low	1.48	0 100
Tornado	Very Low	1.07	0 100
Tsunami	Not Applicable	--	
Volcanic Activity	Not Applicable	--	
Wildfire	No Rating	0.00	0 100
Winter Weather	No Rating	0.00	0 100

Figure 10: Hazard Type Risk Index, National Risk Index[12]

The NRI calculation does not follow the same criteria and formulas used in the hazard risk ranking methodology for this plan but is provided as a comparative measurement tool.

[12] FEMA, National Risk Index, Community Report for City of Falls Church. Retrieved at: Community Report - Falls Church City, Virginia | National Risk Index (fema.gov)

Table 27: Comparison of City of Falls Church Scores with Virginia and National Average

Index	City of Falls Church	Virginia Average	National Average
Risk	0.59	6.50	10.60
Expected Annual Loss	6.95	9.22	13.33
Social Vulnerability	4.18	35.32	38.35
Community Resilience	56.86	54.92	54.59

Table 28: City of Falls Church Risk Ranking

Index	Rank
Risk	0.59
Expected Annual Loss	6.95
Social Vulnerability	4.18
Community Resilience	56.86

7.5 Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household-level risk factors.

The index produces aggregate-level (census tract, county, and state) small area estimates, providing a tool for understanding the level of risk to disasters that specific neighborhoods face due to characteristics that may make segments of the population more vulnerable to the impacts and consequences of disasters. The 10 risk factors include the following:

1. Income-to-poverty ratio
2. Single or zero caregiver household
3. Unit-level crowding
4. Communication barrier
5. Aged 65 years or older
6. Lack of full-time or year-round employment (Household)
7. Disability
8. No health insurance coverage
9. No vehicle access (Household)
10. No broadband internet access (Household)

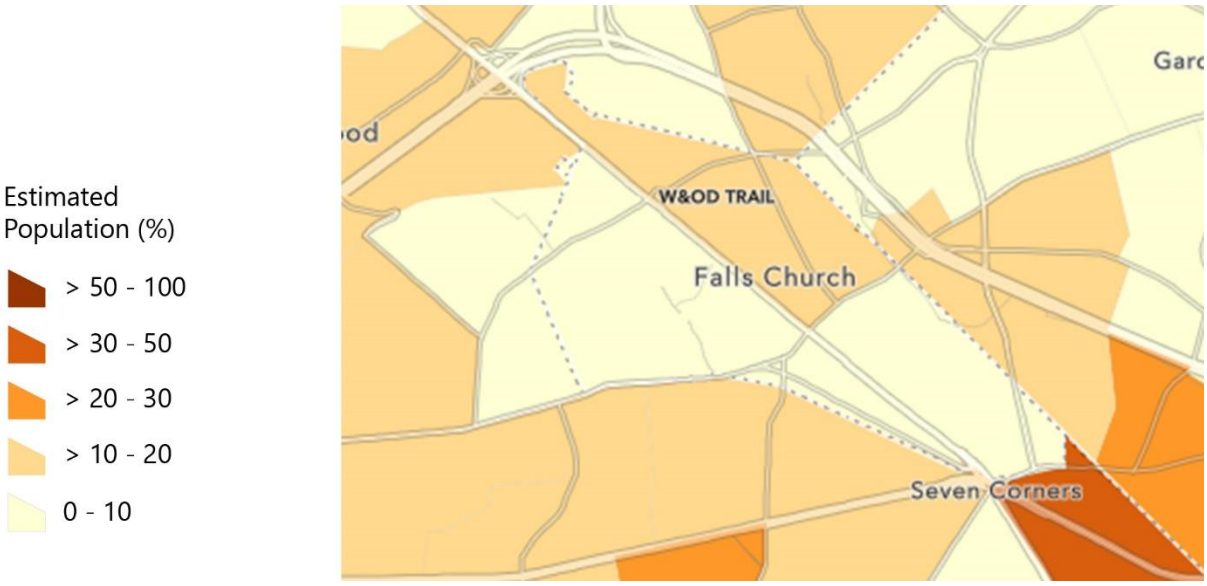

Figure 11: Community Resilience Estimate[13]

The estimate is categorized into three groups:

- Zero risks
- One to two risks
- Three or more risks

The combination of data and analysis described in this section provides a comprehensive representation of the City of Falls Church's risk, vulnerability, and resilience to all hazards.

7.6 New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

The City of Falls Church Planning Team identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- The risk of cyber-related incidents on critical infrastructure and key resource sites
- Impacts of climate change
- Increases in the number of excessive rainfall events that impact new areas with flooding

[13] Community Resilience Estimate, United States Census. Retrieved at: 2019 Community Resilience Estimates (arcgis.com)

8 Mitigation Actions

8.4 Goals and Objectives

The City of Falls Church Planning Group adopted the regional goal statement presented in **Section 8, Base Plan**.

8.5 Status of Previous Actions

The comprehensive list of previous mitigation actions, including descriptions of progress made and current status, is presented in **Attachment 3** of this annex.

8.6 New Mitigation Actions

In addition to the actions carried forward from previous plans, the City of Falls Church Planning Group identified two new mitigation actions to include in this plan: to address expansion and strengthening of the OEM continuity program by increasing the resilience of city operations; and to have the GIS Manager & Floodplain Manager (Department of Public Works) coordinating with FEMA to re-evaluate flood zones and update Flood Insurance Rate Maps (FIRMs) as a basis for future NFIP Activities. **Attachment 3** of this annex includes a table that summarizes each new and continued action, describing the proposed activity, priority level, estimated cost, and lead agency.

8.7 Action Plan for Implementation and Integration

The Action Plan for Implementation and Integration describes how the city's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 29: Action Plan for Implementation and Integration, City of Falls Church

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plan.	Primarily enforced through obligations in the CRS program to identify risks within the city and work with departments to mitigate risks and include mitigation activities in the comprehensive plan when possible.
Review/update land development regulations for consistency with mitigation goals.	Currently reviewing stormwater management ordinances and looking at several updates to the code.
Review/update building/zoning codes for consistency with mitigation goals.	The building department consistently updates the codes by VA housing development authority.
Maintain regulatory requirements of floodplain management program (NFIP).	Continue to monitor and update ordinance as needed and continue participation in the CRS program.
Enhance floodplain management through CRS.	Currently, the City holds a Class 6 ranking in CRS. Continue to actively participate in CRS.
Review/update economic development plan and policies for consistency with mitigation goals.	The OEM and Fire Marshal will ask Economic Development Department to review/update plans and policies for consistency with mitigation goals.

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Continue public engagement in mitigation planning.	Currently, the City holds a Class 6 ranking in CRS, which involves a significant amount of education and outreach to at-risk homes. Continue this engagement.
Identify opportunities for mitigation education and outreach.	Currently, the City holds a Class 6 ranking in CRS, which involves a significant amount of education and outreach to at-risk homes. Explore additional education opportunities for other hazards.
Review/update stormwater plans and procedures for consistency with mitigation goals.	Currently reviewing stormwater management ordinances and looking at several updates to the code.
Review/update emergency plans to address evacuation and sheltering.	To be reviewed. Continue to ensure plans are up to date and feasible.
Maintain ongoing enforcement of existing policies.	DPW will seek support for some floodplain compliance items from other departments.
Monitor funding opportunities.	This is now being done as part of the SWM CIP. Continue to look at other local, state, and federal funding opportunities that could be utilized for hazard mitigation. This includes HMA opportunities and non-traditional mitigation funding sources.
Incorporate goals and objectives into day-to-day government functions.	Goals and objectives will be incorporated into day-to-day government functions.

9 Annex Maintenance Procedures

9.4 Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 30: City of Falls Church Plan Maintenance Responsibilities for the Northern Virginia Hazard Mitigation Plan, Base Plan

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.5 Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP, Base Plan**, the City of Falls Church Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**.

9.5.2 Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in fifth year

Table 31: City of Falls Church Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with jurisdiction planning group. 2. Review the status of all mitigation actions, using the *Mitigation Action Implementation Worksheet* (**Section 3, Attachment A, NOVA HMP Base Plan**).	Produce an annual report that includes the following: • Status update on all mitigation actions • Summary of any changes in hazard risk or vulnerabilities and capabilities • Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	3. Schedule the annual plan evaluation with jurisdiction planning group. 4. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the *Planning Considerations Worksheet* (**Section 3, Attachment C, NOVA HMP Base Plan**).	Submit the annual report to the NOVA HMP Project Team Point of Contact.
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	Adopt the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

The City of Falls Church will continue to be a planning partner with multiple jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan.

10 Annex Adoption

The City of Falls Church Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation Plan*.

11 City of Falls Church Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Actions

11.4 Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.5 Attachment 2: Documentation of Public Participation

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Monday, October 4, 2021

NEWS COMMENTARY AROUND F.C. ARTS & ENTERTAINMENT BUSINESS LETTERS SPORTS CRIME

NEWS

F.C. Plans Hazard Mitigation Update

August 17, 2021 4:00 PM by FCNP.com

The City of Falls Church and other Northern Virginia jurisdictions are preparing an update to the 2017 Northern Virginia Hazard Mitigation Plan. The regional plan will identify local policies and actions for reducing risk and future losses from hazards such as floods, severe storms, wildfires, winter weather, and more.

The plan will meet key federal planning regulations that require local governments to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance, including funding for hazard mitigation projects.

This survey provides an opportunity for citizens to share opinions and participate in the mitigation planning process. The information provided will help officials better understand the public's hazard concerns and can lead to mitigation activities that help lessen the impacts of future disasters. Participation in the survey is voluntary and none of the information provided will be attributed.

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Real Estate Summer Special Edition

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City Of Falls Church: Take The Survey: Hazard Mitigation

Quick Link:

Press Release Desk, News Partner

Posted Sat, Aug 7, 2021 at 12:37 pm ET

(City of Falls Church)

Press release from the City of Falls Church:

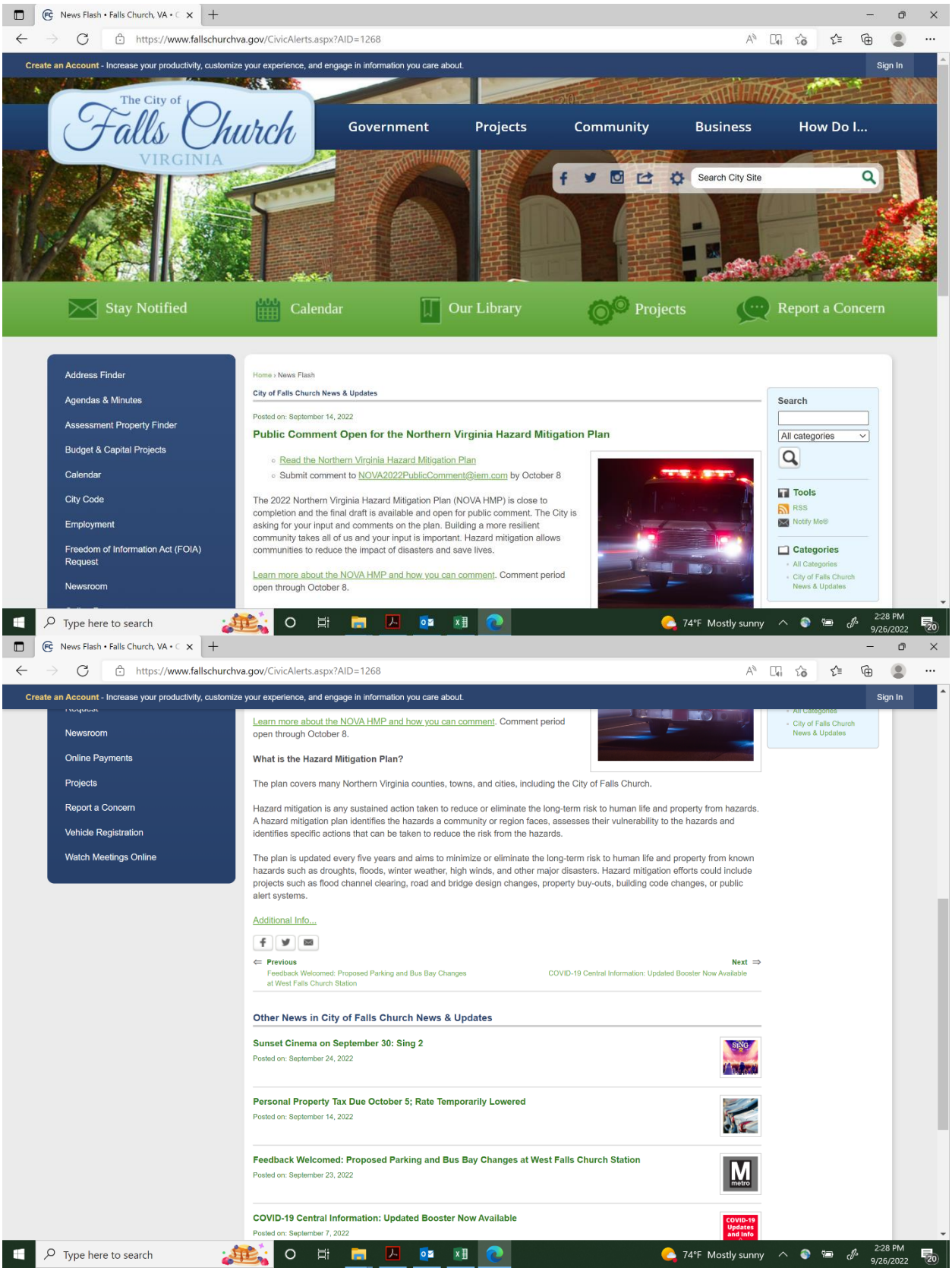
August 6, 2021

Quick Link:

- Take the survey now: https://www.surveymonkey.com/r/NorthernVirginiaHazardMitigationSurvey.

The City of Falls Church and other Northern Virginia jurisdictions are preparing an update to the 2017 Northern Virginia Hazard Mitigation Plan. The regional plan will identify local policies and actions for reducing risk and future losses from hazards such as floods, severe storms, wildfires, winter weather, and more.The plan will meet key federal planning regulations that require local governments to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance, including funding for hazard mitigation projects.This survey provides an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that help lessen the impacts of future disasters. Participation in the survey is voluntary and none of the information you provide will be attributed to you.Take the survey now: https://www.surveymonkey.com/r/NorthernVirginiaHazardMitigationSurvey.This product was funded by the Federal Emergency Management Agency through the Virginia Department of Emergency Management, via Grant Agreement Number PDMC-PL-03-VA-2018-003 for $250,000.

This press release was produced by the City of Falls Church. The views expressed are the author's own.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The City of Falls Church VIRGINIA
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Agendas & Minutes
Assessment Property Finder
Budget & Capital Projects
Calendar
City Code
Employment
Freedom of Information Act (FOIA) Request
Newsroom
Home › News Flash
City of Falls Church News & Updates
Posted on: September 14, 2022
Public Comment Open for the Northern Virginia Hazard Mitigation Plan
Read the Northern Virginia Hazard Mitigation Plan
Submit comment to NOVA2022PublicComment@iem.com by October 8
The 2022 Northern Virginia Hazard Mitigation Plan (NOVA HMP) is close to completion and the final draft is available and open for public comment. The City is asking for your input and comments on the plan. Building a more resilient community takes all of us and your input is important. Hazard mitigation allows communities to reduce the impact of disasters and save lives.
Learn more about the NOVA HMP and how you can comment. Comment period open through October 8.
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City of Falls Church News & Updates
Type here to search
74°F Mostly sunny
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9/26/2022
Newsroom
Online Payments
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What is the Hazard Mitigation Plan?
The plan covers many Northern Virginia counties, towns, and cities, including the City of Falls Church.
Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. A hazard mitigation plan identifies the hazards a community or region faces, assesses their vulnerability to the hazards and identifies specific actions that can be taken to reduce the risk from the hazards.
The plan is updated every five years and aims to minimize or eliminate the long-term risk to human life and property from known hazards such as droughts, floods, winter weather, high winds, and other major disasters. Hazard mitigation efforts could include projects such as flood channel clearing, road and bridge design changes, property buy-outs, building code changes, or public alert systems.
Additional Info...
Previous
Feedback Welcomed: Proposed Parking and Bus Bay Changes at West Falls Church Station
Next
COVID-19 Central Information: Updated Booster Now Available
Other News in City of Falls Church News & Updates
Sunset Cinema on September 30: Sing 2
Posted on: September 24, 2022
Personal Property Tax Due October 5; Rate Temporarily Lowered
Posted on: September 14, 2022
Feedback Welcomed: Proposed Parking and Bus Bay Changes at West Falls Church Station
Posted on: September 23, 2022
COVID-19 Central Information: Updated Booster Now Available
Posted on: September 7, 2022

11.6 Attachment 3: Mitigation Actions

Table 32: Previous Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2023-1	USGS Gauge Program - The City along with the USGS will be installing two rain gauges and two stream gauges within the City Limits. The Rain Gauges will be located at City Hall and the City's Maintenance Yard. One flow gauge will be installed in Tripp's Run and the other will be on Four Mile Run.	DPW	Flood	USGS/CFC Agreement	2023	Agreement Signed, Installation Fall 2022	High	
2023-2	Storm System Maintenance Operation - At least one maintenance crew is devoted to ensuring stormwater drains and inlets remain unblocked.	DPW	Flood	Stormwater Funds	Ongoing	Continued success in keeping drains clear and ready for storms	High	

2023-3	Community Rating System Program Participation - The City participates in the CRS Program as a way to lower flood insurance premiums for its Citizens. Falls Church is rated a Class 6 which saves its policy owners between 15% and 20% on their flood policies.	DPW	Flood	Falls Church General funds	Ongoing	CRS Ranking just renewed for 5 years	High	
2023-4	Infiltration and Inflow Studies for Sanitary Sewer Systems - These studies are being done to investigate whether stormwater is entering into the sanitary sewer system during rain event. Solving the magnitude of the problem will help the City make informed decisions on how to address I&I that is caused by flooding.	DPW	Flood	Sewer Funds	Spring 2023	two studies for two separate areas started in Fall of 2022	High	
2023-5	City Light Mast Arm Replacement - The City is undertaking a program where it will replace the mast arms on the street lights and sign poles. The purpose is to replace mast arms that are rusting and could come down during an extreme wind events.	DPW	Flood High Wind/Severe Storm Winter Weather Tornado	Transportation Funds	Ongoing	Planning Underway	High	
2023-6	Citywide Flood and Level of Service Study -The City is modeling all of its watersheds (approximately 3 sq miles)and all its mapped infrastructure upstream of its defined outfall for flood inundation and the	DPW	Flood	ARPA Funding	Summer 2023	Planning Underway	High	

	level of service the system provides. This will allow us to understand where the hazards lie and develop a list of projects based on raising the level of the infrastructure.							
2023-7	Stormwater Capital Improvement Program - The City has developed a list of projects that will help with flood control in the City. Each project is being studied, designed and planned for construction. There are 6 priority projects currently underway.	DPW	Flood	ARPA Funding	Ongoing	6 Projects underway with others on the list	High	
2023-8	Annual Fleet Readiness for Winter Weather Emergencies - an ongoing program where the maintenance of vehicles that participate in Winter Weather Emergencies are in good operating condition.	DPW	Winter Weather	Falls Church General funds	Ongoing		High	
2023-9	Annual Tree Trimming - Ongoing practice of trimming City owned trees to prevent overgrowth and take care of dead branches that could be dangerous as well as removing dead or dying trees. This will limit the number of downed trees and limbs in the City during wind or ice events		High Wind/Severe Storm Winter Weather Tornado	Falls Church General funds	Ongoing		High	

2023-10	Promote structural mitigation to assure redundancy of critical facilities—including but not limited to roof structure improvement—to meet or exceed building code standards, upgrade electrical panels to accept generators, etc.	OEM	Flood High Wind/Severe Storm	Falls Church General funds	On-Going	Query local government building services staff as to effectiveness of provided information regarding the structural	Medium	Directed to the City Building Official.
2023-11	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, and flood insurance information) that can assist them in reducing their flood risk.	DPW	Flood	Falls Church General funds Stormwater Funds	On-Going	Continue outreach program with educational materials.	Medium	The City has monitored the NFIP claims list and there are no repetitive loss properties in the City. We will continue to monitor repetitive loss properties and conduct outreach if any become listed.

2023-12	Review locality's compliance with the NFIP with an annual review of the Floodplain Ordinances and any newly of Virginia Department of Emergency Management to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501 permitted activities in the 100-year floodplain. Additionally, conduct annual review of repetitive loss and severe repetitive loss property list requested	DPW	Flood	Falls Church General funds	On-Going	Establish a schedule of review and review committee (if necessary).	Medium	The city may rewrite the floodplain ordinance in the next five-year term of the HMP to clarify. Review all floodplain development annually as part of our participation in FEMA's Community Rating System.
2023-13	All City Departments are responsible to ensure mitigation plans, policies, and procedures are developed and executed to ensure continuity of operations by their respective Department	OEM	Flood High Wind/Severe Storm Winter Weather	Falls Church General funds	On-Going	Continuously updating the Departmental COOP Plans	Medium	Via coordination with OEM
2023-14	Incorporate standards and requirements in the City's development regulations, including special exceptions, site plans, subdivision plans, and grading plans to support resilience goals.	DPW E&S Planning	Flood High Wind/Severe Storm Winter Weather	Falls Church General funds Stormwater Funds	2024		Medium	

2023-15	Develop an Urban Forest Management Plan to include short-term and long-term tree-canopy goals and forest management policies for public lands.	DPW	Flood	Falls Church General funds	2025		Medium	
2023-16	Develop policies and regulations and explore zoning changes and incentives to preserve more mature trees during commercial and residential redevelopment and update tree-related code provisions to harmonize across City Code.	DPW Planning	Flood High Wind/Severe Storm	Falls Church General funds	2025		Medium	
2023-17	Restore streams and waterways, including Four Mile Run, Tripp's Run, and other smaller branches.	DPW	Flood	To Be Identified	Ongoing		Medium	
2023-18	Citywide Flood Damage Assessment - Once Citywide modeling is complete, the city will do a Citywide Damage assessment due to flood lost with an end goal being to compare pre and post flood damage assessments on the projects we are planning.	DPW	Flood	CIP	2024	Base data being prepared by current flood control studies.	Medium	

2023-19	Update Chesapeake Bay Preservation section of Stormwater Ordinance to meet state requirements.	DPW	Flood High Wind/Severe Storm Winter Weather Tornado	Falls Church General funds	2023		Medium	
2023-20	Develop a climate risk assessment and a climate resilience plan for the City, in consultation with the community, to better understand the risks to the City from climate change and make appropriate risk management decisions for buildings, infrastructure, and emergency planning.	E&S	Flood High Wind/Severe Storm Winter Weather	Falls Church General funds	2025		Medium	
2023-21	Establish an infrastructure policy that encourages the use of green rather than gray infrastructure features across the City, including in capital improvement program projects.	DPW Planning	Flood	Falls Church General funds Stormwater Funds	2025		Low	
2023-22	Strengthen the City's green building policy for all publicly owned facilities to achieve high standards for sustainability in construction and renovation and address climate resilience.	E&S DPW	Flood High Wind/Severe Storm Winter Weather Tornado	Falls Church General funds Stormwater Funds	2024		Low	

2023-23	Support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation, floodproofing, minor localized flood control projects, mitigation reconstruction and, where feasible and appropriate, using FEMA HMA programs.	DPW	Flood	Falls Church General funds Stormwater Funds	On-Going		Low	The City has identified all flood-prone structures and conducts annual outreach about flood safety to

Northern Virginia Hazard Mitigation Plan

Annex 5: City of Manassas

November 2022

City of Manassas Overview

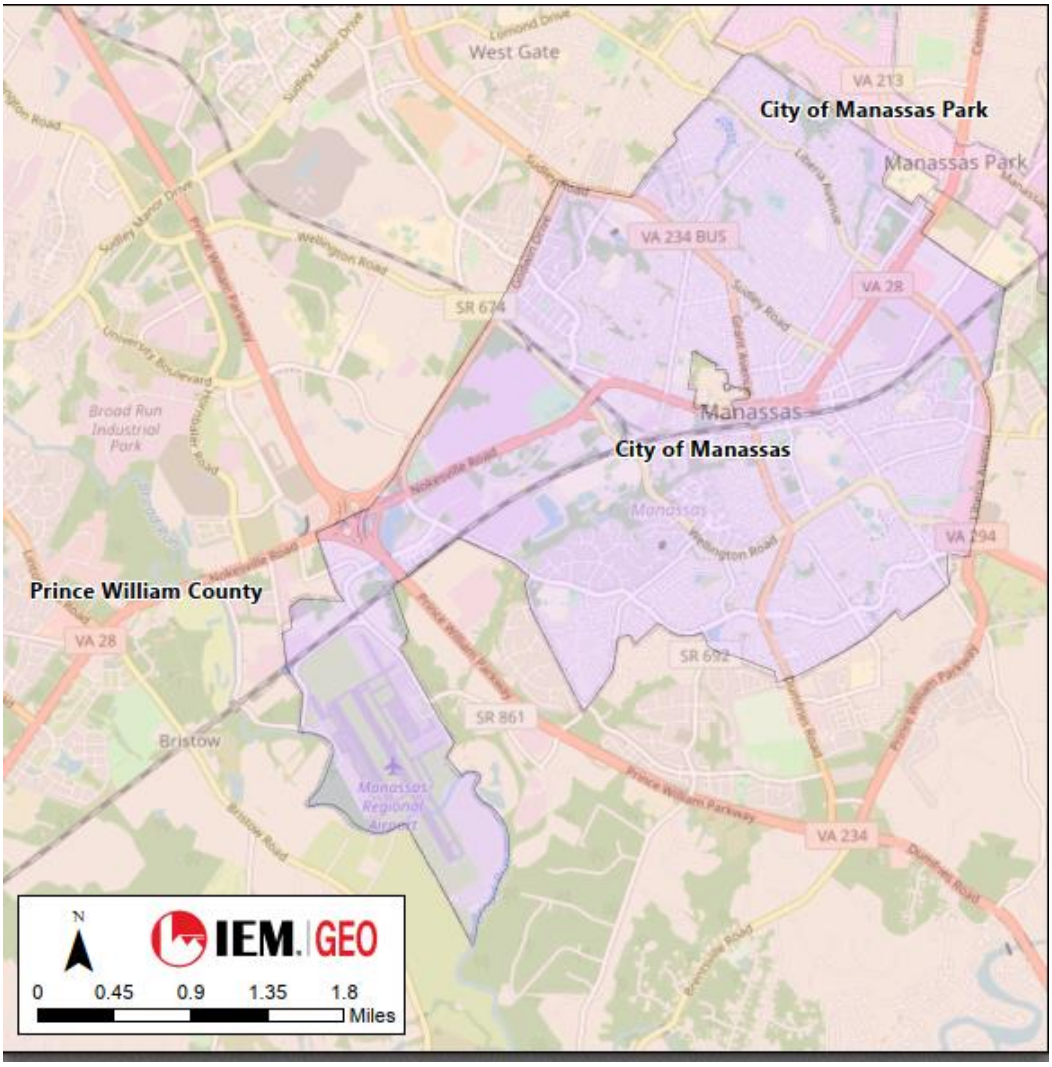

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1873	10 sq. mi.	42,772	9027 Center St. Manassas, VA 20110	14,387	Winter Weather, Flood, High Wind, Severe Weather

City of Manassas Risk Environment

The following is an overview of the basis for the details in this annex. The details in the annex and summarized here, lead up to a well-researched mitigation strategy for the community.

Hazard Event History

National Centers for Environmental Information (NCEI),1996–May 2021

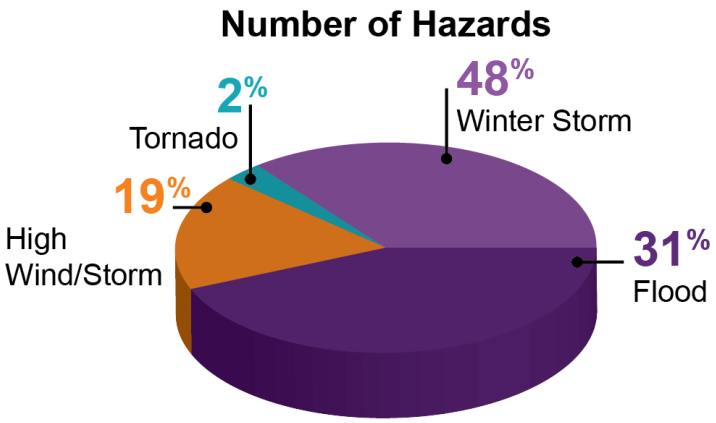

Figure 1: Percentage of Hazards

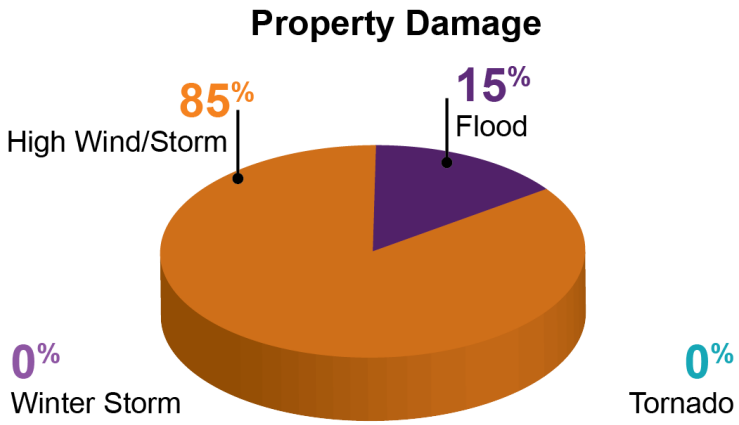

Figure 2: Percentage of Property Damage Costs from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Ranking of Natural Hazards by Risk

Hazard	Hazard Ranking
Winter Weather	**High**
Flood/Flash Flood	**High**
High Wind/Severe Storm	**High**
Tornado	**High**
Drought	**Medium**
Earthquake	**Medium**
Extreme Temperatures	**Medium**
Dam Failure	**Medium**
Karst/Sinkhole/Land Subsidence	**Low**
Wildfire	**Low**
Landslide	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	4
Food, Water, Shelter	0
Health and Medical	1
Energy	2
Communications	3
Transportation	48
Hazardous Materials	0
Education	17
Cultural/Historical	2
High Hazard Dams	2

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for the City of Manassas

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Point of Contact	Contact Information
Primary Point of Contact	Amelia Gagnon, Emergency Management Specialist 703-257-8062 agagnon@manassasva.gov 9324 West St., Suite 103 Manassas VA 20110
Secondary Point of Contact	William Garrett, Fire and Rescue Chief, Emergency Management Coordinator 703-257-8465 wgarrett@manassasva.gov 9324 West St., Suite 103 Manassas, VA 20110

City of Manassas

This annex presents the following jurisdiction-specific information provided by the City of Manassas for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP).*

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List of Figures

1. Jurisdiction Profile

Established	1873
Total Land Area	10 square miles
Geographic Region	Piedmont/Coastal Plain
Persons Per Household	3.13
Persons Per Square Mile	4,174
Median Age	35.2 (as of 2019)
Elevation	Near sea level (~0 feet): 500 feet

1.1. Location

Manassas is an independent city in the Commonwealth of Virginia. The City is located a little over 30 miles west of Washington, D.C. and has several important historic sites from the period of 1825–1914.

1.2. History

In July 1861, the First Battle of Manassas—also known as the First Battle of Bull Run—was fought nearby and is considered the first major land battle of the American Civil War. At that time, Manassas Junction was little more than a railroad crossing, but a strategic one, with rails leading to Richmond, Virginia, Washington, D.C., and the Shenandoah Valley. Following the war, the crossroads grew into the town of Manassas, which was incorporated in 1873. In 1894, Manassas was designated the county seat of Prince William County. In 1975, Manassas was incorporated as an independent city, and as per Virginia law, was separated from Prince William County.

1.3. Demographics, Economy, and Governance

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context for the entire plan. The 2020 U.S. census population estimate for the City of Manassas is 42,772, an approximate 13.1% increase since the 2010 Census. The City is densely populated with 4,179 residents per square mile.

Table 6: Population and Growth Rate

Year	Population	Annual Percent Change
1970	9,164	-
1980	15,438	68.5%
1990	27,957	81.1%
2000	35,135	25.7%
2010	37,821	7.6%
2020	42,772	13.1%

Table 7: Race and Ethnicity Demographics[1] [2]

Race and Ethnicity	Population	Percent of Population
American Indian and Alaska Native	536	1%
Black/African American	5,124	10%
Asian/ Pacific Islander	2,765	6%
Hispanic or Latino	18,345	37%
White	16,717	34%
Two or More Races	5,655	12%

Table 8: Economic Data

Economy	Data
Median Household Income (in 2020 dollars) 2016–2020	$86,227
Unemployment Rate (September 2021)	2.6%
Per Capita Income (in 2020 dollars) 2016–2020	$34,198
Median House or Condo Market Value (2019)	$338,100
Percentage Below Poverty (2019)	7%
Number of Businesses (2019)	4,123
Most Common Business (2020)	Office

1.4. Built Environment and Community Lifelines

The information related to Community Lifelines and critical assets in the City of Manassas presented in this section has been collected from multiple sources, Hazus (Version 4.2), and city government websites. Data extracted from the Hazus Level 1 assessment indicates that the City of Manassas has an estimated total of 74 Community Lifelines and critical assets. Due to the time lag in collecting and verifying data, and the method of documenting location and jurisdiction used in Hazus, this may not reflect the current inventory maintained by the City of Manassas.

Table 98 provides a summary of the number of critical assets by type. The City of Manassas maintains a detailed list of Community Lifeline facilities, sites, and critical assets.

Table 9: Number of Assets per Community Lifeline/Sector

Lifeline/Sector	Number of Assets
Safety and Security	4

[1] Manassas, Virginia Population 2021 (Demographics, Maps, Graphs) (Census2020)

[2] Census Race and Ethnicity numbers differ from the City's population – this is due to respondents of the census checking multiple boxes for the Race and Ethnicity questions.

Lifeline/Sector	Number of Assets
Food, Water, Shelter	0
Health and Medical	1
Energy	2
Communications	3
Transportation	48
Hazardous Materials	0
Education	17
Cultural/Historical	2
High Hazard Dams	2

1.4.1. Safety and Security

As of April 2021, the City of Manassas has two fire stations, one police station, an emergency operations center (EOC), and an alternate EOC.

1.4.2. Food, Water, Shelter

Food commodities are available throughout the city from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

The Manassas public water system provides safe drinking water for the City of Manassas, Manassas Park, and western Prince William County residents. The primary source of water is Lake Manassas, an 880-acre reservoir located in Gainesville, Virginia (approximately 12 miles west of the City of Manassas). The lake is fed by two main sources, Broad Run and North Branch, as well as several other small tributaries. Water is drawn from the high side of the Manassas Lake Dam through three inlets at the south end of the lake and contains three (3) water intake locations for the Water Treatment Plant. The dam, a 710-foot-long construction, has a concrete spillway with an elevation of 290'. The intakes are at elevations of 280', 268', and 254' and have individual screens at the end of each intake pipe that feed a single pipe to the Water Treatment Plant, which is located on the low side of the dam. The T. Nelson Elliott Dam was originally constructed in the early 1970s to create a potable water supply reservoir. The plant is located in Prince William County, Virginia. The property is approximately 17 acres in size. It slopes towards Broad Run to the east and is bordered by Lake Manassas to the north. The surrounding area is wooded with farmland. The Water Treatment Plant consists of several buildings and structures, including a compressor building, a chemical storage building, filter buildings, a water pumping station, a waste thickener, a clear well, a backwash surge tank, clarifiers, and a storm water detention pond. The plant pumps water to the City through a single 24-inch diameter pipeline using two of four available pumps at the plant. Two pumps are available to operate on demand. The process is controlled by a Supervisory Control and Data Acquisition (SCADA) system, which is maintained by the City of Manassas Utility Department. The SCADA system controls six electric substations, three generation facilities, water treatment and distribution, and sewer.

The City distribution system includes 173 miles of watermains ranging in size from 3"–36", two elevated storage tanks and one (1) ground tank. There is 1 pump station and 12,000 service connections, 8 interconnections, and meter vaults that are included in the system for operations and emergencies as needed. Table 10 lists the location, type, and capacity of the storage tanks.

Table 10: Storage Tank Type, Location, and Capacity

Tank	Type	Location	Size
Quarry Road	Elevated	8151 Quarry Road	1,000,000 gallons
Prince William Street	Elevated	9160 Prince William Street at West	300,000 gallons
Dean Drive	Ground	9723 Dean Drive	2–2,500,000 gallons

1.4.3. Health and Medical

Hazus data identified one health and medical facility offering patient care, urgent care, emergency rooms, and other healthcare services in the City of Manassas.

1.4.4. Energy

There is one energy provider that services the City of Manassas.

1.4.5. Communications

Most communications, information systems, and infrastructure in the United States are privately owned; however, the city maintains authority and control over public safety communications for fire, police, and other responding agencies. The City has their own police 911 center, while fire/rescue falls under the County. In addition, the Hazus database notes three broadcast facilities—two television and one radio station—in the City.

1.4.6. Transportation

The Hazus database notes a total of 48 transportation structures, facilities, or segments, including the following:

- Highway Bridges – 19
- Railway Bridges – 2
- Railway Facilities and Segments – 24
- Light Rail Facilities and Segments – 3

1.4.7. Hazardous Materials

Currently there are no hazardous material facilities or storage sites listed in the Hazus database for the City of Manassas.

1.4.8. Education

The City of Manassas public school district has five elementary schools, two intermediate, one middle, and one high school. The Hazus database identifies eight additional educational facilities, including private schools.

1.4.9. Recreational, Cultural and Historic Sites, and Assets

The City of Manassas operates 23 developed parks and historic assets of special architectural, historic, archaeological, or cultural value to residents and visitors. Seven are designated by the National Register of Historic Places including the downtown historic district and six individual sites including Annaburg, Liberia, the Manassas Industrial School for Colored Youth, Cannon Branch Fort, Mayfield Fort, and the Manassas Water Tower.

1.5. Growth and Development Trends

Manassas' growth is closely tied to its proximity to Washington, D.C. and the railroad that connects that area to southwest Virginia. The railroad and other transportation assets, such as the Manassas Regional Airport, major roads, and parkways, provide links to regional opportunities and encourage economic development.

The population demographic has been changing in the city, much like other jurisdictions in the region, but is maintaining a steady growth pattern. The population has increased in the 65+ age demographic, as well as the ethnic mix, impacting transportation, housing, and employment needs.

Much of the available land in the city consists of small, separate parcels which create obstacles for master-planned development. Consequently, new growth is expected to be concentrated in urban, compact infill, and redevelopment along transportation corridors and within the downtown area, with small neighborhoods around the growth areas[3]. This development pattern has the potential to consume current open spaces that provide overland relief for flooding and increase the size of areas that are impervious to drainage, which will lead to more flash flooding. The development process provides the opportunity to integrate hazard mitigation planning to provide appropriate transitions to address future development.

[3] Manassas 2040: City of Manassas Comprehensive Plan. Retrieved at: https://www.manassasva.gov/community_development/planning_and_zoning/comprehensive_plan_update.php

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the City of Manassas followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Team, the City supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction.

Table 11: Local Planning Group Participants

Name	Position/Title	Department/Agency
Tony Dawood	Director of Utilities	Department of Utilities
Amelia Gagnon	Emergency Management Specialist, Fire/Rescue Department- Office of Emergency Management	Fire and Rescue Department
William Garrett	Fire Chief	Fire and Rescue Department
Scott Horan	Director or Public Works	Department of Public Works
Jim Hartnett	Fire Marshall/Deputy Emergency Management Coordinator	Fire and Rescue Department
Patty Prince	Communications Manager	Department of Communications
Liz Via-Gossman	Assistant City Manager/Community Development (Retired)	Department of Community Development
Bryan Foster	Deputy City Manager	City Administration
Matt Arcieri	Director of Planning and Community Development	Department of Community Development
Esteban Jordan	Risk Management Specialist,	Manassas City Public Schools
Tim Fitzwater	Buildings and Grounds Manager	Department of Public Works
Kisha Wilson-Sogunro	Parks, Cultures, and Recreation Manager	Department of Community Development
Jolene Berry	Airport Operations Specialist	Manassas Regional Airport
Jeffrey Stephens	Risk and Safety Analyst	Human Resources
Eric Lowe	Development Services Manager	Department of Community Development
Sean Whitfield	IT Manager	Information Technology
Chris Shields	Lieutenant	Police Department
Margaret Montgomery	GIS Coordinator	GIS
James Hanley	Senior Risk and Safety Analyst	Human Resources
Lance Kilby	City Engineer	Engineering

The jurisdiction identified its chief hazard mitigation planning responsibility as providing oversight in the planning process and representation in the Emergency Managers Group. The City also identified the following tasks as part of its mitigation planning responsibilities:

- Management support for the planning effort

- Planning Group resource/subject matter expert
- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Public outreach activities
- Implementation of the Plan
- Maintaining the Plan

The City of Manassas planning participants coordinated primarily via virtual meetings during the planning process, and independently as needed to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks, and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group's meetings is included in the **Base Plan, Appendix A.**

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a public survey and access to the draft plan for review and input.

In addition to the survey, the public was offered the opportunity to review and provide input to the Draft 2022 Plan update. Notification of the Draft Plan release was made through the same county web link. Documentation of the public survey and draft plan review is included in **Attachment 2** of this annex.

3. Jurisdiction-Specific Hazard Event History

The City of Manassas's comprehensive hazard history is described in **Section 5, Base Plan**. The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 471 recorded natural meteorological events that took place in the city between January 1, 1996, and May 2021. Total property and crop damage exceeded $18 million and there was one death and nine injuries associated with the events. The city has been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 12: Federal Disaster and Emergency Declarations (2017–2021), City of Manassas

Declaration	Date	Hazard	Assistance Type
DR 4512	Apr. 2020	Virginia COVID-19 Pandemic	PA-B
EM 3448	Mar. 2020	Virginia COVID-19	PA-B
EM 3403	Sep. 2018	Virginia Hurricane Florence	PA-B

Table 13: Significant Hazard Events Identified by the City of Manassas, 2017–2021

Date	Hazard	Event and Description
05/26/2021	Thunderstorm Wind	Widespread wind damage was reported in and around Manassas. A tree blew down on Fairview Avenue next to the Manassas Police Station. Multiple large tree limbs were snapped off near the intersection of Sudley Road and VA-28 Centreville Road. Nearby, a tree fell onto a mobile home, destroying it. Numerous trees were blown down in the 9000 block of VA-28 Centreville Road.

4. Hazard Risk Ranking

After developing hazard profiles, the City of Manassas Planning Group conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which can be summarized by one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan**. The Hazard Risk Ranking scores by individual categories for the city are provided in **Attachment 2** of this annex.
The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5, Base Plan**, and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II** of this Plan.

Table 14: Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.7	3.5	7.2	**High**
Flood/Flash Flood	1.7	4.2	5.9	**High**
High Wind/Severe Storm	2.7	3.2	5.8	**High**
Tornado	1.3	4.3	5.7	**High**
Drought	2.3	3.2	5.5	**Medium**
Earthquake	2.3	3.2	5.6	**Medium**
Extreme Temperatures	3.0	2.5	5.5	**Medium**
Dam Failure	1.0	4.1	5.1	**Medium**
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	**Low**
Wildfire	0	0	0	**Low**
Landslide	0	0	0	**Low**

Table 15: Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	3.0	5.8	8.8	**High**
Terrorism	1.0	6.4	7.4	**High**
Cyberattack	2.0	4.7	6.7	**High**
Civil Unrest	1.3	5.2	6.5	**High**
Hazardous Materials	1.3	3.9	5.3	**Medium**
Communication Disruption	1.3	3.7	5.0	**Medium**
Active Violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, the City of Manassas evaluated the level of risk for 16 hazards: 9 natural and 7 non-natural. Two of the natural hazards—landslide and wildfire—do not affect the area and are not applicable to the hazard risk ranking. Nine natural hazards were identified as high or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter weather, flood/flash flood, high wind/severe storm, and tornado
- **Medium:** Earthquake, drought, extreme temperatures, and dam failure

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious disease/public health, terrorism, and cyberattack
- **Medium:** Civil unrest and hazardous materials

All other hazards are ranked as “low” or “not applicable,” signifying a minimal or unlikely risk to the City of Manassas.

4.1. Additional Hazard Risk Considerations

4.1.1. Dam Failure

There are two dams located within the city limits of Manassas, and one dam that is close to the border in Prince William County. These dams have the potential to fail and compromise the safety of those living in the City.

Table 16: State-Regulated High Hazard Dams in the City of Manassas, as of May 2021[4]

Dam Name	Dam Owner/Operator
Winters Branch Dam	City of Manassas
Manassas Dam #1	Unknown
Innovation at Prince William Pond 3	Prince William County Department of Public Works Environmental Services Division

[4] National Inventory of Dams (army.mil)

4.1.2. Flood/Flash Flood

Table 17: Flood/Flash Flood Events in the City of Manassas, 1996–May 31, 2021[5]

Flood/Flash Flood Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
17	0	0	$20,000	0	$20,000

4.1.3. High Wind/Severe Storm

Table 18: High Wind/Severe Storm Events in the City of Manassas, 1996–May 21, 2021 presents the number of severe storm events documented in the NCEI Storm Events Database, including high wind and impacts to people, property, and crops.

Table 18: High Wind/Severe Storm Events in the City of Manassas, 1996–May 21, 2021[6]

High Wind and Severe Storm Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
7	0	0	$110,000	$0	$110,000

4.1.4. Winter Weather

Table 19: Severe Winter Weather Events in the City of Manassas, 1996–May 31, 2021 presents the number of severe winter storm events documented in the NCEI Storm Events Database, including blizzard, heavy snow, winter storm, and winter weather.

Table 19: Severe Winter Weather Events in the City of Manassas, 1996–May 31, 2021[7]

Severe Winter Storm Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
14	0	0	$0	0	$0

Other hazard information for the City of Manassas is presented in the **Base Plan**.

[5] https://www.ncei.noaa.gov/access
[6] https://www.ncei.noaa.gov/access
[7] https://www.ncei.noaa.gov/access

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

The City of Manassas is a participant in the National Flood Insurance Program (NFIP).

Table 20:NFIP Policy Status, City of Manassas

Policies in Force	Premiums Paid	Total Coverage
82	$61,668	$23,284,900

Table 21: National Flood Insurance Program Status, City of Manassas

Initial Flood Hazard Boundary Map (FHBM) Identified	Initial Flood Insurance Rate Map (FIRM) Identified	Current Effective FIRM Date	Regular-Emergency Date	Digital Flood Insurance Rate Map (DFIRM)/(Q3)
5/31/1974	1/3/1979	1/5/1995	1/3/1979	DFIRM

NFIP Topic	Source of Information	Comments
Insurance Summary		
How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist	82
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist	
How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA)	

NFIP Topic	Source of Information	Comments
Describe any areas of flood risk with limited NFIP policy coverage.	Community FPA and FEMA Insurance Specialist	
Staff Resources		
Is the Community FPA or NFIP Coordinator certified?	Community FPA	One CFM on Staff
Is floodplain management an auxiliary function?	Community FPA	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability).	Community FPA	Engineering reviews of new development, floodplain studies, and LOMAs. Staff does not have capacity for education, outreach, or inspection.
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	
Compliance History		
Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	
Are there any outstanding compliance issues (i.e., current violations)?		Yes (9851 Park Street)
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		June 18, 2013

5.2. Population

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations. The CDC SVI depicts the vulnerability of communities at census tract level, by county, into fifteen census-derived factors grouped into four themes: socioeconomic status, household composition/disability, race/ethnicity/language, and housing type/transportation. Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills.

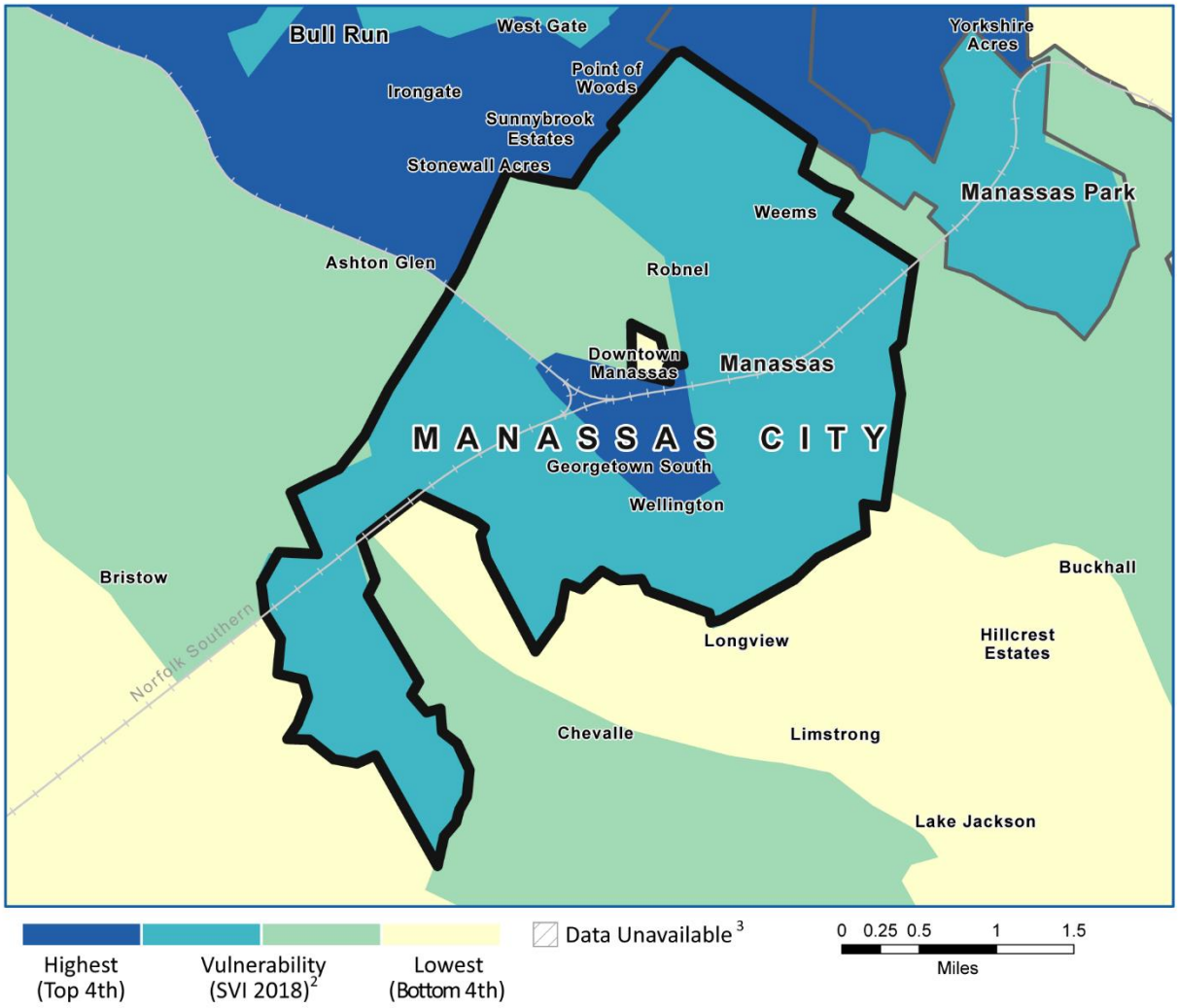


Figure 4: Overall Social Vulnerability (2018), City of Manassas

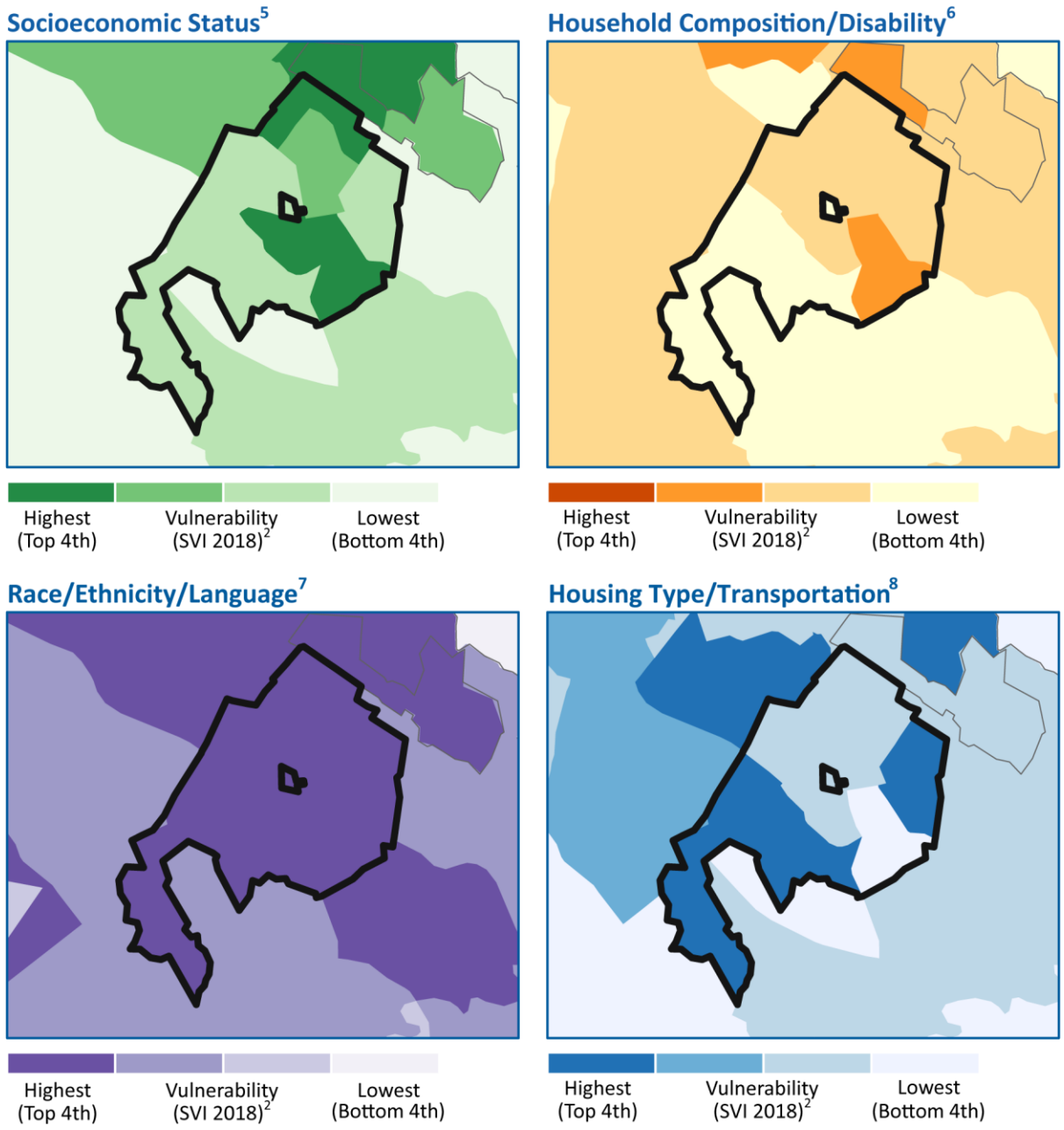


Figure 5: Social Vulnerability, by Theme, City of Manassas[8]

The themed maps illustrate the City's higher level of vulnerability within the race/ethnicity/language theme, demonstrating the importance of communicating essential hazard mitigation, preparedness, response, and recovery information to the public in alternate formats and multiple languages.

[8] Virginia2018_Manassas city.pdf (cdc.gov)

5.3. Built Environment

Based on data currently available through Hazus, the tables presented in this section provide a total number of exposed facilities and properties in relation to earthquake, flood, and hurricane wind.

Table 22: Building Stock Exposure by General Occupancy

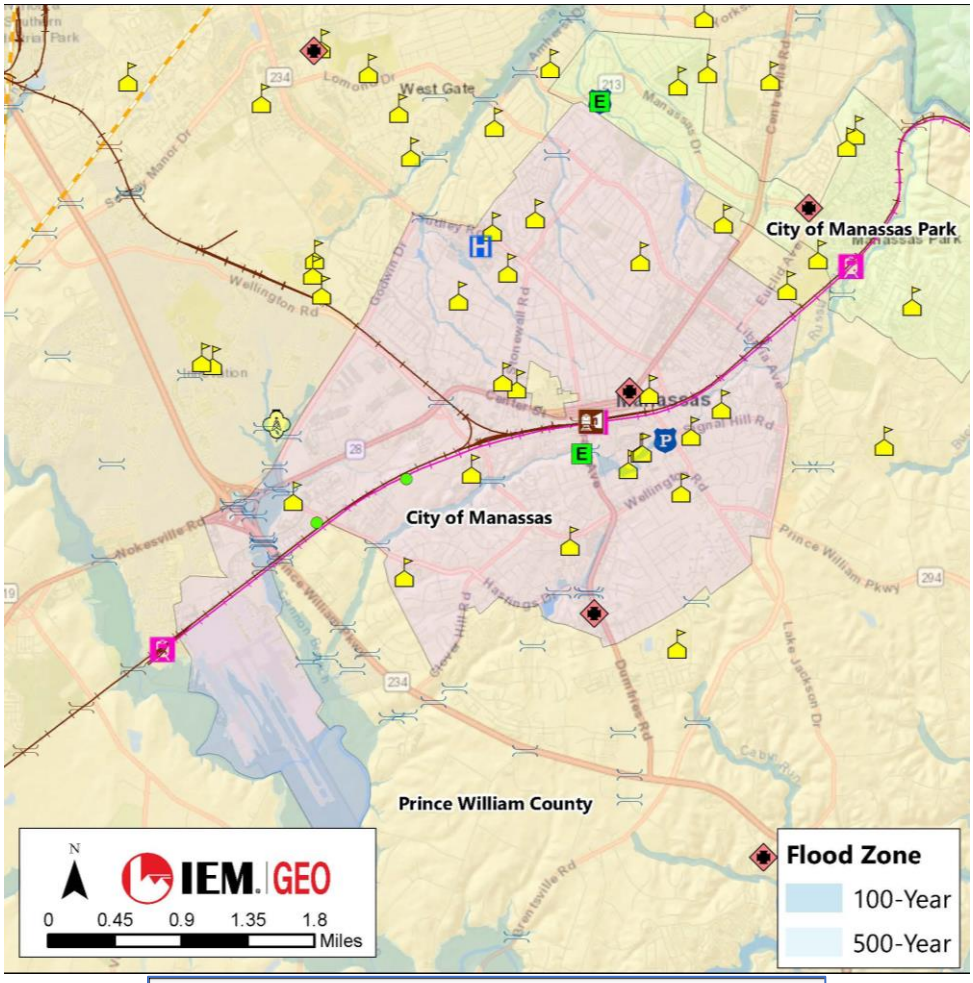
Type	Amount
Residential	$3,672,496,000
Commercial	$885,410,000
Industrial	$229,191,000
Agricultural	$11,562,000
Religion	$59,555,000
Government	$32,685,000
Education	$56,356,000
TOTAL	**$4,947,255,000**

5.4. Community Lifelines and Assets

The City of Manassas reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events. The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA.

Table 23: Critical Facilities Exposed to FEMA Floodplains, City of Manassas

Facility Type	Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
Railway Segments	24	2	0
Highway Bridges	19	3	2
Highway Segments	11	6	1
Light Rail Segments	2	1	0



Legend

- Medical Care Facilities
- Emergency Operations Centers
- Fire Stations
- Police Stations
- Schools
- Highway Bridges
- Highway Tunnels
- Railway Bridges
- Railway Facilities
- Light Rail Facilities
- Bus Terminals
- Ports
- Ferries
- Potable Water System Facilities
- Waste Water Treatment Plants
- Natural Gas Compressor Plants
- Oil Refineries
- Power Plants
- Airport Facilities
- Broadcast Facilities
- Highway Segments
- Light Rail Segments
- Railway Segments
- Natural Gas Pipelines

Source: FEMA 2021

Figure 6: Critical Facilities in Flood Zones

5.5. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

5.6. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2,500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets.

Table 24: Direct Economic Losses Related to Earthquake, Flood, and Hurricane Wind

Hazard	Buildings (capital stock and income)	Transportation	Utilities
Earthquake	76,980	353	4,332
Flood	11,877	0	0
Hurricane Wind	3,266	0	0

5.7. Cultural and Historical Assets

Information related to vulnerability of cultural and historical assets is presented in the hazard-specific sections of the **Base Plan**.

Historic structures and sites are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites.

Table 25: Cultural and Historic Properties Exposed to FEMA Floodplains, City of Manassas

Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
7	0	0

6. Capability Assessment

The City of Manassas reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the city completed a Jurisdiction Needs Identification Questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the levels of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans, and/or resources, and it can implement most mitigation actions.

Table 26: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary

The City utilizes the all-hazards approach when developing any jurisdictional plans, including emergency operations and continuity of operations, as well as the hazard mitigation plan.

The following plans have been newly developed or updated since the 2017 HMP:

- Comprehensive Plan
- Capital Improvements Plan
- Local Emergency Operations Plan

Capability Analysis: High

Significant planning and regulatory tools are in place within the City of Manassas and shed light on successes in integrating hazard mitigation planning with existing planning mechanisms. This demonstrates that the jurisdiction recognizes the benefit of incorporating hazard mitigation in local planning and regulatory processes such as the Comprehensive Plan, Capital Improvement Plan, and land development and floodplain regulations, as well as how to use these to develop and implement mitigation actions.

6.1.2. Administrative and Technical Capabilities Summary

- Planning and Zoning staff include planners, engineers, and a floodplain manager with an understanding of natural and non-natural hazards who are integrated into mitigation planning.
- The City maintains an Information Technology department with GIS personnel.
- City emergency management, county health department, and other staff are familiar with the community's hazards.
- City administration has a grant writer who coordinates with the hazard mitigation program.

The City identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and implementation of the plan:

- Emergency Management and Security
- Fire Department
- Health Department
- Police Department

- Communications
- Public Works
- Department of Utilities
- Department of Community Development
- City Administration
- Manassas City Public Schools
- Risk Management
- Manassas Regional Airport
- Information Technology and GIS
- Engineering Department

Capability Analysis: High

The City of Manassas has a robust staffing capability that provides for a high level of coordination for the purpose of mitigation planning and action implementation. While enhancements in its administrative and technical capabilities were achieved through the increase in department and agency positions that have resulted from the COVID-19 pandemic, the need for continued funding for positions and ongoing education and training present an area for improvement.

Additional staff time is needed to fulfill the demands of the floodplain manager role. At present, only the floodplain engineering staff review for new/redevelopment of items is completed.

6.1.3. Safe Growth Capabilities Summary

- Land-use policies discourage development or redevelopment in natural hazard areas.
- Transportation plan limits access to hazard areas.
- Environmental systems that protect development from hazards are identified and mapped.

6.1.3.1. Capability Analysis Moderate

The City of Manassas has well-established safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment.

6.1.4. Financial Capabilities Summary

- The City's capital improvements plan provides funding for projects outside of the jurisdiction's annual operational budget.
- The City has the authority to incur debt through general obligation bonds and/or special tax bonds, as well as fees for utility services and impact fees for new development.
- The City acquires state funding when applicable through SLAF and CWSRF.

Capability Analysis: Moderate

Onsite work restrictions imposed during the COVID-19 pandemic, started in March 2020 and continued throughout 2021, presented challenges to staff availability and coordination. To address these shortfalls, the city may access technical assistance available to potential applicants provided by many grant programs or expand its capabilities to develop and manage mitigation actions through contracted services.

From an engineering and stormwater perspective, risk reduction should be a primary driver in future project planning. Once the updated HMP is complete, it will be used similarly to the way that the City Strategic Plan and City Comprehensive Plan are in program planning.

6.1.5. Education and Outreach Capabilities Summary

The City of Manassas works alongside the following to educate the citizens that reside within the city limits.

- American Red Cross
- Volunteer Prince William
- Community Emergency Response Team
- Community outreach events
- Preparedness communities

Capability Analysis: Moderate

Jurisdictions have multiple opportunities to promote hazard mitigation and increase involvement of stakeholders and the public. There is a critical need to inform the additional stakeholders and the public about the benefits of hazard mitigation planning and implementation.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, the City of Manassas identified activities related to each natural hazard that support risk reduction.

Table 27: Capability Summary-Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Dam Failure (including Levees)	• Public education and operational plans address preparedness and response to reduce risk.
Drought	• Public education and operational plans address preparedness and response to reduce risk. • The Drought Contingency Plan outlines a strategy for monitoring and responding to drought or potential drought. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and international building codes provide for seismic design regulations.

Hazard	Activity
	• Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	• Public education and operational plans address preparedness and response to reduce risk.
Flood/Flash Flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. • Stormwater management programs and projects address flood prevention and risk reduction.
High Wind/Severe Storm	• State and international building codes provide for wind load design regulations.
Karst/Sinkhole/Land Subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Winter Weather	• Public education and operational plans address preparedness and response to reduce risk.
Non-Natural Hazards	• Public education and operational plans address preparedness and response to reduce risk. • Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate Change	• Ongoing resilience planning will allow for identification and mitigation of climate change-related issues in future planning cycles.

7. Resilience to Hazards

7.1. National Risk Index

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of “low risk” is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

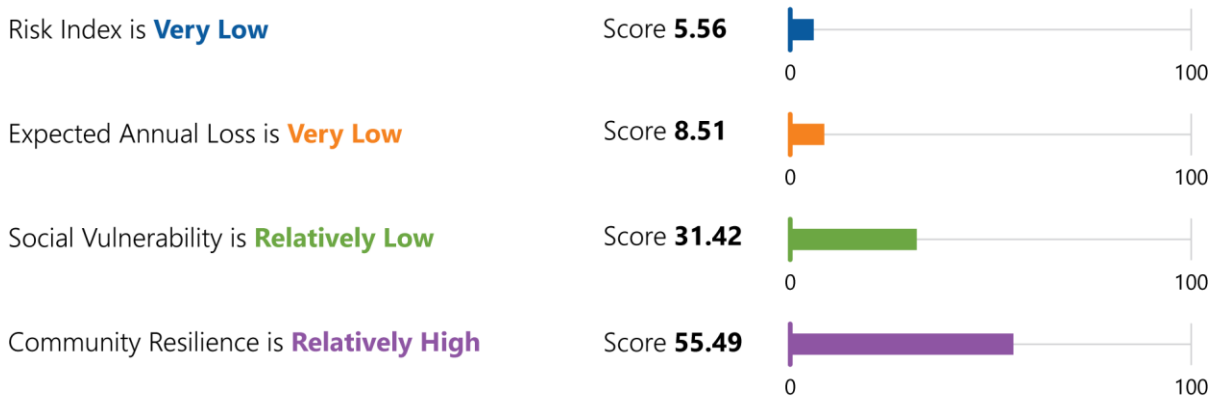


Figure 7: Summary of National Risk Index Findings, City of Manassas

The National Risk Index (NRI) is a dataset and online tool developed by the Federal Emergency Management Agency (FEMA) and other partners to help illustrate communities in the United States at risk for 18 natural hazards.

National Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard risk is calculated based on data for a single hazard type and reflects the relative risk for that hazard type and should be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local hazard risk ranking in the **Hazard Risk Ranking** section of this annex. In addition, some hazards are defined differently than the hazards in this plan, so a direct hazard-to-hazard comparison of risk is unable to be determined.

Based on the NRI findings, the highest five hazards by risk rating for the city are Strong Wind, Lightning, Tornado, Cold Wave, and Hail; however, even these hazards were ranked as “relatively low.” Drought, Landslide, and Wildfire received no rating. The city has determined it is not at risk for landslide or wildfire, and will not profile them as hazards in this update.

Hazard Types	Risk Index Rating	Risk Index Score	
Avalanche	Not Applicable	--	
Coastal Flooding	Not Applicable	--	
Cold Wave	Relatively Low	8.94	0 100
Drought	No Rating	0.00	0 100
Earthquake	Very Low	1.99	0 100
Hail	Relatively Low	8.89	0 100
Heat Wave	Relatively Low	8.18	0 100
Hurricane	Relatively Low	5.04	0 100
Ice Storm	Very Low	4.94	0 100
Landslide	No Rating	0.00	0 100
Lightning	Relatively Low	11.23	0 100
Riverine Flooding	Very Low	3.14	0 100
Strong Wind	Relatively Low	12.88	0 100
Tornado	Relatively Low	10.85	0 100
Tsunami	Not Applicable	--	
Volcanic Activity	Not Applicable	--	
Wildfire	No Rating	0.00	0 100
Winter Weather	Very Low	8.36	0 100

Figure 8: Hazard Type Risk Index, National Risk Index[9]

The NRI calculation does not follow the same criteria and formulas used in the hazard risk ranking methodology for this plan, but it is instead provided as a comparative measurement tool.

Table 28: City of Manassas Risk Score

Index	Score
Risk	5.56
Expected Annual Loss	8.51
Social Vulnerability	31.42

[9] Community Report - Manassas City, Virginia | National Risk Index (fema.gov)

Index	Score
Community Resilience	55.49

Table 29: Comparison of City of Manassas Scores with Virginia and National Average[10]

Index	City of Manassas	Virginia Average	National Average
Risk	5.56	6.50	10.60
Expected Annual Loss	8.51	9.22	13.33
Social Vulnerability	31.42	35.32	38.35
Community Resilience	55.49	54.92	54.59

7.2. Community Resilience Estimate

The Community Resilience Estimate (CRE)[11] is a data product produced by the United States Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual- and household-level risk factors.

The index produces aggregate-level (census tract, county, and state) small area estimates that provide a tool for understanding how at-risk specific neighborhoods might be to disasters due to characteristics that may make specific segments of the population more vulnerable to the impacts and consequences of disasters. The 10 risk factors include the following:

1. Income-to-poverty ratio
2. Single or zero caregiver household
3. Unit-level crowding
4. Communication barrier
5. Aged 65 years or older
6. Lack of full-time or year-round employment (Household)
7. Disability
8. No health insurance coverage
9. No vehicle access (Household)
10. No broadband internet access (Household)

The estimate is categorized into three groups: zero risks, one to two risks, and three plus risks. The combination of data and analysis described in this section provides a comprehensive representation of the city's risk, vulnerability, and resilience to all hazards.

[11] https://experience.arcgis.com/experience/b0341fa9b237456c9a9f1758c15cde8d/

7.3. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

The City of Manassas identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- The risk of cyber-related incidents on critical infrastructure and key resource sites
- Impacts of climate change
- Increases in the number of excessive rainfall events that impact new areas with flooding

8. Mitigation Actions

8.1. Goals and Objectives

The City of Manassas Planning Group adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

The City monitors actions and tracks progress through the periodic review, evaluation, revision, and update of the NOVA HMP. Some projects that contribute to risk reduction have been completed or are currently in progress, but have not been included in this plan for one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and resulting risk reduction.

A comprehensive list of previous mitigation actions, including descriptions of progress made and current status, is presented in **Attachment 4** of this annex.

8.3. New Mitigation Actions

In addition to the actions carried forward from previous plans, the City of Manassas Planning Group identified 17 new mitigation actions to include in this plan. **Attachment 3** of this annex includes a table that summarizes each new and continued action, and describes the proposed activity, priority level, estimated cost, and lead agency.

Table 30: New Mitigation Actions Summary

2022 Action Item #	Agency/Department Mitigation Action
2022-1	Identification of Repetitive Loss and Severe Repetitive Loss properties.
2022-2	Public outreach and Alert Manassas expansion.
2022-3	Educate public on floodplain changes.
2022-4	Update zoning and development regulations for critical facilities.
2022-5	Improve access on Piper Lane and Observation Road during flooding periods.
2022-6	Install sensors on Piper Lane at the train trestle.
2022-7	Improve Security infrastructure at Manassas Regional Airport.
2022-8	Install a backup generator at the airport.
2022-9	Install communication relays.
2022-10	Install flood fencing at the airport.
2022-11	Install water/snow/ice sensors throughout the airfield.
2022-12	Provide routine inspections of the airport's main runway 16L/34R and parallel taxiway Bravo bridges.

2022 Action Item #	Agency/Department Mitigation Action
2022-13	Improve drainage throughout the airport.
2022-14	Install additional in-ground fire hydrants throughout the airport.
2022-15	Improve water piping of the airport.
2022-16	Inspect Public Works dams and Sumner Lake dam.
2022-17	Complete the Virginia Department of Conservation and Recreation (DCR) dam certification process.

8.4. Action Plan for Implementation and Integration

The Action Plan for Implementation and Integration describes how the City's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 31: Action Plan for Implementation and Integration, City of Manassas

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plan.	Action (CFI 7.3.5) to enhance the City's disaster preparedness, mitigation, and response by maintaining our emergency operations plans. This action will be a part of the City's Comprehensive Plans going forward.
Review/update land development regulations for consistency with mitigation goals.	Review the City Design and Construction Standards Manual (DCSM) and update regulations to align with mitigation goals as appropriate and permitted by state and local code.
Review/update building/zoning codes for consistency with mitigation goals.	Review local zoning and update as appropriate and permitted by state code. The City building code is adopted at the state level and the City does not have the authority to adopt specific local building regulations.
Maintain regulatory requirements of floodplain insurance program (NFIP).	Monitor regulations and update floodplain ordinance as necessary.
Continue public engagement in mitigation planning.	Pursue additional avenues to engage the public in mitigation planning.
Identify opportunities for mitigation education and outreach.	Incorporate mitigation information into existing public outreach plans.
Review/update stormwater plans and procedures for consistency with mitigation goals.	Propose review as part of annual mitigation plan actions review.
Review/update emergency plans to address evacuation and sheltering.	Continue to ensure evacuation and sheltering are included in future EOPs.
Maintain ongoing enforcement of existing policies.	Highlight the positive effects of mitigation during enforcement.

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Monitor funding opportunities.	Emergency Management will notify stakeholders when funding becomes available.
Incorporate goals and objectives into day-to-day government functions.	Educate all stakeholders on mitigation so that it can be a factor in the day-to-day government functions.
Incorporate goals into day-to-day development policies, reviews, and priorities.	Educate all stakeholders on mitigation so that it can be a factor in the day-to-day development of policies, reviews, and priorities.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 32: City of Manassas Plan Maintenance Responsibilities for the Northern Virginia Hazard Mitigation Plan, Base Plan

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP, Base Plan**, the City of Manassas Emergency Management Specialist will facilitate the method and schedule for maintaining the **Jurisdiction Annex**.

9.2.1. Plan Maintenance Schedule

- Monitor: Annually and/or following major disaster(s)
- Evaluate: Annually and/or following major disaster(s)
- Update: Annual tasks over the five-year planning cycle; planning process in the fifth year

Table 33: City of Manassas Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with jurisdiction planning group. 2. Review the status of all mitigation actions using the Mitigation Action Implementation Worksheet (**Section 3, Attachment A, NOVA HMP Base Plan**).	Produce an annual report that includes the following: • Status update of all mitigation actions • Summary of any changes in hazard risk or vulnerabilities and capabilities • Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	3. Schedule the annual plan evaluation with jurisdiction planning group. 4. Evaluate the current hazard risks, vulnerabilities, and hazard mitigation capabilities using the Planning Considerations Worksheet (**Section 3, Attachment C, NOVA HMP Base Plan**).	Submit the annual report to the NOVA HMP Project Team Point of Contact
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan's components. 4. Following FEMA Approvable Pending Adoption (APA) designation; adopt the updated plan.	Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

The City of Manassas will continue to be a planning partner of multiple jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk of the hazards identified in this plan.

10. Annex Adoption

The City of Manassas Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation Plan*.

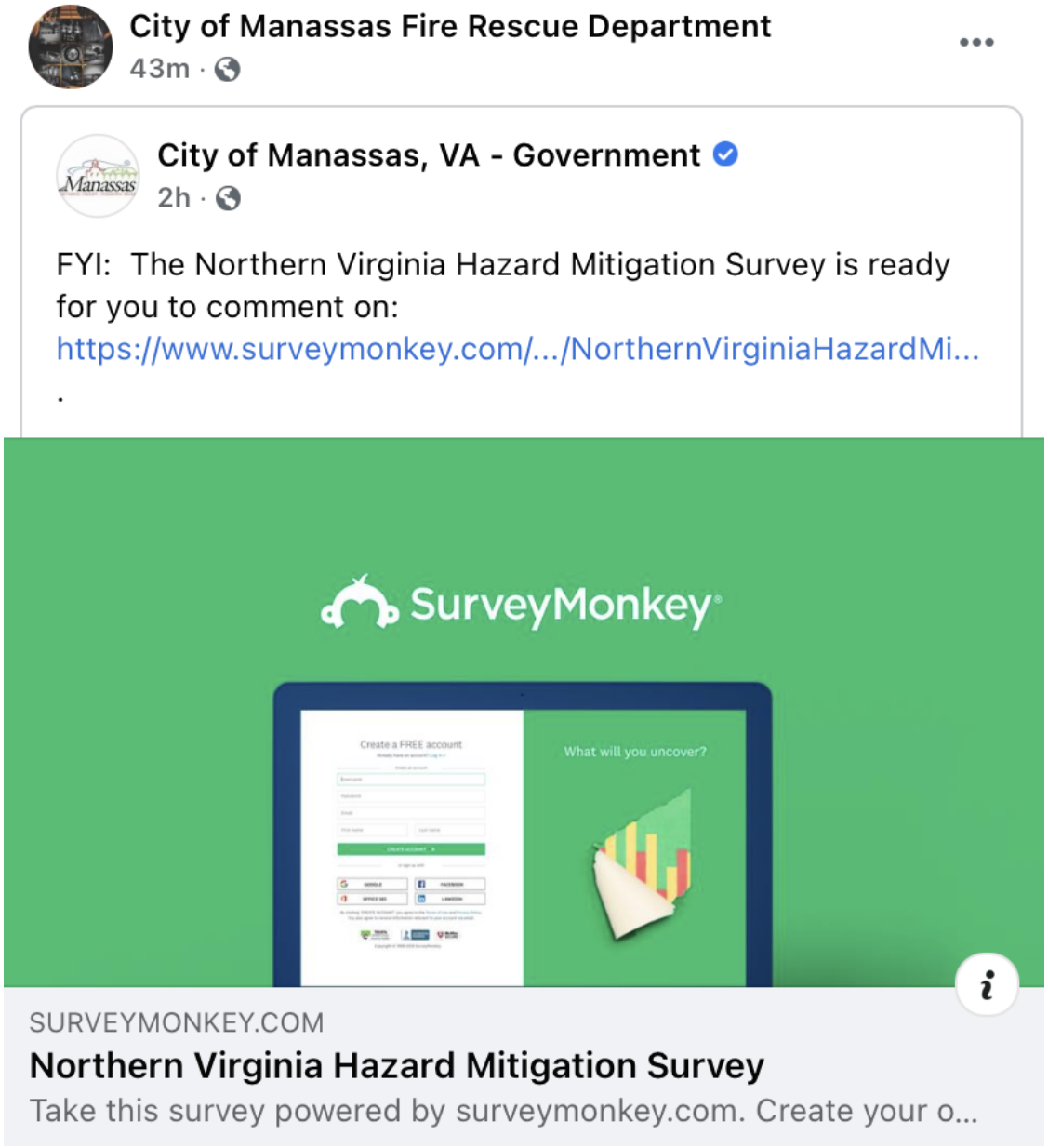
11. City of Manassas Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this Jurisdiction]

11.2. Attachment 2: Documentation of Public Participation




City of Manassas, VA - Government
Published by Patty Prince · Just now ·
FYI: The Northern Virginia Hazard Mitigation Survey is ready for you to comment on:
https://www.surveymonkey.com/.../NorthernVirginiaHazardMi....
SurveyMonkey
Create a FREE account
What will you uncover?
SURVEYMONKEY.COM
Northern Virginia Hazard Mitigation Survey
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11.3. Attachment 3: Mitigation Actions

Table 34: Previous Mitigation Actions

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-1	Evaluate Repetitive Loss and Severe Repetitive Loss properties within the City. Support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and, where feasible and appropriate, using FEMA HMA programs.	Engineering Department, Public Works, Emergency Management	• Dam Failure • Flood • High Wind/ Severe Storm	FEMA Unified Hazard Mitigation Assistance	Ongoing	Obtain funding	High	Ongoing
2017-2	Train required City staff on NIMS/ICS.	All Agencies	• Dam Failure • Drought • Earthquake • Extreme Temperatures • Flood • High Wind/Severe Storm • Karst/Sinkholes • Tornado	EMPG	Ongoing	Annual staff certifications	Low	This is being completed as new staff are hired

			• Winter Weather					
2017-3	Expand communications and notification participation through public outreach.	Emergency Management, CERT volunteers, Fire and Rescue Department-Safe Around Manassas Program (SAM)	All Hazards	Staff and volunteer resources, UASI grants, and private donations	2020	Complete outreach plan, prioritize outreach efforts, implement outreach to priority stakeholder/citizen groups, develop of marketing materials	Medium	SAM Program is in process with limited resources
2017-4	Educate citizens on use of Manassas Alert and expand communications and notification participation through public outreach.	Emergency Management Citizen Corps or CERT volunteers	All Hazards	Staff and volunteer resources	2020	Prioritize stakeholder groups for Manassas Alert outreach efforts	Medium	Ongoing
2017-5	Cross-train staff across departments to support critical functions.	Office of Emergency Management	All Hazards	City Staff resources	Ongoing	Develop a plan for cross-training staff	Medium	Ongoing as new staff are hired
2017-6	Update flood inundation maps.	Department of Public Works	• Dam Failure • Flood	FEMA Risk MAP, City funds	Ongoing	Develop a plan (including schedule) for updating maps	Low	Completed in 2021; will be updated on a 4–5-year cycle
2017-7	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, and flood insurance information) that can assist them in	Engineering Department, Department of Public Works	• Flood • High Wind/ Severe Storm	FEMA Unified Hazard Mitigation Assistance Funding for qualified structures	Ongoing	Develop outreach materials or identify appropriate outreach materials for dissemination	Medium	Ongoing

	reducing their flood risk.							
2017-8	Support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and, where feasible and appropriate, using FEMA HMA programs.	Engineering Department, Department of Public Works	• Flood • High Wind/ Severe Storm	FEMA Unified Hazard Mitigation Assistance Funding for qualified structures	Ongoing	Identify all priority flood-prone structures	Medium	Ongoing
2017-9	Promote structural mitigation to assure redundancy of critical facilities including, but not limited to, roof structure improvement to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	Engineering Department, Office of Emergency Management, Community Development Department	• Dam Failure • Drought • Earthquake • Extreme Temperatures • Flood • High Wind/Severe Storm • Karst/Sinkholes • Tornado • Winter Weather	FEMA Unified Hazard Mitigation Assistance Funding for qualified structures	Ongoing	Query local government building services staffs on effectiveness of provided information regarding the structural review	Medium	Ongoing
2017-10	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinance and any newly permitted activities in the 100-year floodplain. Additionally, conduct	Engineering Department, Department of Public Works	• Flood • High Wind/ Severe Storm	City Funds	Ongoing	Establish a schedule of review and review committee (if necessary)	Medium	Ongoing

	annual review of Repetitive Loss and Severe Repetitive Loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination of whether that property has been mitigated for, and by what means. Provide corrections if needed by filing form FEMA AW-501.							
2017-11	Conduct preparedness presentations in the community to ensure public awareness of steps the public can take to care for themselves during an emergency.	Emergency Management CERT, Fire and Rescue Department	• All Hazards	LEMPG, and UASI Citizen Corps (CERT) Grant	Ongoing	Complete outreach plan; development of outreach materials	Low	Ongoing
2017-12	Increase generator capacity at schools that function as shelters.	Manassas City Public Schools	• All Hazards	FEMA Unified Hazard Mitigation Assistance Funding	2024	Identify funding source	Medium	
2017-13	Increase snow removal capacity at shelter sites.	Manassas City Public Schools	• Winter Weather	City Funds	2018	Identify tools and process to increase capacity	Low	
2017-14	Maintain GIS planimetric data.	IT, GIS	• Flood • High Wind/ Severe Storm	City Funds	2019	Create update schedule	Low	

			• Karst/Sinkholes • Tornado • Winter Weather					

Table 35: New Mitigation Actions

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority
2022-1	Identify Repetitive Loss and Severe Repetitive Loss properties within the City. Support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and, where feasible and appropriate, using FEMA HMA programs.	Engineering Department	• Flood	FEMA Unified Hazard Mitigation Assistance	2024	Secure funding	High
2022-2	Expand communications and notification participation through public outreach and expand program for Alert Manassas.	Emergency Management	• Dam Failure • Drought • Earthquake • Extreme Temperatures • Flood • High Wind/Severe Storm	City funds	2023	Increase in opt-ins to the Alert Manassas system	Medium

			• Karst/Sink holes • Tornado • Winter Weather				
2022-3	Educate public on flood plain changes.	Engineering Department, Communications	• Dam Failure • Flood	City funds	2024	Create outreach materials	Low
2022-4	Update zoning and development regulations for critical facilities including gas stations and grocery stores to require generators or other resilient power supply systems are provided such that ice, food, gasoline, and other similar products may be acquired by consumers during time of extended power outages.	Community Development	• Dam Failure • Drought • Earthquake • Extreme Temperatures • Flood • High Wind/Severe Storm • Karst/Sink holes • Tornado • Winter Weather	City funds	2024	Seek support from stakeholders	Medium
2022-5	Improve access on Piper Lane and Observation Road during flooding periods.	Manassas Regional Airport, Public Works	• Flood • High Wind/ Severe Storm	FEMA Unified Hazard Mitigation Assistance	2024	Identify ways to improve access	High
2022-6	Install sensors on Piper Lane at the train trestle to notify the emergency management teams of current conditions.	Manassas Regional Airport	• Dam Failure • Flood • High Wind/ Severe Storm	FEMA Unified Hazard Mitigation Assistance	2024	Identify funding	Medium

2022-7	Improve Security infrastructure at Manassas Regional Airport through lighting protection, additional servers to store data, additional cameras to scan airport during weather systems.	Manassas Regional Airport	• Dam Failure • Drought • Earthquake • Extreme Temperatures • Flood • High Wind/Severe Storm • Karst/Sinkholes • Tornado • Winter Weather	FEMA Unified Hazard Mitigation Assistance	2024	Identify appropriate security measures	Medium
2022-8	Install a backup generator to aid in the operations of the airport during inclement weather or airport emergencies.	Manassas Regional Airport	• Dam Failure • Drought • Earthquake • Extreme Temperatures • Flood • High Wind/Severe Storm • Karst/Sinkholes • Tornado • Winter Weather	FEMA Unified Hazard Mitigation Assistance	2024	Identify funding	Medium
2022-9	Install communication relays that would help during emergencies and hazardous weather.	Manassas Regional Airport	• Dam Failure	FEMA Unified Hazard Mitigation Assistance	2024	Identify funding	Medium

			• Drought • Earthquake • Extreme Temperatures • Flood • High Wind/Severe Storm • Karst/Sinkholes • Tornado • Winter Weather				
2022-10	Install flood fencing on the airport for flooding events to ensure the fencing does not get knocked down during flooding and security is maintained on the airport.	Manassas Regional Airport	• Dam Failure • Flood	FEMA Unified Hazard Mitigation Assistance	2024	Identify funding	Medium
2022-11	Install water/snow/ice sensors throughout the airfield to notify airport staff and others of conditions at the airport.	Manassas Regional Airport	• Dam Failure • Flood • High Wind/ Severe Storm • Tornado • Winter Weather	FEMA Unified Hazard Mitigation Assistance	2024	Identify funding	Medium
2022-12	Provide routine inspections of the airport's main runway 16L/34R and parallel taxiway Bravo bridges.	Manassas Regional Airport	Earthquake	FEMA Unified Hazard Mitigation Assistance	2024	Identify funding	Medium
2022-13	Improve drainage throughout the airport.	Manassas Regional Airport	Flood	FEMA Unified Hazard Mitigation Assistance	2024	Identify funding	Medium

2022-14	Install additional in-ground fire hydrants throughout the airport as there are limited resources for fire fighters.	Manassas Regional Airport	• High Wind/ Severe Storm • Tornado • Winter Weather	FEMA Unified Hazard Mitigation Assistance	2024	Identify funding	Medium
2022-15	Improve water piping of the airport to create a continuous loop and improve the airport's water pressure.	Manassas Regional Airport	• Drought • Extreme Weather	FEMA Unified Hazard Mitigation Assistance	2024	Identify funding	Medium
2022-16	Inspect Public Works and Sumner Lake dams to see if they meet the threshold for the Virginia Department of Conservation and Recreation (DCR) dam safety regulations.	Engineering Department	Dam Failure	FEMA Unified Hazard Mitigation Assistance	2024	Identify funding	Medium
2022-17	Complete the Virginia Department of Conservation and Recreation (DCR) dam certification process for Public Works and Sumner Lake dams if necessary.	Engineering Department	Dam Failure	FEMA Unified Hazard Mitigation Assistance	2024	Identify funding	Medium

Northern Virginia Hazard Mitigation Plan

Annex 6: City of Manassas Park

November 2022

City of Manassas Park Overview

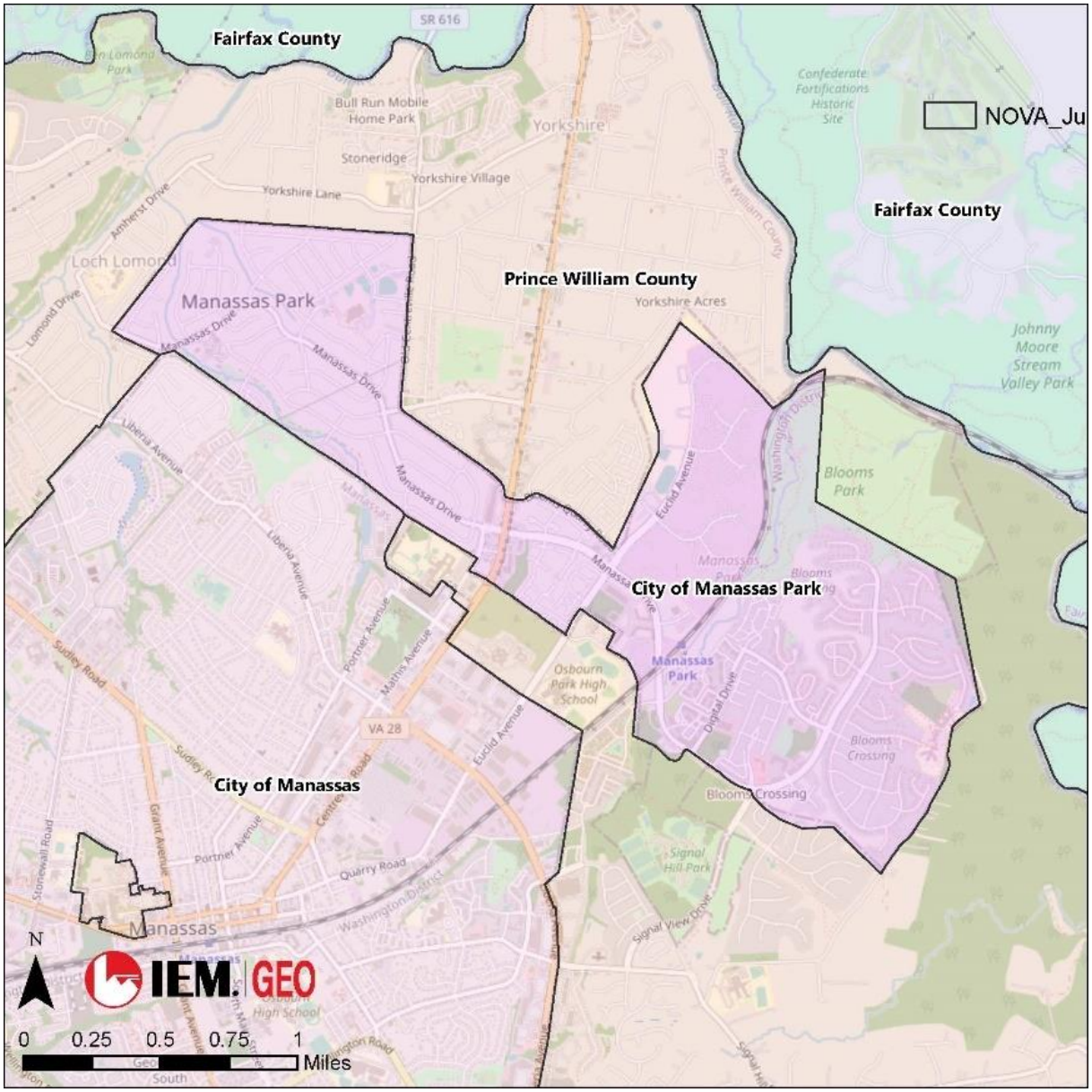

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
Founded in 1957	3.03 sq mi	17,002	One Park Center Court, Manassas Park, VA 20111	4,596	Flood and Flash Flooding

City of Manassas Park Risk Environment[1]

The following is an overview of the basis for the details in this annex. The details in the annex and summarized here, lead up to a well-researched mitigation strategy for the community.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

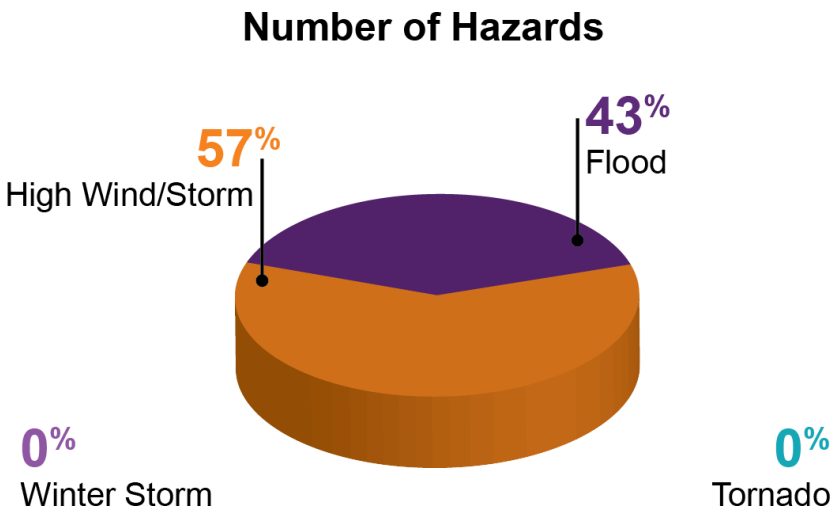

Figure 1: Percentage of Hazards

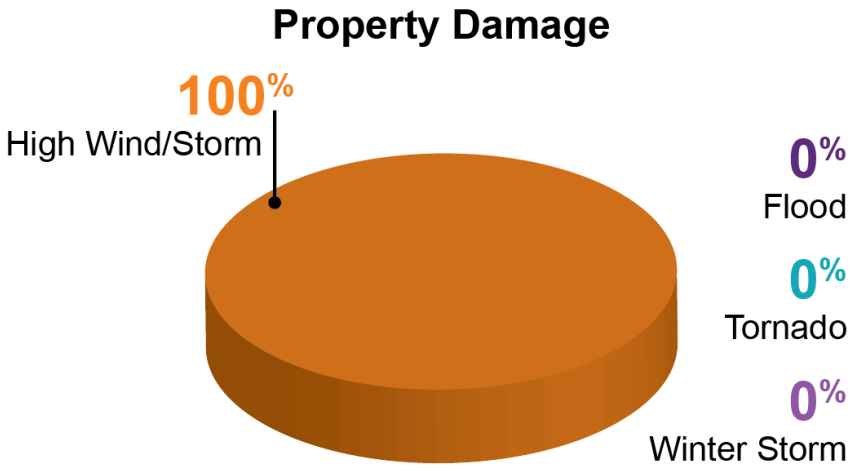

Figure 2: Reported Property Damage Percentages from Natural Hazard Events

[1] Data Source: NOAA, National Center for Environmental Information, Storm Events Database, https://www.ncdc.noaa.gov/stormevents

Natural Hazard Risk Ranking

Hazard	Hazard Ranking
Winter Weather	**High**
Flood	**High**
High Wind/Severe Storm	**High**
Tornado	**Medium**
Earthquake	**Medium**
Drought	**Medium**
Extreme Temperatures	**Medium**
Karst/Sinkhole	**Medium**
Dam Failure	**Low**
Wildfire	**Low**
Landslide	**Low**

Table 2: Ranking of Natural Hazards by Risk

Community Lifelines/Critical Assets

Table 2: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	3
Food, Water, Shelter	0
Health and Medical	1
Energy	0
Communications	0
Transportation	2
Hazardous Materials	0
Education	7
Cultural/Historical	1
High Hazard Dams	0

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 3: Capability Assessment Summary Ranking for the City of Manassas Park

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	Moderate
Safe Growth	High
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Points of Contact

Table 4: Points of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Keith Nguyen, Assistant City Manager City Management 703-335-0640 k.nguyen@manassasparkva.gov One Park Center Court Manassas Park, VA 20111
Secondary Point of Contact	James Soaper Fire and Rescue 703-335-8040 j.soaper@manassaspark.gov One Park Center Court Manassas Park, VA 20111

City of Manassas Park

This annex presents the following jurisdiction-specific information provided by the City of Manassas Park for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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List of Figures

1. Jurisdiction Profile

Geographic Region	Piedmont/Coastal Plain
Persons Per Household	3.82
Persons Per Square Mile	5,611
Median Age	34.7
Elevations	Near sea level – 500 feet

1.1. Location

The City of Manassas Park is a roughly dumbbell-shaped area that lies to the south of Bull Run. Its longest segment runs NW–SE along Manassas Drive, and the town is bisected by Virginia State Route 28.

The City's Vision: "The City of Manassas Park will be the premier Northern Virginia community in which to live, work, and raise a family."

The City's Mission: "Our focus is to ensure the city is a safe, family oriented, socially unified yet diverse, business friendly community that offers comprehensive and quality educational opportunities, demands top environmental standards, and supports a quality transit and infrastructure system."

1.2. History

During the Civil War, Manassas Park was a staging area for troops proceeding to the Battle of Bull Run. The road to Manassas Park becoming an independent city started in 1955 when the first homes were built as a subdivision in Prince William County. In 1956, a group of citizens founded a civic association. In 1957, the courts were petitioned, and Manassas Park achieved city status. "The Park," as the city was called, is now managed by a city manager and governed by a mayor and city council.

Following the annexation of approximately 600 acres of land in 1974, Manassas Park was developed as an independent city in 1975. Now fully incorporated and having nearly doubled in size, it was the last town in the Commonwealth of Virginia to become an independent city. In the years following its founding, Manassas Park developed into a full-service city and established its own schools, police and fire rescue departments, social services, and public works facilities, which have been upgraded over the years as the City matured.

1.3. Demographics and Economy

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context for the entire plan. The 2020 U.S. Census population estimate for the City of Manassas Park was 17,002 an approximate 19% increase since 2010. The City is densely populated with 5,611 residents per square mile.

Table 5: Population Growth

Year	Population
2010	14,273
2020	17,002

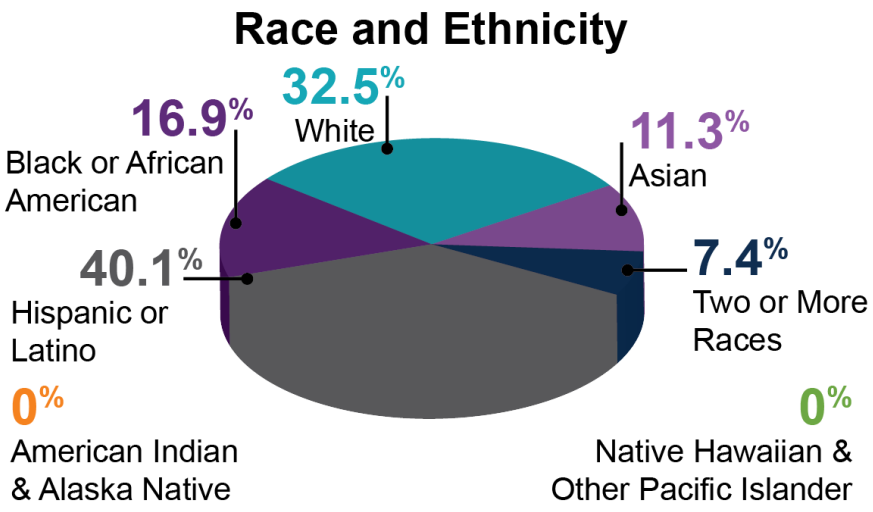


Figure 4: Race and Ethnicity Demographics from 2020 US Census

Table 6: Economic Data

Economy	Data
Median household income (2019)	$81,639
Unemployment rate (September 2021)	4.5%
Per capita income (2019)	$35,618
Median house or condo market value (2020)	$299,700
Percentage below poverty (2019)	5.0%
Number of businesses (2012)	1,572

1.4. Built Environment and Community Lifelines

Table 7: Number of Assets per Community Lifeline/Sector

Lifeline/Sector	Number of Assets
Safety and Security	3
Food, Water, Shelter	0
Health and Medical	1
Energy	0
Communications	0
Transportation	2
Hazardous Materials	0
Education	7
Cultural/Historical	1
High Hazard Dams	0

1.4.1. Safety and Security

The City of Manassas Park has one fire station, one police station, and one Emergency Operations Center as analyzed by the FEMA Hazus risk analysis-based software. A secondary Emergency Operations Center located at the fire station.

1.4.2. Food, Water, and Shelter

Food commodities are available throughout the City from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

1.4.3. Health and Medical

Manassas Park is serviced by the Mason and Partners (MAP) Clinic. The new Manassas Park Chief of Public Health Coordinator will assist residents with health-related issues including working with area health facilities and the County Health Department. Residents seek medical treatment in neighboring communities.

1.4.4. Energy

There are no energy providers in the city limits of Manassas Park, but services are available from providers in neighboring jurisdictions.

1.4.5. Communications

Reports from the FEMA Hazus program indicate there are no direct communication providers in the City, but residents receive services from providers in nearby communities.

1.4.6. Transportation

The Hazus database notes a total of two transportation structures, facilities, or segments, including the following:

- Culvert* – 1
- Light Rail Facilities and Segments – 1

*The culvert is listed as a bridge due to its prominent location, thus indicating its importance.

1.4.7. Hazardous Materials

A Hazus analysis indicates that there are no hazardous facilities or storage sites in the City.

1.4.8. Education

Hazus data shows there are seven schools in the City. There are two elementary schools, one middle school, one high school, a parochial school, and two early childhood learning facilities.

1.4.9. Recreational, Cultural and Historic Sites, and Assets

Reports from the FEMA Hazus program indicate the City has one asset of special architectural, historic, archaeological, or cultural value to residents and visitors. The Connor House, built in in the early 19th century from materials acquired from within the city limits of what is now Manassas Park. The house is believed to have once housed Confederate soldiers during the Civil War.[2]

1.5. Growth and Development Trends

Estimates and forecasts of population, housing units, and households for the City are included in Prince William County information. A Future Housing Demand Projects analysis in the county's comprehensive plan update reports the following[3]:

According to the Metropolitan Washington Council of Governments (COG) 9.2 Round Cooperative Forecasts, the county's population will stand at 520,468 and its households will equal 169,164 in 2020, at an annual change of 9,739 population and 2,993 households between 2000 and 2020. On the supply side, there has been an average annual change of 2,940 housing units between 2000 and 2020 according to the county's property assessment database. This means that during the past two decades, for every additional person there has been 0.3 new housing unit, and for every additional household, there has been 0.98 new housing unit added in the county.

As COG projects that there will be an increase of 107,387 people and 42,714 households between 2020 and 2040 in the county, there will likely be an additional 32,418 to 41,958 new housing units by 2040. This means that the projected number of housing units in 2040 in the county will equal 188,056 to 197,596. Compared to the COG projected 2040 households of 211,878, there will likely be a housing shortage of between 14,282 and 23,822 units in the county in 2040.

In addition, the county's Build-Out Analysis as of December 31, 2019 points out that Prince William County has the capacity for 35,869 additional residential dwelling units, bringing the residential build-out

[2] C. Charity Suthard, *Patch*, April 1, 2011, accessed at https://patch.com/virginia/manassaspark/conner-house-brings-history-to-manassas-park
[3] Prince William County Comprehensive Plan Update, Future Housing Demands Projections. (2021 August). https://www.pwcva.gov/assets/2021-10/Future%20Housing%20Demand%20Projections%209.9.2021.pdf

to 192,486 units. As the projected new housing unit growth will likely fall between 32,418 and 41,958 by 2040, the county's land parcels currently available for residential development under existing zoning will likely be all consumed by future housing development activities. Furthermore, even though the county maxes out its current residential development capacity and reaches the residential build-out to 192,486 units, there will still be a shortage of 19,392 units as COG projected that there will be 211,878 households in the county in 2040.

This suggests that the county's existing lands available for residential development under the current zoning policies are not sufficient to accommodate the future population growth as projected by COG by 2040. The county could look into rezoning some of its non-residential lands and introducing zoning changes to allow for additional residential densities in certain areas to increase its capacity to meet the future housing demand.

Trends in growth and development should be monitored and documented in the next planning cycle with the intent of providing a more detailed statistical analysis of vulnerable populations and how this could affect the analysis of hazards and opportunities for mitigating risks.

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the City of Manassas Park followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Team, the City supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction.

Table 8: Local Planning Group Participants

Name	Position/Title	Department/Agency
Keith Nguyen	Assistant City Manager, Emergency Management representative	City Management
Joe Neiberger	Battalion Chief	Fire and Rescue
James Soaper	Fire Chief	Fire and Rescue

The jurisdiction identified its chief hazard mitigation planning responsibility as providing oversight in the planning process and representation in the Emergency Managers Group. The City also identified the following tasks as part of its mitigation planning responsibilities:

- Support management for the planning effort
- Act as Planning Group resource/subject matter expert
- Provide Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Conduct capabilities assessment
- Develop mitigation strategy
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Conduct public outreach activities
- Implement the Plan
- Maintain the Plan

The City of Manassas Park planning participants coordinated primarily by means of virtual meetings during the planning process, and as needed, independently carried out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a posting on the City's website that pointed users to a public survey about hazards of concern to the City. The same site was later used to provide access to the Final Draft Plan to secure community input. A screenshot of this announcement and additional public outreach documentation is provided in **Attachment 2** of this annex.

3. Jurisdiction-Specific Hazard Event History

The detailed history of hazard events in Northern Virginia, including those of the City of Manassas Park, is described in **Section 5, Base Plan**. The diversity of the region's landscape increases its vulnerability to a variety of hazards, most notably flooding and severe storms. In addition to snow melt and rain-related river flooding episodes, low-lying areas of the City along the Bull Run River are subject to tidal and storm surge flooding. As sea levels rise, permanent inundation of low-lying areas along and near the river shoreline is also a threat. Additionally, winter weather poses significant threats, as evidenced during the 2015–2016 severe winter season, which resulted in a Federal Disaster Declaration.

The National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) Storm Events Database includes 7 recorded natural meteorological events that took place in the City between January 1, 1950, and May 2021. The City has been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 9: Federal Disaster and Emergency Declarations (2017–2021), City of Manassas Park

Declaration	Date	Hazard	Assistance Type
DR 4512	Apr. 2020	Virginia COVID-19 Pandemic	PA-B
EM 3448	Mar. 2020	Virginia COVID-19	PA-B
EM 3403	Sep. 2018	Virginia Hurricane Florence	PA-B

Table 10: Significant Hazard Events Identified by the City of Manassas Park (2017–2021)

Date	Hazard	Event and Description
March 2020	COVID-19 Pandemic	In response to the pandemic, there were mandated closures for businesses, reduced in-person government capacity. Schools were also closed, and virtual learning platforms were used to continue education. FEMA reimbursement was received.
March 2020	Snow	A snow emergency was declared for several days due to a severe winter weather. There were no long-term impacts, but the whole city experienced effects, including no parking on snow emergency routes and telework for government employees.
May 6-12, 2020	Colonial Pipeline Hacking Incident	A local emergency was declared in response to gas shortages at fuel pumps throughout City. The City fleet had to ration gas and implement a refueling plan and city staff operations were modified.
June 2020	First Amendment Activities	A local emergency was declared and the EOC was activated in response to several first amendment activities at the major intersection of Route 28 and Manassas Drive. These events were planned so businesses were able to adjust by closing early and the City was able to place roadblocks, redirect traffic and maintain traffic control.

Date	Hazard	Event and Description
8/12/2020	Moseby Ridge Sinkhole	A large sinkhole and landside occurred due to rain at the Moseby Ridge apartment complex. A culvert collapsed and the road broke open. Due to road damage, there was no entrance or exit available to the complex and traffic had to be rerouted. Two cars had to be pulled out, the culvert and surrounding waterlines had to be replaced, and significant funding was spent on road repairs. All property and infrastructure, including road and cars, were insured. A local declaration was issued, and the City is pursuing VDOT reimbursement.

4. Hazard Risk Ranking

After developing hazard profiles, the City of Manassas Park Planning Committee conducted a two-step quantitative risk assessment for each hazard, which considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan**.
The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented in the hazard sub-sections in **Section 5, Base Plan**, and local details are provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II** of this Plan.

Table 11: Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.7	3.5	7.2	**High**
Flood	1.7	4.2	5.9	**High**
High Wind/Severe Storm	2.7	3.2	5.8	**High**
Tornado	1.3	4.3	5.7	**Medium**
Earthquake	2.3	3.2	5.6	**Medium**
Drought	2.3	3.2	5.5	**Medium**
Extreme Temperatures	3.0	2.5	5.5	**Medium**
Karst/Sinkhole	1.7	2.7	4.4	**Medium**
Dam Failure	1.0	3.1	4.1	**Low**
Wildfire	1.0	3.0	4.0	**Low**
Landslide	1.0	2.7	3.7	**Low**

Table 12: Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	3.0	5.8	8.8	**High**
Terrorism	1.0	6.4	7.4	**High**
Cyber Attack	2.0	4.7	6.7	**High**
Civil Unrest	1.3	5.2	6.5	**Medium**
Hazardous Materials	1.3	3.9	5.3	**Medium**
Communication Disruption	1.3	3.7	5.0	**Low**
Active Violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, the City of Manassas Park evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high- or medium-risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter Weather, Flood (riverine/flash flood), High Wind/Severe Storm
- **Medium:** Tornado, Earthquake, Drought, Extreme temperatures, Karst/Sinkhole

Five non-natural hazards were identified as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, Cyber Attack
- **Medium:** Civil Unrest, Communication Disruption

All other hazards are ranked as “low,” signifying they are a minimal risk to the City of Manassas Park.

4.1. Additional Hazard Risk Considerations

4.1.1. National Risk Index

The National Risk Index (NRI) is a dataset and online tool developed by the Federal Emergency Management Agency (FEMA) and other partners to help illustrate communities in the United States at risk for 18 natural hazards. Hazard risk is calculated based on data for a single hazard type and reflects the relative risk for that type. It should be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently from the hazards in this plan, so a direct hazard-to-hazard comparison of risk cannot be determined.

Based on the NRI findings, the top five risk hazards for the City of Manassas Park (in descending order) are Strong Wind, Landslide, Lightning, Tornado, and Cold Wave (known within this plan as “Extreme Cold”). Lightning, Ice Storm, Hail, and Riverine Flooding received lower risk ratings; however, 10 of the 12 hazards rated for risk were all determined to be “very low,” with two hazards (Heat Wave and Strong Wind) determined to be “relatively low.”

Hazard Types	Risk Index Rating	Risk Index Score	
Avalanche	Not Applicable	--	
Coastal Flooding	Not Applicable	--	
Cold Wave	Very Low	6.13	0 100
Drought	No Rating	0.00	0 100
Earthquake	Very Low	1.31	0 100
Hail	Very Low	4.94	0 100
Heat Wave	Relatively Low	5.66	0 100
Hurricane	Very Low	3.49	0 100
Ice Storm	Very Low	3.68	0 100
Landslide	Very Low	7.42	0 100
Lightning	Very Low	7.19	0 100
Riverine Flooding	Very Low	2.73	0 100
Strong Wind	Relatively Low	9.77	0 100
Tornado	Very Low	7.18	0 100
Tsunami	Not Applicable	--	
Volcanic Activity	Not Applicable	--	
Wildfire	No Rating	0.00	0 100
Winter Weather	Very Low	5.89	0 100

Figure 5: Hazard Type Risk Index, National Risk Index[4]

The NRI calculation does not follow the same criteria and formulas used in the hazard risk ranking methodology for this plan, but this information is provided as a comparative measurement tool.

[4] FEMA, The National Risk Index, accessed at https://hazards.fema.gov/nri/map.
Community Report - Manassas Park City, Virginia | National Risk Index (fema.gov)

Table 13: Comparison of Catastrophic Hazard Likelihood and Consequences

Potential Consequence	High Likelihood	Medium Likelihood	Low Likelihood	No Likelihood
High	• N/A	• Pandemic Influenza • Biological attack	• Nuclear Device	• N/A
Medium	• Hurricane/ Tropical storm wind • Major flooding • Severe thunder or windstorms • Utility failures • Natural infectious disease (not pandemic)	• Chem/bio/rad attack • Complex coordinated attack • Intentional water contamination • Sustained utility outages • Tornado (large)	• Dam Failure • Multi-year drought • Earthquake • Nuclear reactor attack or accident	• N/A
Low	• Extreme heat/ cold • Urban fire • Improvised or vehicle-borne improvised explosive device (IED/VBIED) • Tornado (moderate/small) • Winter storms	• Chemical accident • Isolated terror attack • Coastal erosion • Food contamination • Riots/civil disturbance • Sinkhole	• Livestock disease • Drought • Landslide • Wildfire	• Land subsidence • Tsunami

4.1.2. Dam Failure

According to the National Dam Inventory, there are no dams in the City of Manassas Park, nor are there any that are in the surrounding areas that would affect the City.

4.1.3. Flood/Flash Flood

Table 14: Flood/Flash Flood Events in the City of Manassas Park (1950–May 31, 2021)

Flood/Flash Flood Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
3	0	0	$0	$0	$0

4.1.4. High Wind and Severe Storm

The National Weather Service has a record of specific severe storm events documented in the NCEI Storm Events Database, including high wind and its impacts on people, property, and crops. However, it is highly unlikely that this information is accurate, which is one reason community input is necessary to capture information about hazards affecting the City.

Table 5: City of Manassas Park High Wind/Severe Storm Events, 1950–June 30, 2021

High Wind and Severe Storm Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
4	0	5	$10,000	$0	$10,000

4.1.5. Winter Weather

Information about past winter weather events is in **Section 5, Base Plan**.

Other hazard information for the City of Manassas Park is presented in the **Base Plan**.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets that could potentially be at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

The City of Manassas Park participates in the National Flood Insurance Program (NFIP). In addition, the City may explore a number of options to mitigate against the hazards it faces. These actions cover a broad range of project types that may include planning and regulation, structural, natural systems protection, and public outreach and education projects.

Table 6: National Flood Insurance Program Status, City of Manassas Park[5]

Initial FHBM Identified	Initial FIRM Identified	Current Eff Map Date	Reg-Emer Date
3/11/2017	9/29/1978	1/5/1995	9/29/1978

Table 7: NFIP Status, as of September 14, 2021

NFIP Topic	Source of Information	Comments
Insurance Summary		
How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist Community Information System Database	Unknown
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist Community Information System Database	Unknown
How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA) Estimate from FEMA	Unknown
Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	Unknown
Staff Resources		

[5] Source: FEMA

NFIP Topic	Source of Information	Comments
Is the Community FPA or NFIP Coordinator certified?	Community FPA	Unknown
Is floodplain management an auxiliary function?	Community FPA	Unknown
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	Unknown
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	Unknown
Compliance History		
Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Unknown
Are there any outstanding compliance issues (i.e., current violations)?		Unknown
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		Unknown

5.2. Population

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations. The CDC SVI depicts the vulnerability of communities at the Census tract level into 15 Census-derived factors grouped into four themes—socioeconomic status, household composition/disability, race/ethnicity/language, and housing type/transportation. Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters—such as tornadoes or disease outbreaks—to human-caused threats, e.g., toxic chemical spills.

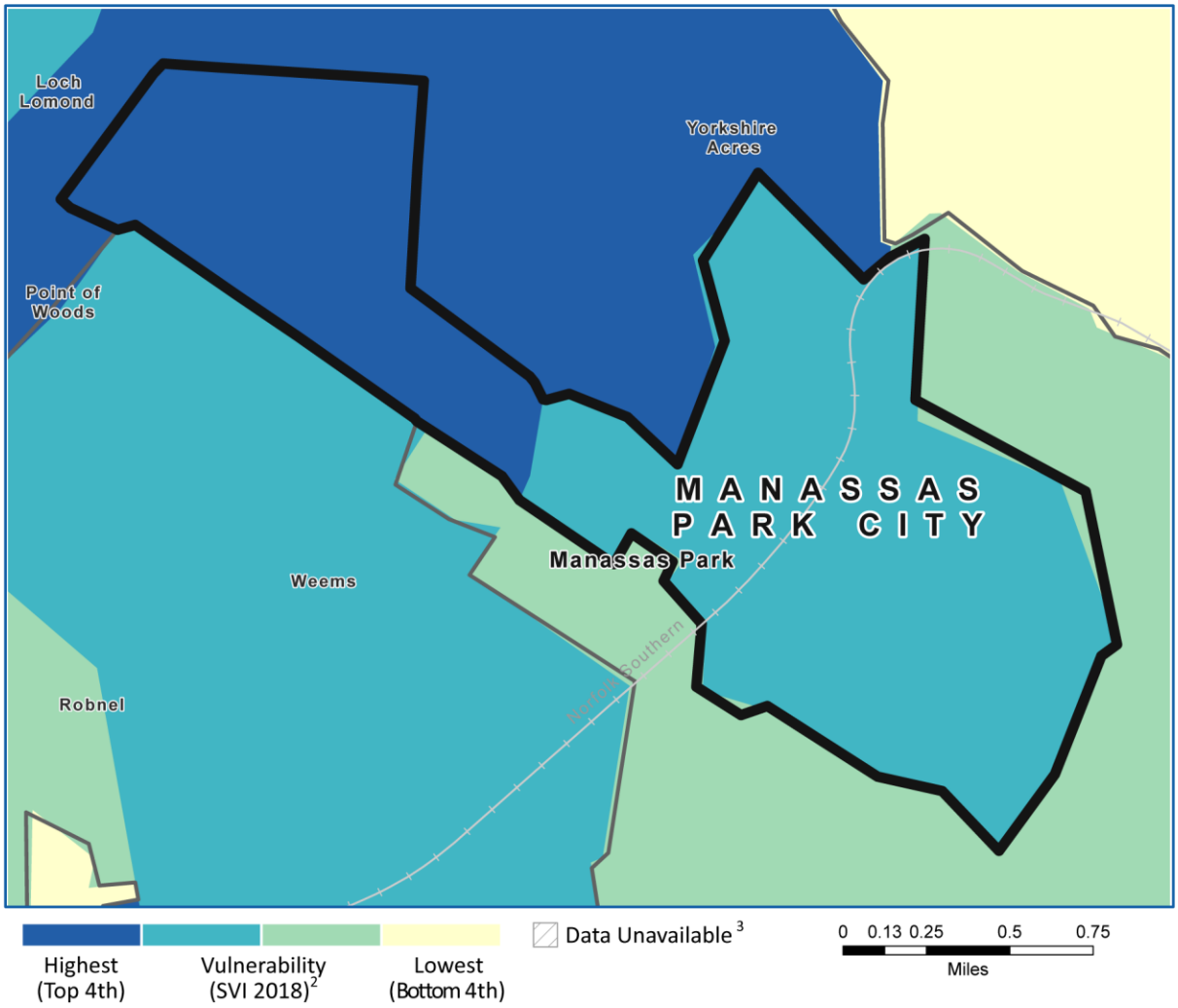


Figure 6: Overall Social Vulnerability (2018), City of Manassas Park

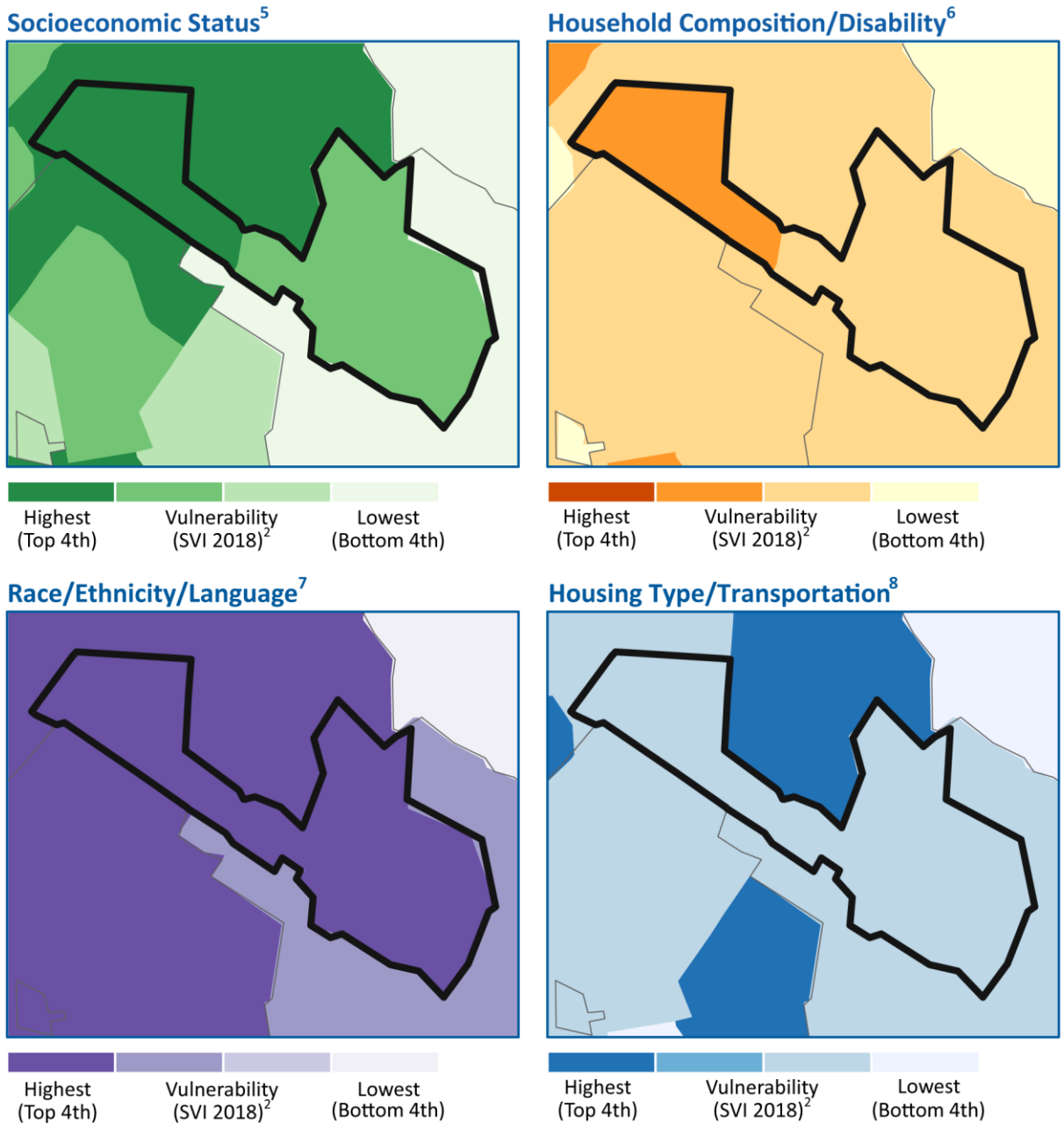


Figure 7: Social Vulnerability, by Theme, City of Manassas Park[6]

The themed maps illustrate the City's higher level of vulnerability within the race/ethnicity/ language theme, thus demonstrating the importance of communicating essential hazard mitigation, preparedness, response, and recovery information to the public in various formats and multiple languages.

[6] Virginia 2018_Manassas Park city.pdf (cdc.gov)

5.3. Built Environment

Based on the best data currently available, the tables presented in this section provide a total number of exposed facilities and properties in relation to earthquakes, floods, and hurricane wind.

Table 15: Building Stock Exposure to 2500-Year 6.5 Magnitude Earthquake (in Thousands of Dollars), by General Occupancy

Residential	Commercial	Industrial	Agricultural	Religion	Government	Education	TOTAL
1,298,379	155,463	64,064	7,422	8,011	5,174	21,671	1,560,184

Table 16: Building Stock Exposure to 100-Year Flood (in Thousands of Dollars), by General Occupancy

Residential	Commercial	Industrial	Agricultural	Religion	Government	Education	TOTAL
1,298,379	155,463	64,463	7,422	8,011	5,174	21,671	1,560,184

Table 17: Building Stock Exposure to Probabilistic Hurricane Wind (in Thousands of Dollars), by General Type

Wood	Masonry	Concrete	Steel	Mobile Home	TOTAL
997,903	404,166	30,356	127,347	411	1,560,183

5.4. Community Lifelines and Assets

The City of Manassas Park reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss due to hazard events. The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA but is not listed in the Hazus files. Information about the number of assets is available but not the dollar value thereof.

Table 18: Critical Facilities Exposed to FEMA Floodplains, City of Manassas Park

Facility Type	Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
Transportation	2	1	0

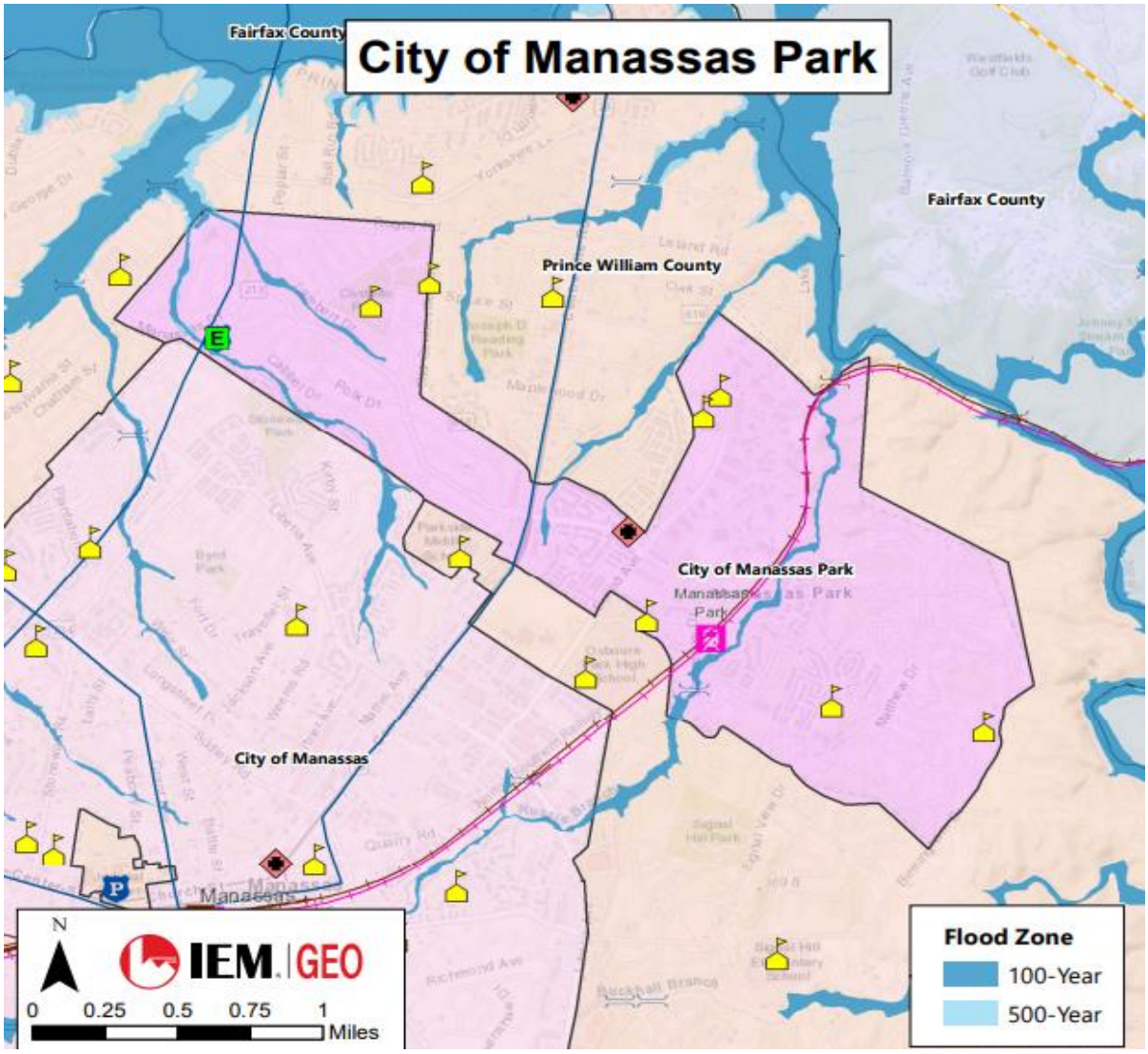


Figure 8: Critical Facilities in Flood Zones

5.5. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

5.6. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets.

Table 19: Direct Economic Losses (in Thousands of Dollars) Related to Earthquakes, Floods, and Hurricane Winds

Hazard	Buildings (capital stock and income)	Transportation	Utilities
Earthquake	20,833	139	28
Flood	N/A	N/A	N/A
Hurricane Wind	1,228	16,590	319,296

5.7. Cultural and Historical Assets

Information related to the vulnerability of cultural and historical assets is presented in the hazard-specific sections of the **Base Plan**.

Historic structures and sites are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites to ensure that improvements do not reduce the character or resiliency of a structure or other asset. No assets have been documented as being in a floodplain in the City of Manassas Park.

Table 20: Cultural and Historic Properties Exposed to FEMA Floodplains, City of Manassas Park

Total Facilities Identified	In 100-year Floodplain	In 500-year Floodplain
2	0	0

6. Capability Assessment

The City of Manassas Park reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the City completed a Jurisdiction Needs Identification Questionnaire that summarized changes in and enhancements of capabilities since the last plan.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the levels of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans, and/or resources, and it can implement most mitigation actions.

Table 21: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	Moderate
Safe Growth	High
Financial	Moderate
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary

The City utilizes the all-hazards approach when developing any jurisdictional plans, including emergency operations, continuity of operations, and the hazard mitigation plan.

The following plans have been newly developed or updated since the 2017 HMP Capabilities Assessment:

- Capital Improvements Plan
- Local Emergency Operations Plan
- Continuity of Operations Plan

Capability Analysis: High

Significant planning and regulatory tools are in place within the City of Manassas Park and bring to light successes in integrating hazard mitigation planning with existing planning mechanisms. This demonstrates that the jurisdiction recognizes the benefit of incorporating hazard mitigation in local planning and regulatory processes such as the Comprehensive Plan, the Capital Improvement Plan, and land development and floodplain regulations. There is a need for better enforcement of and updates/revisions of codes to reflect current needs, as applicable.

6.1.2. Administrative and Technical Capabilities Summary

- Public Works and Community Development staff include planners, engineers, and a floodplain manager with an understanding of natural and non-natural hazards, which are integrated into mitigation planning.
- City emergency management, city management, police, fire and other staff are familiar with the community's hazards.
- City administration and Fire and Rescue have a grant writer who coordinates with the hazard mitigation program.

The City identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and plan implementation:

- City Administration
- City Management
- Community Development
- Fire and Rescue

- Police Department
- Public Works

Capability Analysis: Moderate

Although the City has capable and knowledgeable staff, more staffing is required to thoroughly execute mitigation strategies. Additional hazard training for current and new staff will also help achieve this goal.

6.1.3. Safe Growth Capabilities Summary

- The comprehensive plan provides adequate space for expected growth in areas located outside of the natural hazard areas.
- The transportation plan limits access to hazard areas and is used to guide growth in safe locations.
- Environmental policies maintain and restore protective ecosystems and provide incentives to development that is located outside protective ecosystems.
- Public safety is explicitly included in the comprehensive plan's growth and development policies.
- Zoning ordinances, including subdivision regulations, discourage development or redevelopment within natural hazard areas and prohibit development within, or fining of, wetlands, floodways, and floodplains.
- The Capital Improvement Program limits expenditures on projects that would encourage development in areas vulnerable to natural hazards.
- Building codes contain provision to strengthen or elevate construction to withstand hazard forces.
- The City has adopted an evacuation and shelter plan to deal with emergencies from natural hazards.

Capability Analysis: High

The City of Manassas Park has well-established safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and to protect the natural environment.

6.1.4. Financial Capabilities Summary

- The City's capital improvements funding has provided monies for past infrastructure projects and could be used to fund future mitigation actions.
- Fees collected for utilities, stormwater services, and new development have provided funding for past infrastructure projects and could be used to fund future mitigation actions.
- State and federal funding and grant programs have been utilized by the City to complete mitigation projects and can be used to assist with future projects.
- The City has the authority to incur debt through general obligation bonds and/or special tax bonds and private activities and use public/private funding sources.

Capability Analysis: Moderate

The City should continue to seek and diversify funding and resource opportunities to implement current and future mitigation actions and activities.

6.1.5. Education and Outreach Capabilities Summary

The City of Manassas Park works with local groups and non-profits to educate local residents. This is accomplished by the following:

- Promoting CERT
- Holding a Preparedness Fair
- Holding an Open House with Fire and Rescue, an event that always attracts families with young children
- Weekly social media postings
- Safety-related school programs

Capability Analysis: Moderate

More events are always needed to keep people informed and safe. Additionally, the Community Rating System is a program that provides initiatives as part of the NFIP program. It can assist the City in increasing public awareness of and involvement in hazard mitigation.[7]

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, the City of Manassas Park identified activities related to each natural hazard that support risk reduction.

Table 22: Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Dam Failure (Including Levees)	No dams are located in the City.
Drought	Public education and operational plans address preparedness and response to reduce risk.
Earthquake	Land use and environmental policies acknowledge the importance of protecting the natural environment.
Extreme Temperature	State and international building codes provide for seismic design regulations.
Flood/Flash Flood	Public education and operational plans address preparedness and response to reduce risk.
High Wind/Severe Storm	Public education and operational plans address preparedness and response to reduce risk.

[7] Commonwealth of Virginia Department of Conservation and Recreation, The Community Rating System https://www.dcr.virginia.gov/dam-safety-and-floodplains/fp-crs

Hazard	Activity
Karst/Sinkhole/Land Subsidence	Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited.
Landslide	Stormwater management program and projects address flood prevention and risk reduction.
Tornado	State and International building codes provide for wind and seismic design regulations.
Wildfire	Land use and environmental policies acknowledge the importance of protecting the natural environment.
Winter Weather	Land use and environmental policies acknowledge the importance of protecting the natural environment.
Non-Natural Hazards	Public education and operational plans address preparedness and response to reduce risk.
Climate Change	Public education and operational plans address preparedness and response to reduce risk.

7. Resilience to Hazards

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of "low risk" is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

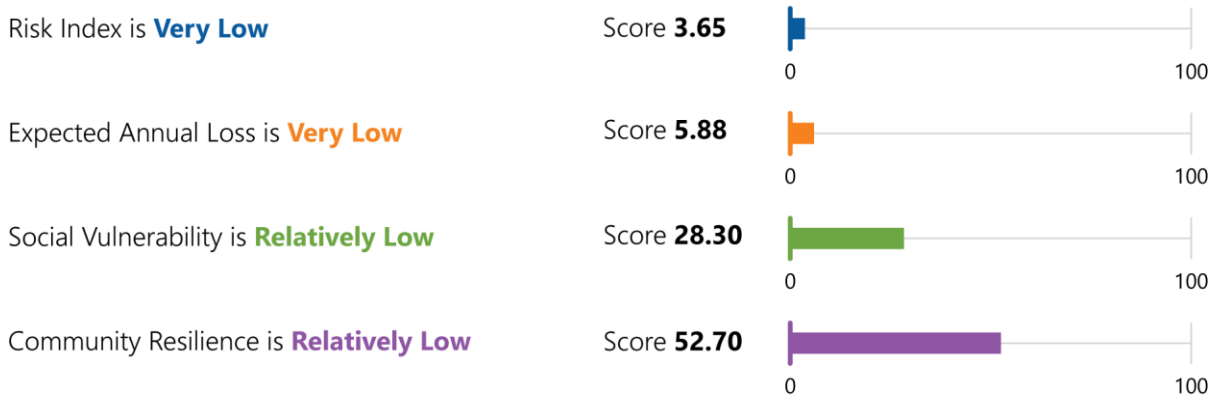


Figure 9: Summary of National Risk Index Findings, City of Manassas Park[8]

Table 23: Comparison of City of Manassas Scores with Virginia and National Average

Index	City of Manassas Park	Virginia Average	National Average
Risk	3.65	6.50	10.60
Expected Annual Loss	5.88	9.22	13.33
Social Vulnerability	28.30	35.52	38.35
Community Resilience	52.70	54.92	54.59

Table 24: City of Manassas Park Risk Ranking

Index	Rank
Risk	3.65
Expected Annual Loss	5.88
Social Vulnerability	28.30
Community Resilience	52.70

[8] FEMA, The National Risk Index, accessed at https://hazards.fema.gov/nri/map.
Community Report - Manassas Park City, Virginia | National Risk Index (fema.gov)

7.1. Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household level risk factors.

The index produces aggregate-level (Census tract, county, and state) small area estimates that provide a tool for understanding how at-risk specific neighborhoods might be to disasters due to characteristics that may make specific segments of the population more vulnerable than others to the impacts and consequences of disasters. The ten risk factors include the following:

2. Income-to-poverty ratio
3. Single or zero caregiver household
4. Unit-level crowding
5. Communication barrier
6. Aged 65 years or older
7. Lack of full-time or year-round employment (household)
8. Disability
9. No health insurance coverage
10. No vehicle access (household)
11. No broadband internet access (household)[9]

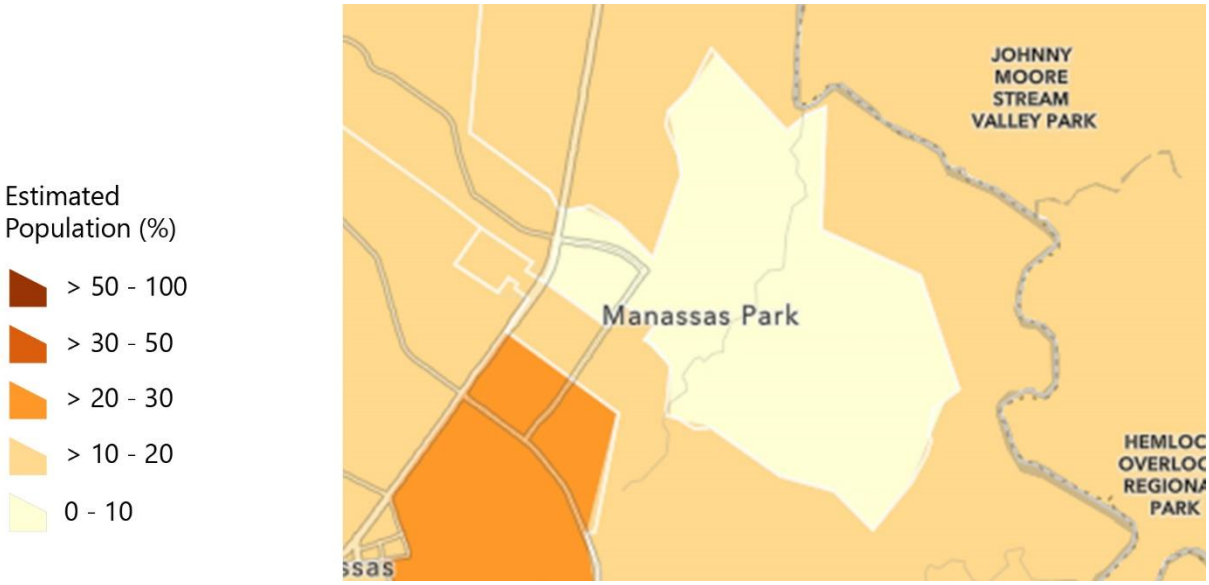


Figure 10: Community Resilience Estimate[10]

The estimate is categorized into three groups: zero risks, one or two risks, and three or more risks.

The combination of data and analysis described in this section provides a comprehensive representation of the City's risk, vulnerability, and resilience to all hazards.

[9] U.S. Census Bureau
[10] 2019 Community Resilience Estimates (arcgis.com)

8. Mitigation Actions

8.1. Goals and Objectives

The City of Manassas Park Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

A comprehensive list of previous mitigation actions, including descriptions of progress made and the current status, is presented in **Attachment 4** of this annex.

8.3. New Mitigation Actions

The City is carrying nine actions forward into the next planning cycle. **Attachment 4** of this annex includes a table that summarizes each continued action, describing the proposed activity, priority level, estimated cost, and lead agency.

8.4. Action Plan for Implementation and Integration

The Action Plan for Implementation and Integration describes how the City's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 25: Action Plan for Implementation and Integration, City of Manassas Park

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plan.	Strive to integrate risk mitigation strategies into the plan when it is updated.
Review/update building/zoning codes for consistency with mitigation goals.	Ensuring the plans follow international building codes.
Maintain regulatory requirements of floodplain management program (NFIP).	Strive to remain in compliance with the FEMA floodplain management program.
Review/update economic development plan and policies for consistency with mitigation goals.	Hire an economic development coordinator and task them with reviewing and updating plans to reflect mitigation goals, when appropriate.
Continue public engagement in mitigation planning.	Strive to educate the public on all-hazards mitigation strategies.
Identify opportunities for mitigation education and outreach.	Strive to integrate CERT and other emergency management disciplines at the city functions and events.
Review/update stormwater plans and procedures for consistency with mitigation goals.	Public works should review stormwater plans to reflect mitigation goals, when appropriate.
Review/update emergency plans to address evacuation and sheltering.	EOP was updated in 2021. Strive to conduct an evacuation/sheltering exercise on an annual basis (Manassas Park is the only city to do this in the region).

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Monitor funding opportunities.	Strive to apply for FEMA grant funding opportunities (LEMPG, HISCAP, etc.). Apply for State Funding when applicable.
Incorporate goals and objectives into day-to-day government functions.	Strive to adopt a risk management mindset for all city operations via staff education and plan and policy updates.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 26: City of Manassas Park Plan Maintenance Responsibilities for the Northern Virginia Hazard Mitigation Plan, Base Plan

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP, Base Plan**, the City of Manassas Park Mitigation Planning Coordinator will facilitate organizing the method and schedule for maintaining the **Jurisdiction Annex**.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in the fifth year

Table 27: City of Manassas Park Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with the jurisdiction planning team. 2. Review the status of all mitigation actions, using the *Mitigation Action Implementation Worksheet* (**Section 3, Attachment A, NOVA HMP Base Plan**).	Produce an annual report that includes the following: • Status update of all mitigation actions • Summary of any changes in hazard risk or vulnerabilities and capabilities • Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	3. Schedule the annual plan evaluation with the jurisdiction planning team. 4. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the Planning Considerations Worksheet (**Section 3, Attachment C, NOVA HMP Base Plan**).	Submit the annual report to the NOVA HMP Project Team Point of Contact
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

The City of Manassas Park will continue to partner with other participating jurisdictions and regional entities to plan and identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan.

10. Annex Adoption

The City of Manassas Park Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation Plan*.

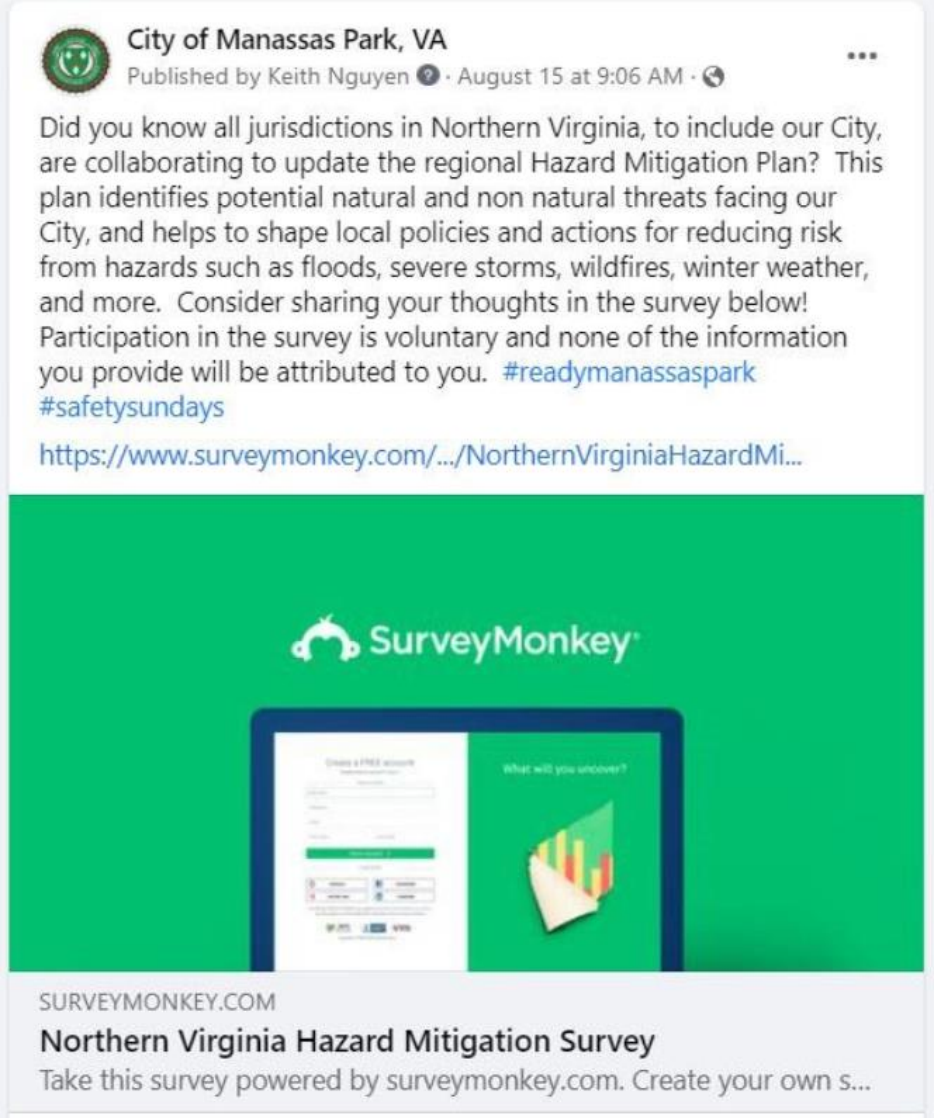
11. City of Manassas Park Attachments

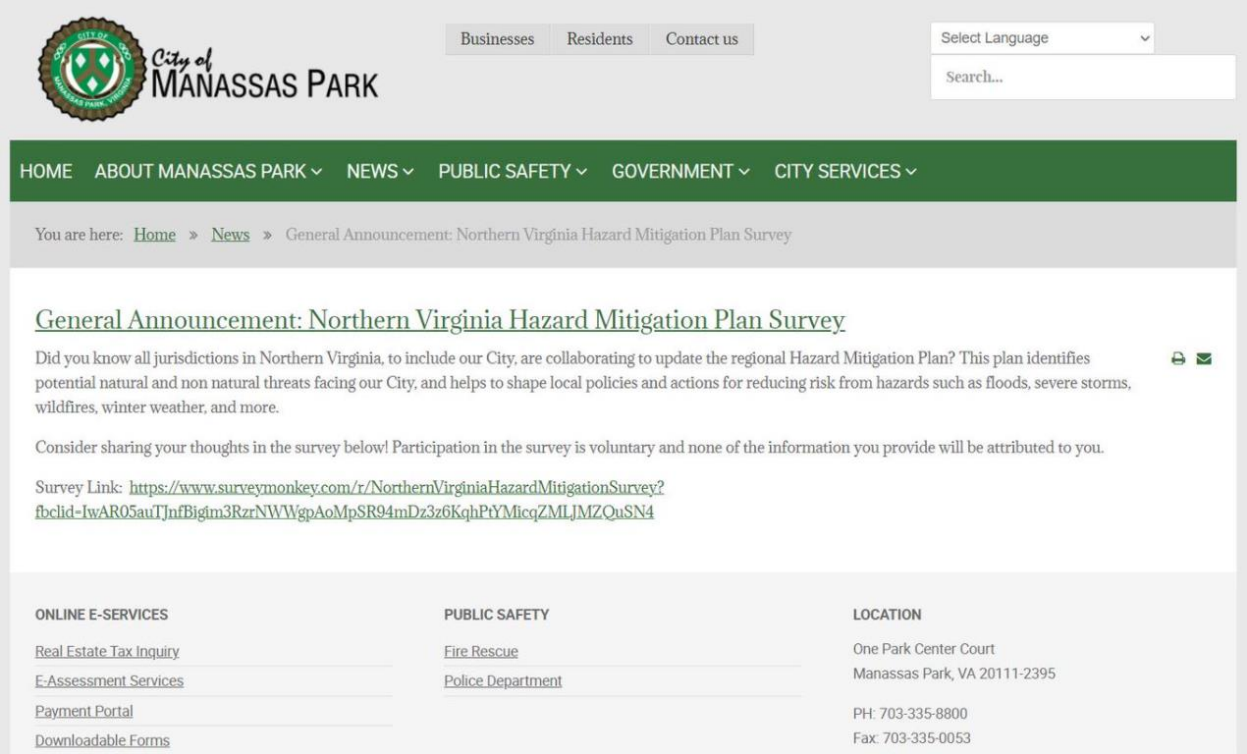
- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Documentation of Public Participation





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General Announcement: Northern Virginia Hazard Mitigation Plan Survey

Did you know all jurisdictions in Northern Virginia, to include our City, are collaborating to update the regional Hazard Mitigation Plan? This plan identifies potential natural and non natural threats facing our City, and helps to shape local policies and actions for reducing risk from hazards such as floods, severe storms, wildfires, winter weather, and more.

Consider sharing your thoughts in the survey below! Participation in the survey is voluntary and none of the information you provide will be attributed to you.

Survey Link: https://www.surveymonkey.com/r/NorthernVirginiaHazardMitigationSurvey?fbclid=IwAR05auTJnfBigim3RzrNWWgpAoMpSR94mDz3z6KqhPtYMicqZMLJMZQuSN4

ONLINE E-SERVICES

Real Estate Tax Inquiry
E-Assessment Services
Payment Portal
Downloadable Forms

PUBLIC SAFETY

Fire Rescue
Police Department

LOCATION

One Park Center Court
Manassas Park, VA 20111-2395

PH: 703-335-8800
Fax: 703-335-0053

11.3. Attachment 3: Mitigation Actions

The actions presented here were included in the 2017 Northern Virginia Hazard Mitigation Plan. The City of Manassas Park Mitigation Planning Team reviewed all actions to see if they were completed, no longer relevant, or moved forward and included in the 2022 Plan.

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazards	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-1	Distribute hazard education information using different medias to include social media and webpages.	Office of Emergency Management	All Hazards	Internal funding	July 2023	Develop distribution schedule and utilize all methods of distribution, including digital and non-digital forms.	Medium	In progress; retain
2017-2	Consider executing a public outreach campaign in the City's schools to educate staff about all hazards.	Office of Emergency Management	All Hazards	No cost-internal staff support	July 2023	Develop new MOUs with the school system and work with special projects coordinator to conduct outreach, education, and training activities.	High	In progress; retain
2017-3	Display and distribute educational hazard and emergency brochures at local events where information displays exist (i.e., National Night Out, Fire Prevention Week, and	Office of Emergency Management, Office of Public Safety	All Hazards	Internal funding, leverage EMPG funds	July 2023	Actively participate in 50% of local events, if possible.	Medium	In progress; retain

	Preparedness Month).							
2017-4	Continue to update the City's stormwater management plan.	Department of Public Works	• Flood • High Wind • Severe Weather • Winter Weather	Internal funding, Water Quality Improvement Act funds, revolving loan funds, Section 319 NPS grants from DCR, VDOT funding	July 2023	Review by July 2023.	High	In progress; retain
2010-5	Exercise the Everbridge and Next Gen 911 systems city-wide (Alert 911).	Office of Emergency Management and Office of Public Safety	All Hazards	Grant funding (changes every year)	July 2023	Continuous outreach to residents as measured by self-subscription.	Medium	In progress; retain
2010-6	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, and flood insurance information) that can assist them in reducing their flood risk.	Office of Emergency Management	• Flood • High Wind • Severe Weather	FEMA Hazard Mitigation Assistance Funding	July 2023	Develop outreach materials or identify appropriate outreach materials for ongoing dissemination.	Low	In progress; retain

2010-7	Support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and, where feasible, using FEMA HMA programs where appropriate.	Office of Emergency Management	• Flood • High Wind • Severe Weather	FEMA Hazard Mitigation Assistance Funding	July 2023	Identify all priority flood-prone structures.	Medium	In progress; retain
2010-7	Promote structural mitigation to assure redundancy of critical facilities, to include but not be limited to roof structure improvement, meeting or exceeding building code standards, upgrading electrical panels to accept generators, etc.	Office of Emergency Management, Code Enforcement Division, Community Development and Public Works, and private sector partners	• Flood • High Wind • Severe Weather	FEMA Unified Hazard Mitigation Assistance Funding	July 2023	Work with building officials to identify properties; work with private sector partners for outreach.	Medium	In progress; retain
2010-8	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct annual review of repetitive loss and	Office of Emergency Management, Community Development and Public Works	• Flood • High Wind • Severe Weather	Internal program support	July 2023	Establish a schedule of review and review committee.	Medium	Flood insurance study and rate maps including City of Manassas Park information. In progress; retain

	severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.							

Northern Virginia Hazard Mitigation Plan

Annex 7: Fairfax County

November 2022

Fairfax County Overview

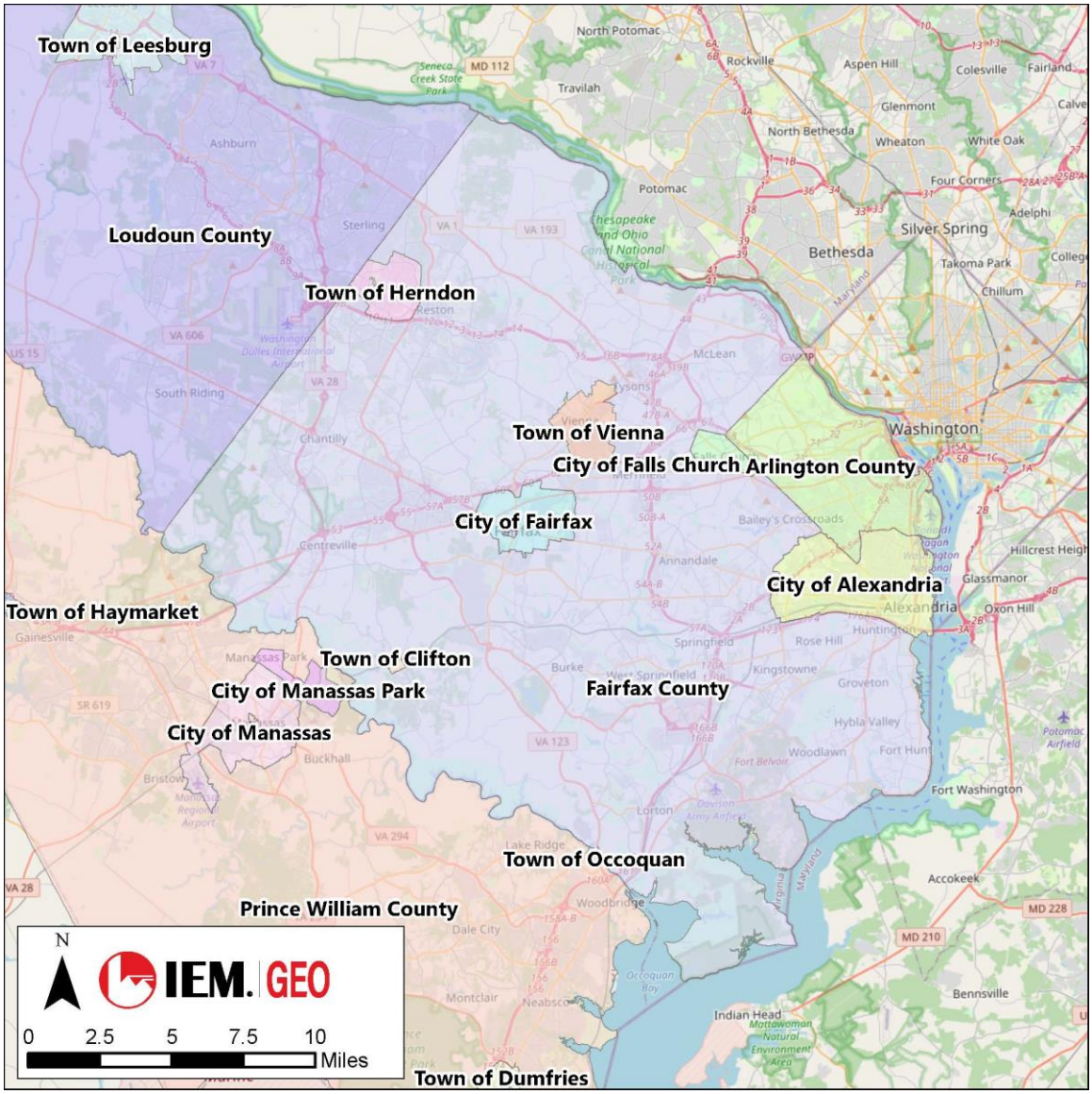

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1742	406 sq. mi.	1,171,848	12000 Government Center Pkwy Fairfax, VA 22035	417,464	Winter Storm, Flood/Flash Flood and High Wind/Severe Storms

Fairfax County's Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information, 1950–June 2021

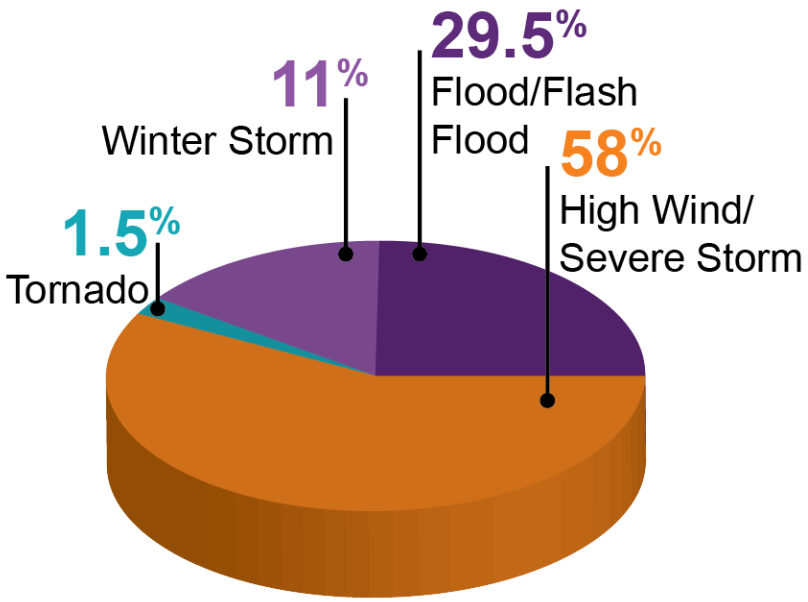

Figure 1: Percentage of Hazards

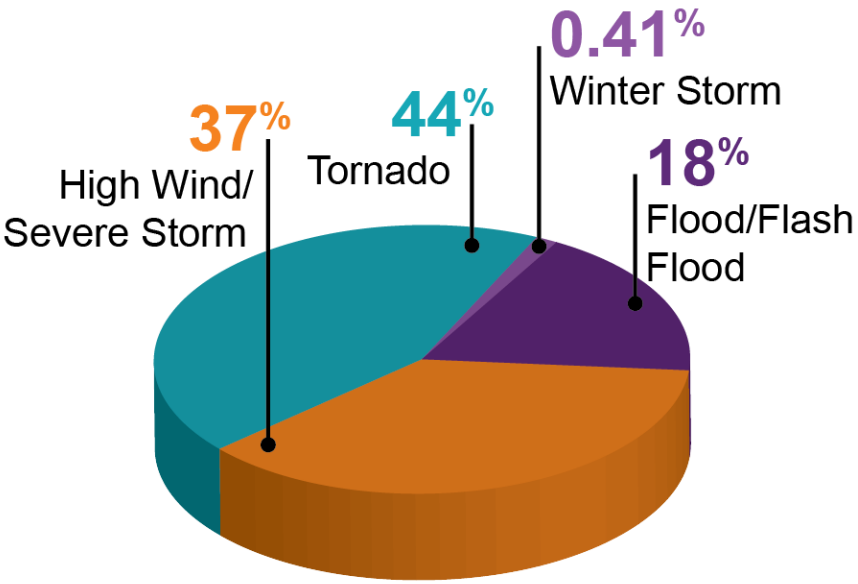

Figure 2: Property Damage Percentages from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Ranking of Natural Hazards by Risk

Hazard	Hazard Ranking
Winter Storm	High
Flood/Flash Flood	High
High Wind/Severe Storm	High
Dam Failure	Medium
Tornado	Medium
Extreme Temperatures	Medium
Drought	Medium
Earthquake	Medium
Wildfire	Low
Karst/Sinkhole/Land Subsidence	Low
Landslide	Low

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sector

Lifeline/Sector	Number of Assets
Safety and Security	561
Food, Water, Shelter	10
Health and Medical	8
Energy	16
Communications	8
Transportation	1,025
Hazardous Materials	437
Education	402
Cultural/Historical	91
High Hazard Dams	26

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for Fairfax County

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	High
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Contact Type	Contact information
Primary Point of Contact	Greg Zebrowski, Assistant Coordinator of Planning and Policy Analysis Department of Emergency Management and Security 571-350-1000 | TTY 711 Gregory.Zebrowski@fairfaxcounty.gov 4890 Alliance Dr. Fairfax, VA 22030
Secondary Point of Contact	Cara Howard, Lead Planner Department of Emergency Management and Security 571-350-1010 | TTY 711 Cara.Howard@fairfaxcounty.gov 4890 Alliance Dr. Fairfax, VA 22030

Fairfax County

This annex presents the following jurisdiction-specific information provided by Fairfax County for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

Table of Contents

List of Tables

List of Figures

1. Jurisdiction Profile

Incorporated Towns	3
Population	1,171,848
Geographic Region	Piedmont/Coastal Plain
Persons Per Household	2.79
Persons Per Square Mile	2,941.8
Median Age	38.4
Elevations	Near sea level (~0 feet) to 500 feet

1.1. Location

Located in the northeast region of the Commonwealth of Virginia, Fairfax County is part of the suburban ring of Washington, D.C. The County is partially bounded on the north and east by Arlington County and the cities of Alexandria and Falls Church. Fairfax County shares a border with Loudoun County to the west and Prince William County and the City of Manassas to the south. The Potomac River forms the County's northern and southeastern borders. Across the Potomac to the north is Montgomery County, Maryland and to the southeast are Prince George's County and Charles County, Maryland.

1.2. History

The land that is now Fairfax County was originally part of the Northern Neck Proprietary granted by King Charles II in 1649 and inherited by Thomas Fairfax, Sixth Lord Fairfax of Cameron, in 1719. The County itself was formed in 1792 from Prince William County.

Fairfax County is located directly across the Potomac River from Washington, D.C. Due to its location on both the Virginia piedmont and the Atlantic coastal plain, the County experiences a variety of weather. The diversity of Fairfax County's landscape increases its vulnerability to a variety of hazards, most notably flooding and severe storms. In addition to snowmelt and rain-related river flooding episodes, low-lying areas of Fairfax County along the Potomac River are also subject to tidal and storm surge flooding. As sea levels rise, permanent inundation of low-lying areas along and near the river shoreline is also a threat. Additionally, winter storms pose significant threats, as evidenced during the 2015–2016 winter season when snow levels in late January reached between 23 and 31 inches across the County and ice and blizzard-related wind conditions impacted travel and caused power outages and property damage.

1.3. Demographics, Economy, and Governance

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context for the entire plan. The 2020 U.S. Census population estimate for Fairfax County was 1,150,309, which represents an approximate 6.6% increase since 2010. The County is densely populated with approximately 2,886 residents per square mile. The following section summarizes Fairfax County's demographic, economic, and governance characteristics.

Table 6: Population and Growth Rate

Year	Population	Annual Percent Increase
1970	455,021	
1980	596,901	31.18%
1990	818,584	37.14%
2000	969,749	18.47%
2010	1,081,699	11.55%
2020	1,150,309	6.6%

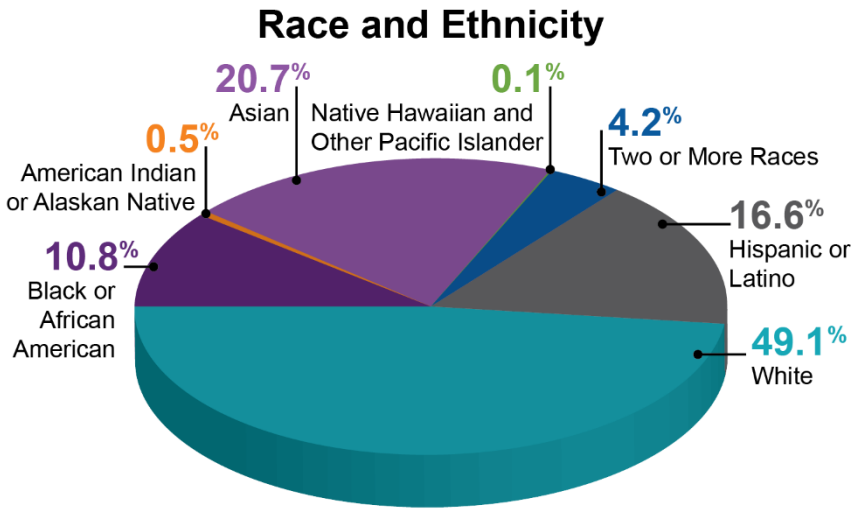

Figure 4: Race and Ethnicity Demographics from 2020 Census*

*Due to how people view Race and Ethnicity and answer the questions in the Census, there is overlapping of responses and results equal greater than 100% of the population.

Table 7: Economic Data

Economy	Data
Median Household Income (2019)	$128,374
Unemployment Rate (September 2021)	3.7%
Per Capita Income (2020)	$58.338
Percentage Below Poverty (2020)	6.1%

Fairfax County has been among the highest median income counties in the United States for many years. Despite this statistic, approximately 13.5% of persons aged 18 and older, 8.3% of children under 18 years, and 9.6% of persons aged 5 and older who speak a language other than English at home live in poverty.

The County's location in the Washington metropolitan area, its ease of access by car and public transportation, and its highly skilled labor force continue to attract an increasingly economically varied

residential and commercial mix. Much of the commercial development in Fairfax County is centered around the Metrorail's Silver Line with stations in Reston and Tysons. In 2020, Fairfax County ranked second in the United States for suburban office space, with more than 119 million square feet of office space and 3.5 million square feet newly leased in 2020. In addition, the County has more than 39 million square feet of industrial and flex space.

Eleven Fortune 500 corporations maintain their headquarters in Fairfax County, including Volkswagen, Hilton, and Capital One. Several U.S. defense and aerospace industries, including Bechtel, General Dynamics, Leidos, Northrup Grumman, Raytheon, and Leidos (formerly SAIC), as well as federal government offices, are also headquartered in the County.

1.4. Built Environment and Community Lifelines

The information related to Community Lifelines and critical assets in Fairfax County presented in this section has been collected from multiple sources, including the Fairfax County Department of Emergency Management and Security, Hazus (Version 4.2), and county government websites. Data extracted from the Hazus Level 1 assessment indicates that Fairfax County has an estimated total of 2,084 Community Lifelines and critical assets. Due to the diversity of methods for collecting and verifying data and the method of documenting location and jurisdiction used in Hazus, this data may not fully reflect the current inventory maintained by Fairfax County.

Table 8 provides a summary of the number of critical assets by type. Fairfax County maintains a detailed list of Community Lifeline facilities, sites, and critical assets.

Table 8: Number of Assets per Community Lifeline/Sector

Lifeline/Sector	Number of Assets
Safety and Security	61
Food, Water, and Shelter	10
Health and Medical	8
Energy	16
Communications	8
Transportation	1,025
Hazardous Materials	437
Education	402
Cultural/ Historical	91
High Hazard Dams	26

1.4.1. Safety and Security

As of April 2021, based on Hazus data, Fairfax County has 42 fire stations (including the Fire Rescue Academy) and 15 police stations. In addition, there are four Emergency Operations Centers.

1.4.2. Food, Water, Shelter

Food commodities are available throughout Fairfax County from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

Fairfax County provides water and wastewater services through multiple utilities, including Fairfax Water (serving an estimated 2 million residents in Fairfax, Falls Church, and other areas), and the Fairfax County Department of Public Works and Environmental Services, which includes interjurisdictional agreements with DC Water, Prince William Service Authority, AlexRenew, and the Upper Occoquan Service Authority for the provision of Wastewater Treatment Service. In addition, the Town of Herndon and the Town of Vienna provide water and sewer services for Fairfax County residents. The Hazus database lists ten water and wastewater treatment facilities in Fairfax County.

The Hazus database does not identify schools that might be designated as public shelters.

1.4.3. Health and Medical

The Hazus data identifies eight health and medical facilities offering patient care, urgent care, emergency rooms, and other healthcare services in Fairfax County, including the following five hospitals:

- Fort Belvoir Community Hospital
- Inova Fair Oaks Hospital
- Inova Fairfax Hospital
- Inova Mount Vernon Hospital
- Reston Hospital Center

1.4.4. Energy

The Hazus database identifies 16 energy assets. Power providers in Fairfax County include Dominion Energy Virginia, Northern Virginia Electric Cooperative (NOVEC), Washington Gas, and Columbia Gas of Virginia. In addition to power providers, several natural gas pipelines cross the County, including those for Colonial, Columbia Gas, Cove Point, Dominion, and Transcontinental.

1.4.5. Communications

Most communications and information systems and infrastructure in the United States are privately owned; however, the County maintains authority and control over public safety communications for fire, police, and other responding agencies. The Hazus database identifies eight communications assets. In recent years, the federal government has assumed a stronger role in protecting information and communications infrastructure, which may also present a challenge in relation to disaster impacts. Increasing reliance on this infrastructure by individuals, businesses, and government could cause vulnerabilities that emergency managers should take into consideration in pre- and post-incident planning and operations.

1.4.6. Transportation

Fairfax County is served by the following major highways and commuter and rail lines:

- Interstates: 66, 95, 395, 495 (Capital Beltway)
- U.S. Highways: 1, 7, 28, 29, 50
- George Washington Memorial Parkway and Fairfax County Parkway
- Washington Metrorail: Orange, Blue, Yellow, and Silver lines
- Virginia Railway Express (VRE)

The Amtrak rail system connects at VRE stations for rail service beyond the Northern Virginia area.

The maintenance of transportation facilities and systems is the responsibility of the owner or entity with authority, including municipal, county, state, and federal highway departments, and agencies; toll and rail authorities; and the military. The Virginia Department of Transportation (VDOT) maintains most primary and secondary roads in Fairfax County, except for the Dulles Toll Road, which is under the authority of the Metropolitan Washington Airports Authority (MWAA), and the George Washington Memorial Parkway, which is under the authority of the National Park Service.

The Hazus database notes a total of 1,025 transportation structures, facilities, or segments, including the following:

- Highway Bridges – 684
- Highway Segments – 204
- Railway bridges – 35
- Railway Facilities and Segments – 68
- Light Rail Facilities and Segments – 23
- Bus Terminals – 1
- Ports (including public and private wharves and marinas) – 5
- Airport Facilities – 5

1.4.7. Hazardous Materials

The Hazus database identifies 1 oil refinery, 1 natural gas facility, and 13 natural gas pipeline locations within Fairfax County. In addition, as of November 2021, there are 422 active Emergency Planning and Community Right-to-Know Act (EPCRA) facilities in the County, including Fairfax City, for a total of 437 sites or facilities.

1.4.8. Education

Fairfax County has one of the largest public-school districts in the United States, with 198 pre-K–12 grade schools and centers and a diverse student population of 178,000 students. More than 27% of these students are considered economically disadvantaged and more than 26% of students learn English as a second language.

In addition to these public and private educational facilities within Fairfax County, there are 35 college and university facilities located within its jurisdictional boundaries, including the following:

- Fairfax University of America
- George Mason University
- Northern Virginia Community College – Annandale Campus
- Stratford University
- University of the Potomac – Virginia Campus
- Virginia International University

1.4.9. Recreational, Cultural and Historic Sites, and Assets

The Fairfax County Park Authority (FCPA) develops and maintains the community's park system to support recreation and the residents' health through the preservation of environmentally sensitive land and resources and areas of historic significance, as well as through the provision of recreational facilities and services.

Table 9: Assessment of Community Park Assets & Potential Hazard Impacts, Fairfax County Park[1]

Category	Community Park Asset/What May Be Impacted by Hazard(s)?	Which Hazard(s)
Natural Environment	• 23,000+ acres of parkland • Landholdings including large, biodiverse forests along the Potomac Gorge and in the western region of the County, emergent wetlands at Huntley Meadows, a tidal freshwater marsh on Mason Neck, and nearly all of Fairfax County's stream valleys.	• Natural Hazards • Pandemic effects on staffing • Economic loss of funding
Natural Environment	• 427 parks • 334 miles of trails • 11 dog parks • 715 athletic fields (maintained) • 10 lakefront parks and/or parks with significant ponds/lakes (including 3 managed dam systems)	• Natural Hazards • Pandemic effects on staffing • Vandalism • Economic loss of funding
Natural Environment	• Air, water, soil, natural habitat, natural vegetative communities, and the ecosystems they form. • Inventory includes protective species of rare or significant resources.	• Natural Hazards • Pandemic effects on staffing • Vandalism • Economic loss of funding
Economy	• FCPA employees: 1,740 merit and/or non-merit staff	• Pandemic effects on staffing
Economy	• Recreation and Parks • Historic and Natural Preservation • Facilities and Support	• Natural Hazards • Pandemic effects on staffing • Vandalism • Economic loss of funding
Population	• Fairfax County population 1.1 million • 90% of residents live less than half a mile away from parkland • 14+ million park visitors each year • 1.6 million Recreation Center visits per year	• Natural Hazards • Economic loss of funding

[1] Fairfax County Park Authority

Category	Community Park Asset/What May Be Impacted by Hazard(s)?	Which Hazard(s)
Population	• Clemyjontri Park offers recreation to children with all abilities	• Natural Hazards • Vandalism • Economic loss of funding
Built Environment	• 9 Recreation Centers • 1 Waterpark • 7 Golf Courses • 5 Natural Resource areas • 13 Natural and Historic structures in the Resident Curator Program	• Natural Hazards • Pandemic effects on staffing • Vandalism • Economic loss of funding
Built Environment	• Bathhouses and maintenance shops and storage facilities	• Natural Hazards • Pandemic effects on staffing • Vandalism • Economic loss of funding
Built Environment	• Herrity Building headquarters, managed by County Facilities Management Department	• Natural Hazards • Pandemic effects on staffing • Vandalism • Economic loss of funding
Built Environment	• Historic Properties • Natural preservation sites • Artifacts and archeology inventory	• Natural Hazards • Pandemic effects on staffing • Vandalism • Economic loss of funding
Built Environment	• Park Planning has several development and renovation projects in planning	• Natural Hazards • Pandemic effects on staffing • Vandalism • Economic loss of funding

Fairfax County maintains a master list of 91 historic sites and assets of special architectural, historic, archaeological, or cultural value to residents and visitors. These sites are designated by the National Register of Historic Places, Virginia Landmarks Register, and/or the Historic Overlay District. Historic assets are addressed in the County's Comprehensive Plan. The County recognizes 13 Historic Overlay Districts under the Zoning Ordinance to provide regulations over and above the regular zoning protection to prevent the destruction of or encroachment upon such areas and structures and to prevent the creation of environmental influences adverse to the purposes of these assets. These sites serve as assets by providing significant context to the County's development over time and contributing to the community's tourism economy.

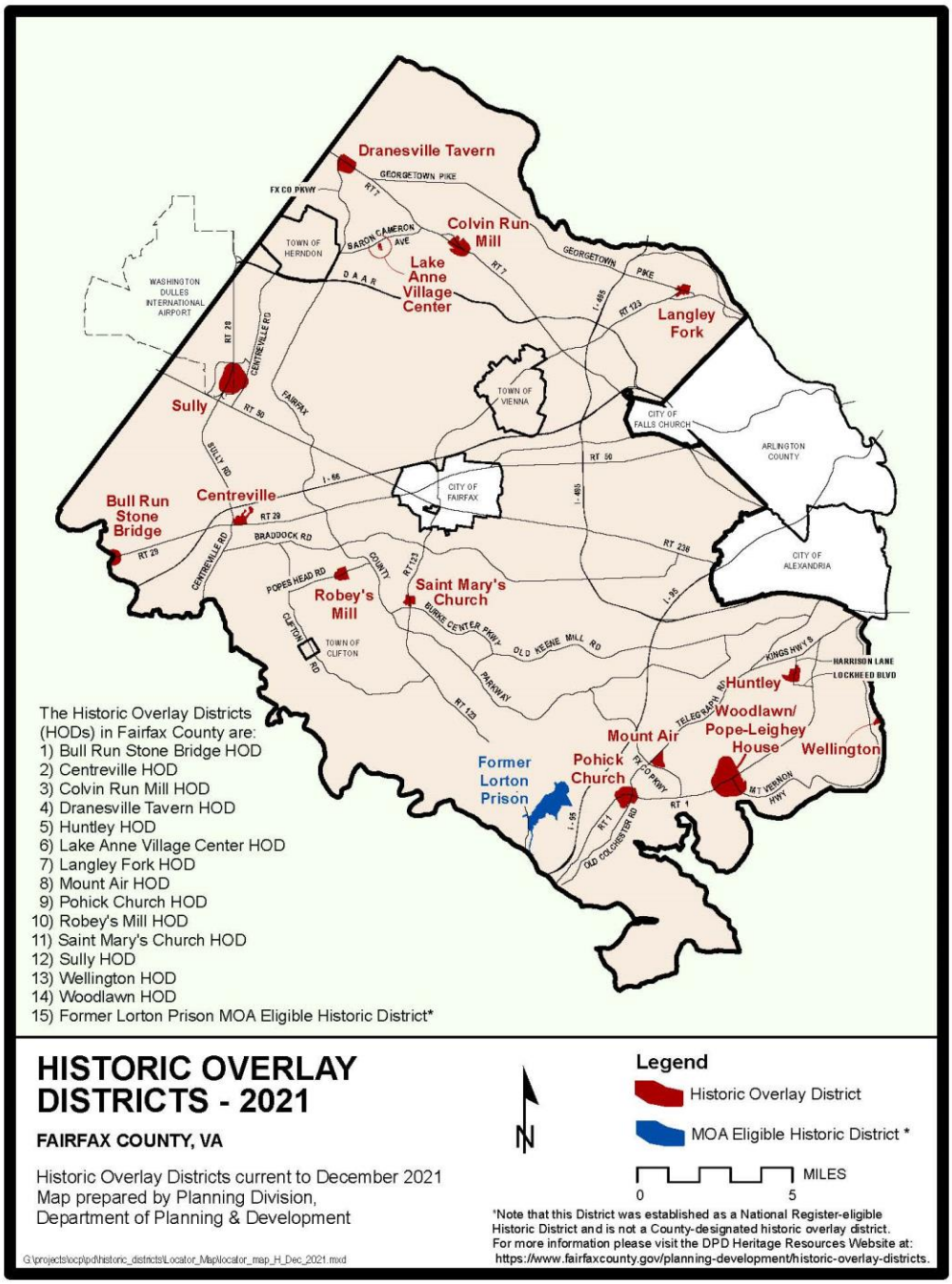

Figure 5: Historic Overlay Districts, 2021[2]

[2] Fairfax County Department of Planning and Development (https://www.fairfaxcounty.gov/planning-development/sites/planning-development/files/Assets/Documents/historic/locator_map_all_districts.jpg)

1.5. Growth and Development Trends

The County's population grew rapidly during the 1950s and 1960s, more than doubling during those decades. Since 1970, the rate of population growth has declined each year. However, between 2010 and 2020, the population grew at a rate of 6.3%.

Over the past few decades, Fairfax County has been transformed from a residential suburb of Washington, D.C., to a vital commercial, residential, office, and research hub. This substantial change has been reflected in the jurisdiction's land use pattern with the vast expansion of non-residential land uses, and, to a lesser extent, growth in residential land use by acre. Since 1990, the rate of multi-family townhouses and apartments has exceeded single-family detached housing construction at a rate of two to one. As of December 2020, there was a planned 2.7 million square feet of office space under construction in the County.[3]

This rate of growth has significantly impacted public facilities and infrastructure, particularly in terms of transportation capacity and a reduction in the supply of vacant land. The increased demand for future development and infrastructure may result in pressure to build in inappropriate areas susceptible to impacts from natural hazards such as floods. Land use controls through the County's ordinances and regulations provide some protection against this pressure but should be continuously monitored for new demands that could increase hazard risks in the future.

Despite the overall slowing growth rate, the 2050 forecast for population, housing units, and households indicates slight growth. Much of the population growth is related to continuing development of multi-family housing, including owned and rental properties.

		Population			Total Housing Units	Households		
Year		Total	Average Annual Increase	Average Annual Growth Rate		Total	Average Annual Increase	Average Annual Growth Rate
1970	Estimates	454,300 [1]	- -	- -	130,800	126,500	- -	- -
1975		537,200	16,600	3.4%	173,000	166,400	8,000	5.6%
1980		596,900	11,900	2.1%	215,600	205,200	7,800	4.3%
1985		668,300	14,300	2.3%	247,800	238,500	6,700	3.1%
1990		818,600	30,100	4.1%	302,500	289,000	10,100	3.9%
1995		879,400	12,200	1.4%	328,200	317,000	5,600	1.9%
2000		969,700	18,100	2.0%	359,000	353,100	7,200	2.2%
2005		1,033,600	12,800	1.3%	385,600	376,700	4,700	1.3%
2010		1,081,700 [2]	9,600	0.9%	396,400	386,100	1,900	0.5%
2015		1,125,400	8,700	0.8%	412,200	403,900	3,600	0.9%
2016		1,131,900	6,500	0.6%	413,700	402,400	-1,500	-0.4%
2017		1,142,900	11,000	1.0%	415,700	405,800	3,400	0.8%
2018		1,152,900	10,000	0.9%	418,300	409,600	3,800	0.9%
2019		1,167,000	14,100	1.2%	421,100	415,300	5,700	1.4%
2020		**1,171,800**	**4,800**	**0.4%**	**424,100**	**417,500**	**2,200**	**0.5%**
2025	Forecasts	1,209,800	7,600	0.6%	441,400	434,100	3,300	0.8%
2030		1,249,100	7,900	0.6%	459,100	451,000	3,400	0.8%
2035		1,282,500	6,700	0.5%	474,200	465,600	2,900	0.6%
2040		1,317,300	7,000	0.5%	489,900	480,700	3,000	0.6%
2045		1,350,600	6,700	0.5%	504,800	495,100	2,900	0.6%
2050		1,385,700	7,000	0.5%	520,500	510,100	3,000	0.6%

Figure 6: Estimates and Forecasts of Population, Housing Units, and Households, Fairfax County (1970–2050)[4]

The *Comprehensive Plan for Fairfax County, Virginia,* 2017 edition, highlights the intent for appropriate residential development of land in relation to flood hazards, as stated in Objective 7, Policy a: "Prohibit new residential structures within flood impact hazard areas." This objective, in combination with land use

[3] *Real Estate Report,* Fairfax County Economic Development Authority, Year-End 2020, December 31, 2020. (https://www.fairfaxcountyeda.org/wp-content/uploads/2021/07/Yearend2020RealEstateReport.pdf)
[4] Demographic Reports: 2020, Fairfax County

ordinances and the Floodplain Management Plan, provides some controls that restrict the increase of flood hazard risk caused by future development.

Land development in Fairfax County is monitored and controlled at the County level. Fairfax County will continue to partner with local jurisdictions and regional entities to plan and identify hazard mitigation opportunities that reduce risk.

Projected growth trends should be monitored in the next planning cycle with the intent of providing a more detailed statistical analysis of vulnerable populations and how these trends could potentially impact hazard consequences and mitigation opportunities.

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, Fairfax County followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Team, the County supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction.

Figure 7: Local Planning Group Participants

Name	Position/Title	Department/Agency
John Brusch	Patrol Bureau Aid/Lieutenant	Fairfax County Police Department
Avery Church	County Continuity Program Manager	Fairfax County Department of Emergency Management and Security
Mark Dale	Lieutenant	Town of Herndon Police Department
Ian Gregoire	Emergency Management Specialist	Fairfax County Fire and Rescue Department
James Heflin	Communications Operations Manager	Fairfax County Department of Public Safety Communications
Alison Homer	Senior Community Specialist/Planner IV	Fairfax County Office of Environment and Energy Coordination
Daniel Janickey	Deputy Chief	Town of Vienna Police Department
Kimberly Malejko	Program Manager	Fairfax County Park Authority
Matthew Marquis	Regional Planner	Fairfax County Department of Emergency Management and Security
Scott Meyer	Emergency Management Coordinator	Fairfax County Land Development Services
Matt Meyers	Division Manager	Fairfax County Office of Environmental and Energy Coordination
Redic Morris	Strategic Planning Manager	Fairfax County Department of Public Safety Communications
Stephanie Nikola	Emergency Planning Coordinator	Fairfax County Health Department
Jonathan Ortiz	Supervisor, Emergency Response Preparedness Section	Fairfax County Sheriff's Office
Juan Reyes	Assistant Director	Fairfax County Department of Public Works and Environmental Services
Paul Ruwe	Deputy Chief	Fairfax County Fire and Rescue Department
Laurel Shultzaberger	Safety and Emergency Management Coordinator	Fairfax County Department of Public Works and Environmental Services
Jason Thompson	DEMS Liaison and ICS Coordinator	Fairfax County Police Department

Name	Position/Title	Department/Agency
Nathaniel Wentland	Deputy Director	Fairfax County Department of Information Technology

The jurisdiction identified its chief hazard mitigation planning responsibility as providing oversight in the planning process and representation in the Emergency Managers Group. The County also identified the following tasks as part of its mitigation planning responsibilities:

- Management support for the planning effort
- Planning Group resource/subject matter expert
- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review plan drafts and provide input
- Public outreach activities
- Implementation of the plan
- Maintaining the plan

Fairfax County planning participants coordinated primarily by means of virtual meetings during the planning process and, as needed, independently to carry out planning activities, which were completed through a series of worksheets that provide background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A.**

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a Public Hazard Survey and access to the draft plan for review and input.

The survey was opened on August 8th, 2021, and closed on November 3rd, 2021, with over 1,000 responses coming in over that period of time. Fairfax County had 598 responses from those who live inside their borders, the towns of Herndon (15 responses), Venna (28 responses), and Clifton had a few responses from those that work in the town but do not live there.

There were two (2) questions that received almost the identical answers from everyone that took the survey, and those responses identified the natural hazard of climate change and the non-natural hazard of the pandemic to be the most concerning hazards for those who resided in the Northern Virginia Area.

In addition to the survey, the public was offered the opportunity to review and provide input on the Draft 2022 Plan update. Notification of the Draft Plan release was made through the same county web link. Documentation of the public survey and draft plan review is included in **Attachment 2** of this annex.

3. Jurisdiction-Specific Hazard Event History

Fairfax County's comprehensive hazard history is described in **Section 5, Base Plan**. The diversity of the landscape increases the vulnerability to a variety of hazards, most notably flooding and severe storms.

There are three major types of flooding in Fairfax County. The most common type of flooding in the County is urban or pluvial flooding, which occurs when heavy precipitation combined with impervious surface coverage results in an overwhelmed drainage system that floods neighborhoods and roads. A second type is riverine or fluvial flooding, which occurs when rivers, streams, and other water bodies overflow their banks into adjacent floodplains. A third type is tidal or coastal flooding, where low-lying areas of the County along the Potomac River are inundated due to tidal and storm surge flooding. Coastal storm surge flooding occurs when extreme storms push water up the Potomac River onshore. As sea levels rise, increased inundation of low-lying areas along and near the river shoreline is a threat. Additionally, winter storms pose significant threats, as evidenced during the 2015–2016 winter season, which resulted in a Federal Disaster Declaration. Winter storms are projected to decrease in frequency in the future as temperatures increase, but occasional winter storms may continue to occur.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,478 recorded natural meteorological events that took place in the County between January 1, 1950, and May 2021. The County was included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 10: Federal Disaster and Emergency Declarations (2017–2021), Fairfax County[5]

Declaration	Date	Hazard	Assistance Type
DR 4512	Apr. 2020	COVID-19 Pandemic	Individual Assistance, Public Assistance
EM 3448	Mar. 2020	COVID-19 Pandemic	Public Assistance (Category B)
EM 3403	Sep. 2018	Hurricane Florence	Public Assistance (Category B)

The Fairfax County Planning Team submitted the following additional details related to significant hazard events since the 2017 plan.

Table 11: Significant Hazard Events Identified by Fairfax County (2017–2021)

Date	Hazard	Event and Description
July 2019	Severe Storm/Flash Flood	A microburst storm cell made its way from the northwest to the southeastern portion of the County. Up to 5.5 inches of rain was reported to have fallen within a 3-hour period. Damage to county facilities was minimal. Damage to residential property was moderate in the Dranesville, Mason, and Mt. Vernon districts. Roads near Pimmit Run sustained damage or were washed out. No injuries or casualties were reported. Damages were approximately $20,000,000.
July 2018	Severe Storm/Tornado	A major thunderstorm came through the eastern part of the County. An EF0 tornado struck Thomas Jefferson High School and tracked north towards Little River Turnpike.

[5] FEMA

		Damage was minimal and proximal to the high school grounds. Damages were approximately $10,000.
March 2018	Severe Storm	A large cold front that was a part of a larger Nor'easter system brought high sustained winds and gusts. Damage to county facilities was minimal. Damage was sustained to utility infrastructure, with 33% of the County reporting power outages. Four responders were injured, one seriously. No fatalities were reported. Damages were approximately $250,000.

4. Hazard Risk Ranking

After developing hazard profiles, the Fairfax County Planning Group conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan**.
The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented in the hazard sub-sections in **Section 5, Base Plan**, and local details are provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II of the Base Plan**.

Table 12: Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Storm	3.7	3.5	7.2	High
Flood/Flash Flood	1.7	4.2	5.9	High
High Wind/Severe Storm	2.7	3.2	5.8	High
Dam Failure	1.0	4.5	5.5	Medium
Tornado	1.3	4.2	5.5	Medium
Extreme Temperatures	2.7	2.5	5.2	Medium
Drought	2.0	3.2	5.2	Medium
Earthquake	1.7	3.2	4.9	Medium
Wildfire	1.0	3.0	4.0	Low
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	Low
Landslide	1.0	2.5	3.5	Low

Table 13: Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	3.0	5.8	8.8	High
Terrorism	1.0	6.4	7.4	High
Cyber Attack	2.0	4.7	6.7	High
Civil Unrest	1.3	5.0	6.3	Medium
Communication Disruption	1.3	3.7	5.0	Medium
Hazardous Materials	1.0	3.9	4.9	Low
Active Violence	1.0	3.6	4.6	Low

Based on the hazard risk scores, Fairfax County evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter Storm, Flood/Flash Flood, and High Wind/Severe Storm
- **Medium:** Dam Failure, Tornado, Extreme Temperatures, Drought, and Earthquake

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, and Cyber Attack
- **Medium:** Civil Unrest and Communication Disruption

All other hazards are ranked as “low,” signifying a minimal risk to Fairfax County.

4.1. Additional Hazard Risk Considerations

4.1.1. Fairfax County Pre-Disaster Recovery Plan

The *Fairfax County Pre-Disaster Recovery Plan (PDRP)* provides a prioritized list of critical infrastructures for consideration during recovery, which can serve as a guide for directing mitigation efforts as well as funding. The PDRP references the critical facilities list contained in this document as a source of critical assets. The *PDRP*, dated April 2020, presents an expanded assessment of hazard risk based on likelihood and potential consequence for use as a planning tool for recovery. Based on this methodology, no hazards are identified as “high” in relation to potential consequence or likelihood.

Table 14: Comparison of Catastrophic Hazard Likelihood and Consequences[6]

Potential Consequence	High Likelihood	Medium Likelihood	Low Likelihood	No Likelihood
High	N/A	• Emerging Infectious Disease • Biological attack	Nuclear Device	N/A

[6] Fairfax County Pre-Disaster Recovery Plan, dated April 2020, p. 2–4

Medium	• Hurricane/ Tropical storm wind • Major flooding • Severe thunder or windstorms • Utility failures • Infectious disease (not pandemic)	• Chem/bio/rad attack • Complex coordinated attack • Intentional water contamination • Sustained utility outages • Tornado (large)	• Dam Failure • Multi-year drought • Earthquake • Nuclear reactor attack or accident	N/A
Low	• Extreme heat/ cold • Urban fire • Improvised or vehicle-borne improvised explosive device (IED/VBIED) • Tornado (moderate/small) • Winter Weather	• Chemical accident • Isolated terror attack • Coastal erosion • Food contamination • Riots/civil disturbance • Sinkhole	• Livestock disease • Drought • Landslide • Wildfire	• Land subsidence • Tsunami

Additional risk information was provided by Fairfax County in relation to Dam Failures, Flood/Flash Floods, High Winds/Severe Storms, and Winter Storms.

4.1.2. Dam Failure

There are 45 dams located in Fairfax County[7] as documented by Fairfax County Emergency Management and Security (DEMS), 26 of which are classified as **High Hazard** due to the consequences related to potential failure of the structures. DEMS maintains a list of all dams, including their locations, ownership, pool volume, impoundment capacity, and use.

The 26 state-regulated high hazard dams in Fairfax County are both publicly- and privately-owned and utilized for a variety of purposes, including flood control, stormwater management, and recreation.

Table 15: State Regulated High Hazard Dams in Fairfax County, as of May 2021[8]

Dam Name	Dam Owner/Operator
Burke Centre 11B Dam	Department of Public Works and Environmental Services
Carrington Regional Pond, Section 1A	Department of Public Works and Environmental Services
Fairview Lake Dam (also called Holmes Run 2A)	Department of Public Works and Environmental Services
Hampton Forest Section 4 Regional Pond	Department of Public Works and Environmental Services
Kings Park West Section 18 Dam	Department of Public Works and Environmental Services

[7] Dam Inventory – 2021, Fairfax County Emergency Management and Security
[8] Fairfax County Department of Emergency Management and Security

Dam Name	Dam Owner/Operator
Kingstowne Pond 4	Department of Public Works and Environmental Services
Lake Accotink Confined Disposal Facility	Fairfax County Park Authority
Lake Anne Dam	Reston Association
Lake Audubon Dam (also called Lower South Lake)	Reston Association
Lake Barcroft Dam	Lake Barcroft Watershed Improvement District
Lake Fairfax Dam	Fairfax County Park Authority
Lake Newport Dam	Reston Association
Lake Thoreau Dam (also called Upper South Lake)	Reston Association
Occoquan Reservoir – Lower Dam	Fairfax County Water Authority, Fairfax Water Griffith Plant
Occoquan Reservoir – Upper Dam	Fairfax County Water Authority
Pohick Creek Dam #1 (also called Lake Mercer)	Department of Public Works and Environmental Services
Pohick Creek Dam #2 (also called Lake Barton)	Department of Public Works and Environmental Services
Pohick Creek Dam #3 (also called Woodglen Lake)	Department of Public Works and Environmental Services
Pohick Creek Dam #4 (also called Royal Lake)	Department of Public Works and Environmental Services
Pohick Creek Dam #7 (also called Lake Braddock)	Department of Public Works and Environmental Services
Pohick Creek Dam #8 (also called Huntsman Lake)	Department of Public Works and Environmental Services
Pulte-McLean Pond D67	Department of Public Works and Environmental Services
Reston Northern Sector Pond 1	Department of Public Works and Environmental Services
Reston Town Center Western BMP Dam	Reston Town Center Association
Upper Occoquan Dam (also called Polish Pond)	Upper Occoquan Service Authority
West Ox Road Regional BMP Dam (Stormwater Management Pond)	Department of Public Works and Environmental Services

Fairfax County has a new 2,800-foot-long levee that was completed after the adoption of the 2017 HMP. Huntington Levee, the first in the County, was completed in June 2019 to protect the Huntington community from storms up to and including 100-year flooding events.

The community, built prior to the current floodplain regulations, has been exposed to floods due to tidal surges from the Potomac River and flash flooding from the Cameron Run Watershed. More than 160 homes are situated in the floodplain, all of which are considered to be at risk for future flooding. The U.S.

Army Corps of Engineers conducted a study to consider various options for flood protection and ultimately identified the levee and pumping station as the most cost-effective and sustainable method of managing flood risks. The project received an award from the Institute of Sustainable Infrastructure[9] in 2019.

Figure 8: Huntington Levee (2019), Fairfax County, Virginia[10]

4.1.3. Flood/Flash Flood

The Fairfax County Planning Team noted the frequency of flash flood incidents has increased in recent years, which is attributed to more frequent intense rainfall events combined with aging drainage and stormwater infrastructure not designed to today's standards. The County is addressing this issue through increased maintenance of drainage systems and capacity upgrades funded through capital improvement projects but highlights the need for additional studies to identify potential locations and the extent of future events.

Table 16: Flood/Flash Flood Events in Fairfax County, 1950–May 31, 2021[11]

Impact	Data
Flood/Flash Flood Events	394
Direct Deaths	2
Direct Injuries	0
Property Damage	$32,418,000
Crop Damage	$35,000
Total Property and Crop Damage	$32,453,000

[9] Huntington Levee, April 24, 2019, (https://sustainableinfrastructure.org/project-awards/huntington-levee/)
[10] Fairfax County Public Works and Environmental Services (https://www.fairfaxcounty.gov/publicworks/huntington-levee)
[11] NCEI Storm Events Database

4.1.4. High Wind/Severe Storm

The number of severe storm events and impacts on people, property, and crops are documented in the NCEI Storm Events Database under the categories of hail, high winds, lightning, strong winds, and thunderstorm winds.

Table 17: High Wind/Severe Storm Events 1950–May 31, 2021[12]

Impact	Data
High Wind and Severe Storm Events	773
Direct Deaths	3
Direct Injuries	19
Property Damage	$28,658,350
Crop Damage	$52,250
Total Property and Crop Damage	$28,710,600

4.1.5. Winter Weather

Table 18 presents the number of winter weather events documented in the NCEI Storm Events Database, including blizzards, heavy snow, winter storms, and winter weather.

Table 18: Winter Weather Events 1950–May 31, 2021[13]

Impact	Data
Severe Winter Weather Events	148
Direct Deaths	3
Direct Injuries	4
Property Damage	$315,000
Crop Damage	$0
Total Property and Crop Damage	$315,000

Other hazard information for Fairfax County is presented in the **Base Plan**.

[12] NCEI Storm Events Database
[13] NCEI Storm Events Database

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

Fairfax County participates in the National Flood Insurance Program (NFIP). In addition, the County participates in the voluntary Community Rating System (CRS) program under the NFIP with a CRS Class of 6, which is associated with a 20 percent flood insurance discount for policyholders. The *Floodplain Management Plan, Progress Report*, September 2019, describes the 24 mitigation actions related to floods developed since 2006 that were presented in the 2017 NOVA HMP. These actions cover a broad range of project types, including planning and regulatory, structural, natural system protection, and public outreach and education. As of September 2019, the Progress Report provides updates for maintenance of the County's CRS program, which documents continuing progress on the implementation of these actions.

Table 19: National Flood Insurance Program Status, Fairfax County[14]

Initial FHBM Identified	5/5/1970
Initial FIRM Identified	3/5/1990
Current Eff Map Date	9/17/2010
Reg-Emer Date	1/7/1972
CRS Entry Date	10/1/1993
Current Eff Date	10/1/2014
CRS Class	6
% Disc SFHA	20
% Disc Non-SFHA	10

Table 20: NFIP Status, as of September 14, 2021[15]

Policies in Force	6,615
Premiums Paid	$3,601,181
Total Claims	1,260
Total Payment	$13,844,072

[14] FEMA NFIP Community Status Report, September 9, 2021
[15] Fairfax County Department of Emergency Management and Security

Table 21: NFIP Status, as of September 14, 2021[16]

Category	NFIP Topic	Source of Information	Comments
Insurance	How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist Community Information System Database	6,615 policies countywide based on information through July 2021. The total premium is $3,601,181. Approximately 73% of the insured structures are located outside FEMA's designated Special Flood Hazard Areas (SFHAs).
Insurance	How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist Community Information System Database	1,260 claims paid through July 2021; total amount: $13,844,072. Information on how many of the paid claims were for substantial damage is not available.
Insurance	How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA) Estimate from FEMA	Approximately 2,000 structures are estimated to be in SFHAs.
Insurance	Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	An estimated 10% of the structures in SFHAs do not have NFIP coverage, presumably because their owners do not hold federally backed mortgages.
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	Community FPA/NFIP Coordinator holds Professional Engineer (PE) and Certified Floodplain Manager (CFM) certifications.
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	No. Floodplain management is a primary function of the two primary agencies responsible: the Department of Land Development Services (LDS) and the Department of Public Works and Environmental Services (DPWES).

[16] Fairfax County Department of Emergency Management and Security

Category	NFIP Topic	Source of Information	Comments
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	The full range of NFIP administrative services (permitting, inspections, outreach, GIS, and engineering analysis) is provided by LDS and DPWES.
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	Currently no barriers.
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Compliance History	Are there any outstanding compliance issues (i.e., current violations)?		No
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		July 1st, 2020

5.2. Population

Fairfax County is more densely populated in the area closer to the District of Columbia, with dense population clusters throughout the County. Approximately 200 languages are spoken among its residents, highlighting the challenge of communicating emergency information and educating residents about hazard risks and vulnerabilities and the benefits of hazard mitigation. The Fairfax County Board of Supervisors and School Board created the County's One Fairfax Policy – a joint racial and social equity policy that commits the County and schools to intentionally consider equity when making policies or delivering programs and services.[17]

In Fairfax County, there are approximately 75,000 individuals that have identified a disability or access and functional need.[18] According to the U.S. Census Bureau 2013-2017 data, 4.3% of Fairfax County's residents under 65 identify as having a disability. This percentage would be much higher if disabled people 65 and older were counted in the data.[19]

1. [17] One Fairfax. (https://www.fairfaxcounty.gov/topics/one-fairfax)
[18] Census Data from DSPD
[19] U.S. Census Bureau QuickFacts: Fairfax County, Virginia

Estimates of the number of residents in Fairfax County vulnerable to each hazard are presented in the various hazard sections in the **Base Plan.**

The Centers for Disease Control and Prevention's (CDC) **Social Vulnerability Index (SVI)** is a tool that can be used to identify specific vulnerable populations. The CDC SVI depicts the vulnerability of communities at the Census tract level, by county, into 15 Census-derived factors grouped into four themes—socioeconomic status, household composition/disability, race/ethnicity/language, and housing type/transportation. Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills.

Overall CDC SVI is illustrated in Figure 9, which indicates the locations of highest overall vulnerability are in more urbanized areas such as the Jefferson, Fairfax, Mt. Vernon, and Upper Potomac Planning Districts, as well as along major transportation routes.

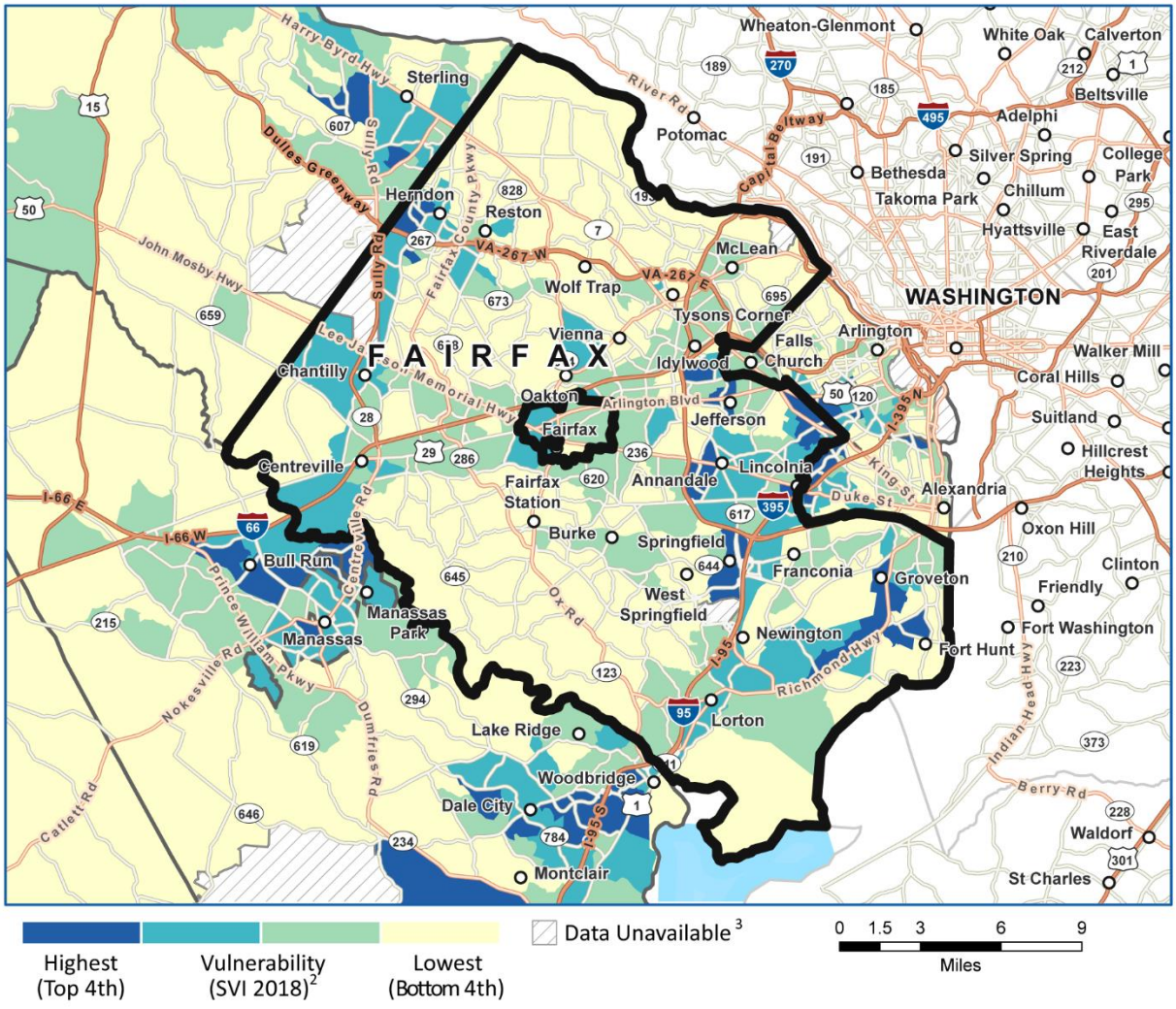

Figure 9: Overall Social Vulnerability (2018), Fairfax County[20]

When examined by vulnerability theme, the planning districts with highest vulnerabilities vary slightly:

[20] Centers for Disease Control and Prevention (https://svi.cdc.gov/map.html)

- **Socioeconomic Status:** Mt. Vernon, Lower Potomac, Baileys, Jefferson, and Annandale
- **Household Composition/Disability:** Mt. Vernon, Lower Potomac, Springfield, Pohick, and Bull Run
- **Race/Ethnicity/Language:** Jefferson, Baileys, Annandale, Bull Run, and Rose Hill
- **Housing Type/Transportation:** Mt. Vernon, Springfield, and Annandale

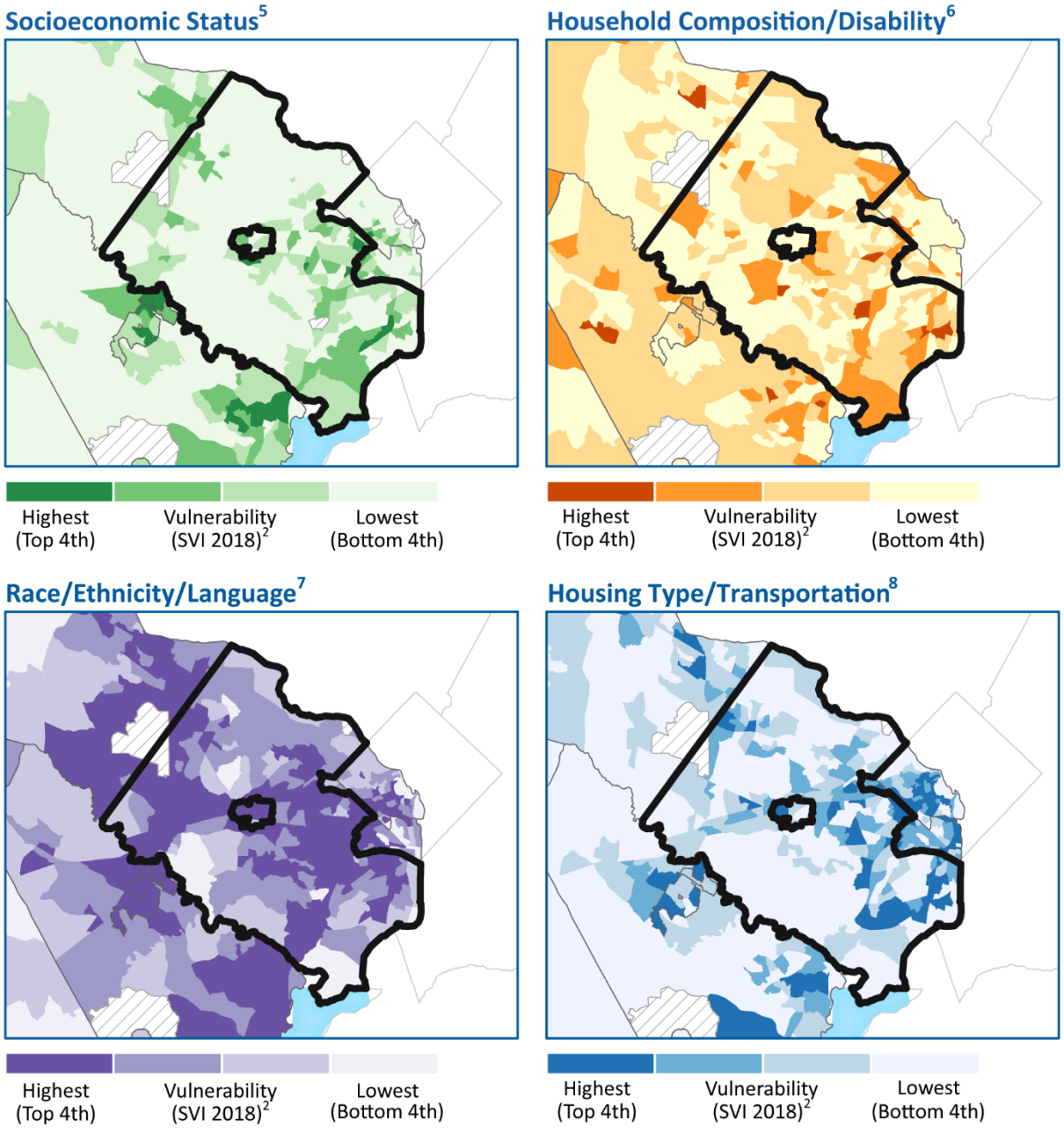

Figure 10: Social Vulnerability, by Theme, Fairfax County[21]

[21] Centers for Disease Control and Prevention (https://svi.cdc.gov/map.html)

The themed maps illustrate the County's higher level of vulnerability in the race/ethnicity/language theme, demonstrating the importance of communicating essential hazard mitigation, preparedness, response, and recovery information to the public in alternate formats and multiple languages.

5.3. Built Environment

Based on data currently available through Hazus, the tables presented in this section provide a total number of exposed facilities and properties in relation to earthquakes, floods, and hurricane winds.

Table 22: Building Stock Exposure by General Occupancy[22]

Type	Amount
Residential	$144,188,703
Commercial	$20,116,524
Industrial	$2,464,611
Agricultural	$272,032
Religion	$1,827,947
Government	$579,222
Education	$1,378,119
TOTAL	**$170,827,158**

Using the 100-year flood scenario, Hazus identified a total of 357 structures that would be damaged, with 44 being at least 50% damage, and 88 incurring substantial damage.

[22] HAZUS

5.4. Community Lifelines and Assets

Fairfax County reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events.[23] The vulnerability of critical infrastructure is presented in the lifeline sector categories identified by FEMA.

Table 23: Vulnerable Community Lifeline Assets (in Thousands of Dollars)[24]

Sector	Dollar Exposure (in thousands)
Safety and Security	0
Food, Water, and Sheltering	$1,487,248
Health and Medical	0
Energy	$837,534
Communications	$744
Transportation	$8,293,279
Hazardous Materials	0

Table 24: Critical Facilities Exposed to FEMA Identified Floodplains, Fairfax County[25]

Facility Type	Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
Fire Stations	40	1	0
Highway Bridges	670	235	1
Highway Segments	205	61	0
Light Rail Segments	13	8	0
Natural Gas Pipelines	14	13	0
Ports	5	1	0
Railway Bridges	35	11	0

[23] Although Fairfax County maintains a separate critical facilities inventory, information used in this analysis is extracted from the HAZUS critical facilities database to maintain consistency with other jurisdictions.
[24] HAZUS 100- and 500-Year Flood Scenarios, August 3, 2021.
[25] Ibid.

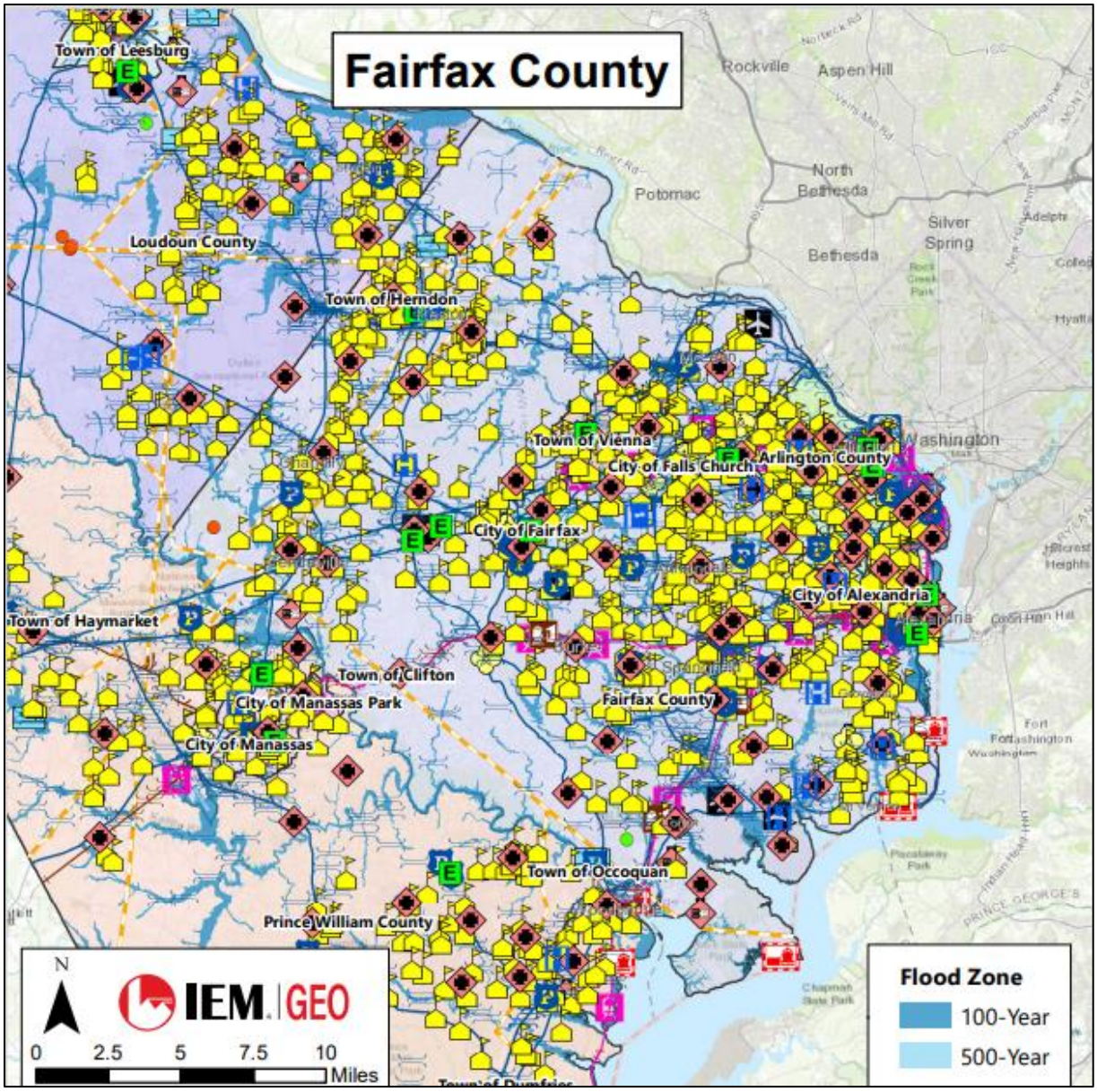

Figure 11: Community Lifelines/Critical Facilities within 100- and 500-Year Floodplains[26]

5.5. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

Additional environmental concerns for Fairfax County are related to the Potomac Watershed Waterways and potential for flooding. The County also has a high number of public parks, outdoor sporting facilities, and National Park Service trails and parks. The County identified Huntley Meadows as a critical habitat due to its forests, meadows, and wetlands.

[26] HAZUS 100- and 500- Year Flood Scenarios, August 3, 2021.

5.6. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2,500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets.

Table 25: Direct Economic Losses (in Thousands of Dollars) Related to Earthquake, Flood, and Hurricane Wind[27]

Hazard	Buildings (Capital Stock and Income)	Transportation	Utilities
Earthquake	$1,929,731	$27,003	$25,288
Flood	$431,591	$12.57	$70,758.83
Hurricane Wind	$123,575	0	0

Additional economic concerns for Fairfax County are related to the area's economic base, which relies on government, information technology, and finance. Major employers include Fortune 500 companies, the federal government, and the military.

5.7. Cultural/Historical

Information related to vulnerability of cultural and historical assets is presented in the hazard-specific sections of the **Base Plan**.

Fairfax County has significant historical and cultural landmarks linked to the founding of the United States, such as these National Trust Historic Sites:

- Gunston Hall
- Mount Vernon
- Patowmack (Potomac) Canal
- Woodland Plantation/Pope-Leighey House

There are also locally designated landmarks.

Historic structures and sites are frequently more vulnerable to flood hazards due to the typical development of a city or town along a waterway. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites.

Table 26: Cultural & Historic Properties Exposed to FEMA Identified Floodplains, Fairfax County[28]

Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
63	18	0

[27] HAZUS (2,500-year, 6.5 magnitude earthquake scenario)
[28] Fairfax County

6. Capability Assessment

Fairfax County reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard related information

In addition to the Capabilities Assessment Worksheet, Fairfax County completed a Jurisdiction Needs Identification Questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the levels of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis, as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans, and/or resources, and it can implement most mitigation actions.

Table 27: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	High
Financial	Moderate
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary[29]

The County utilizes the all-hazards approach when developing any jurisdictional plans, including emergency operations, continuity of operations, and the hazard mitigation plan.

The following plans and goals have been developed or updated since the 2017 HMP:

- Fairfax County Community-Wide Energy and Climate Action Plan (CECAP)
- Fairfax County Five-Year Consolidated Plan for FY 2022–2026, with yearly Action Plan for FY 2022, (Affordable Housing and Community Development Needs)
- Resilient Fairfax, planning process Feb 2021 – Oct 2022; available Fall 2022
- Fairfax County Pre-Disaster Recovery Plan, dated April 2020
- Fairfax County Emergency Operations Plan, updated June 2019
- County of Fairfax, Virginia, Floodplain Management Plan (Part of the Northern Virginia Regional Hazard Mitigation Plan), Progress Report, dated September 2019
- Fairfax County Continuity of Operations Plan (COOP)

The “One Fairfax Policy,” adopted November 21, 2017, is a joint racial and social equity policy of the Fairfax County Board of Supervisors and Schools Board that commits to intentionally consider equity when making policies or delivering programs and services.

[29] Source: Fairfax County jurisdictional capabilities assessment.

Figure 12: One Fairfax Policy – "Equity Lens"[30]

Capability Analysis: High

Significant planning and regulatory tools are in place in Fairfax County and bring to light successes in integrating hazard mitigation planning with existing planning mechanisms. This demonstrates that the jurisdiction recognizes the benefit of incorporating hazard mitigation into local planning and regulatory processes such as the Comprehensive Plan, the Capital Improvement Plan, and land development and floodplain regulations and understands how to use these processes to develop and implement mitigation actions.

6.1.2. Administrative and Technical Capabilities Summary

- Planning and Development staff include planners, engineers, and a floodplain manager with an understanding of natural and non-natural hazards, all of whom participate in mitigation planning.
- The County maintains an Information Technology department with GIS personnel.
- County emergency management, health department, and other staff are familiar with the community's hazards.
- County administration has a grant writer who coordinates with the hazard mitigation program.
- The County uses Everbridge as an emergency warning system for internal and external notifications and warnings.

The County identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and implementation of the plan:

- Code Compliance
- Office of Environmental and Energy Coordination
- Department of Emergency Management and Security
- Facilities Management Department
- Fire and Rescue Department

[30] Fairfax County One Fairfax Policy. Retrieved from: https://www.fairfaxcounty.gov/topics/sites/topics/files/Assets/images/one-fairfax-equity-lens-infographic.png

- Health Department
- Land Development Services
- Park Authority
- Police Department
- Public Safety Communications
- Public Works and Environmental Services
- Sheriff's Office

Capability Analysis: High

Fairfax County has a robust staffing capability that provides for a high level of coordination for the purpose of mitigation planning and action implementation. While enhancements in its administrative and technical capabilities were gained through the increase in department and agency positions that resulted from the COVID-19 pandemic, securing continuous funding for positions and ongoing education and training offer are areas for improvement.

6.1.3. Safe Growth Capabilities Summary

- Growth guidance instruments, such as future land-use policies, regulations, and maps, identify natural hazard areas, e.g., floodplains, and discourage or prohibit development or redevelopment in these areas.
- The Comprehensive Plan includes a Transportation Element that addresses appropriate placement and utilization of transportation systems.
- Environmental policies encourage appropriate development to protect ecosystems.
- Public Safety plans and procedures address emergency evacuation and other safety measures associated with safe growth.
- The Capital Improvement Program integrates hazard mitigation projects identified in the hazard mitigation plan.
- The building code and floodplain regulations provide for a Base Flood Elevation (BFE) sufficient to protect property from the 100-year flood event.

Capability Analysis: High

Fairfax County has well-established safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment. No additional enhancements are identified at this time.

6.1.4. Financial Capabilities Summary

- The County's Capital Improvements Plan provides funding for projects outside of the County's annual operational budget.
- The County has the authority to incur debt through general obligation bonds and/or special tax bonds, as well as fees for utility services and impact fees for new development.
- The County participates in multiple federal and state funding programs such as Hazard Mitigation Assistance (HMA); health department; transportation, fire, and police funding programs such as

Hazard Mitigation Grant Program (HMGP); Emergency Management Performance Grant (EMPG); Staffing for Adequate Fire and Emergency Response Grants (SAFER); Community Oriented Policing Services (COPS); and others through various disciplines.

Capability Analysis: Moderate

Although rising operational costs and limited financial resources are an everyday challenge for most local governments, Fairfax County has significant experience and success in leveraging and combining local, state, and/or federal funding sources to implement mitigation-related projects. The process for identifying potential grants, developing and submitting applications, and managing grant-funded projects is time-consuming and challenging, especially when multiple disasters occur simultaneously. In addition, onsite work restrictions imposed during the COVID-19 pandemic from March 2020 that are set to continue throughout 2022 continue to present challenges in staff availability and coordination. To address these shortfalls, the jurisdiction may access technical assistance available to potential applicants provided by many grant programs or expand its capabilities to develop and manage mitigation actions through contracted services.

6.1.5. Education and Outreach Capabilities Summary

- Community Rating System initiatives within the NFIP program can increase public awareness of and involvement in hazard mitigation.

Fairfax County has identified programs or organizations that can help integrate hazard mitigation into community programs to increase public involvement:

- Fire Department – Fire Safety
- Office of Energy and Environment
- Police Department – Personal Safety
- Fairfax County Economic Development Authority (EDA)
- Department of Public Works and Environmental Services, Stormwater Management – Flood Awareness and Mitigation Chambers of Commerce
- American Red Cross
- Volunteer Fairfax
- Partnerships with energy and water companies

Capability Analysis: Moderate

Jurisdictions have multiple opportunities to promote hazard mitigation and increase involvement of stakeholders and the public. There is a critical need to inform additional stakeholders and the public about the benefits of hazard mitigation planning and implementation. Virginia Department of Emergency Management (VDEM) mitigation staff can provide technical assistance to support increased jurisdictional involvement. Many hazard mitigation educational tools and materials are available from state agencies and disaster preparedness and response organizations, such as the American Red Cross, FEMA, and faith-based organizations with disaster response missions.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, Fairfax County identified activities related to each natural hazard that support risk reduction.

Table 28: Capability Summary - Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Dam Failure (including Levees)	• Huntington Levee was completed in 2019. • All high hazard dams in Fairfax County have Emergency Action Plans (EAP) for potential incidents.
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and international building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	• Public education and operational plans address preparedness and response to reduce risk.
Flood/Flash Flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. • Stormwater management program and projects address flood prevention and risk reduction. • Huntington Levee, completed in 2019, protects at least 160 homes in the community from floods due to tidal surges from the Potomac River and flash flooding from the Cameron Run Watershed. The project was recognized for its sustainable infrastructure by the Institute for Sustainable Infrastructure.
High Wind/Severe Storm	• State and International building codes provide for wind regulations.
Karst/Sinkhole/Land Subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Winter Storm	• Public education and operational plans address preparedness and response to reduce risk.
Non-Natural Hazards	• Public education and operational plans address preparedness and response to reduce risk. • Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.

Hazard	Activity
Climate Change	• The “Resilient Fairfax” climate adaptation and resilience plan will be completed in 2022; it includes projected climate hazards, a climate vulnerability and risk assessment, and an audit of existing policies, plans, and programs, and strategies to enhance the County’s resilience to climate hazards. The climate hazards analyzed include heavy precipitation, severe storms and wind, extreme heat, drought, extreme cold, and coastal flooding.

7. Resilience to Hazards

7.1. National Risk Index

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of "low risk" is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

The National Risk Index (NRI) is a dataset and online tool developed by the Federal Emergency Management Agency (FEMA) and other partners to help illustrate communities in the United States at risk for 18 natural hazards. Hazard risk is calculated on data for a single hazard type and reflects the relative risk for that hazard type and should thus be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently from the hazards in this plan, so a direct hazard-to-hazard comparison of risk cannot be determined.

Based on the NRI findings, the top five hazards by risk rating for Fairfax County are Winter Weather, Strong Wind, Tornado, Cold Wave (known within this plan as Extreme Cold), and Heat Wave (known within this plan as Extreme Heat). Lightning, Ice Storm, Hail, and Riverine Flooding received lower risk ratings; however, 14 of the 15 hazards rated for risk were all determined to be "very low," with one hazard, Heat Wave, determined as "relatively low."

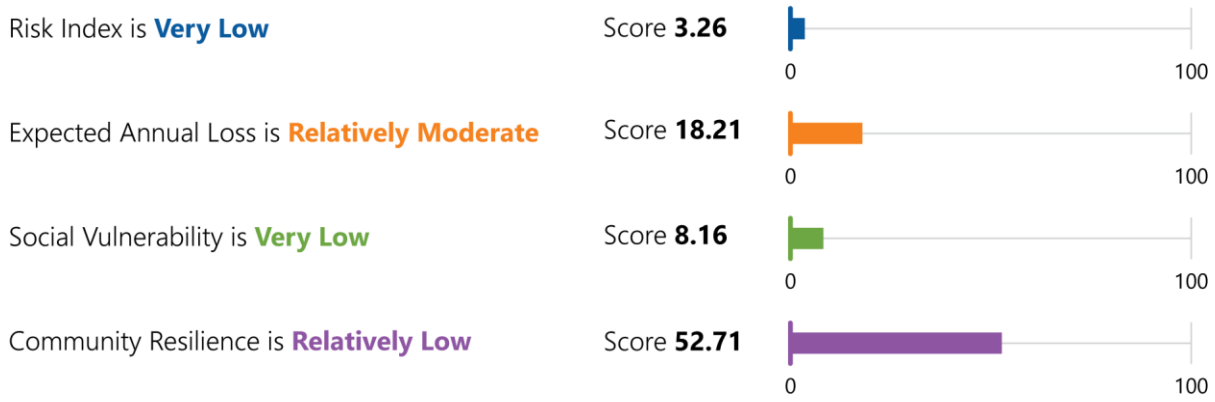

Figure 13: Summary of National Risk Index Findings, Fairfax County[31]

Table 29: Comparison of Fairfax County Scores with Virginia and National Average[32]

Index	Fairfax County	Virginia Average	National Average
Risk	3.26	6.62	10.70
Expected Annual Loss	18.21	9.35	13.47
Social Vulnerability	8.16	35.32	38.35
Community Resilience	52.71	54.92	54.59

[31] National Risk Index
[32] Ibid.

Table 30: Fairfax County Risk Ranking Summary[33]

Index	Rank
Risk	Very Low
Expected Annual Loss	Relatively Moderate
Social Vulnerability	Very Low
Community Resilience	Relatively Low

Fairfax County's NRI Community Resilience score of 52.71 represents a relatively low ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the United States.

The NRI calculation does not follow the same criteria and formulas used in the hazard risk ranking methodology for this plan but is provided as a comparative measurement tool.

7.2. Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household level risk factors.

The index produces aggregate-level (Census tract, county, and state) small area estimates that help determine how at risk specific neighborhoods might be to disasters due to characteristics that may make specific segments of the population more vulnerable to the impacts and consequences of disasters. The 10 risk factors[34] include the following:

1. Income-to-poverty ratio
2. Single or zero caregiver household
3. Unit-level crowding
4. Communication barrier
5. Aged 65 years or older
6. Lack of full-time or year-round employment (household)
7. Disability
8. No health insurance coverage
9. No vehicle access (household)
10. No broadband internet access (household)

[33] Ibid.
[34] The Community Resilience Estimates are developed by the U.S. Census Bureau; initial release date, August 10, 2021. Methodology is described at the U.S. Census Bureau Community Resilience Methodology page (https://www.census.gov/programs-surveys/community-resilience-estimates/technical-documentation/methodology.html).

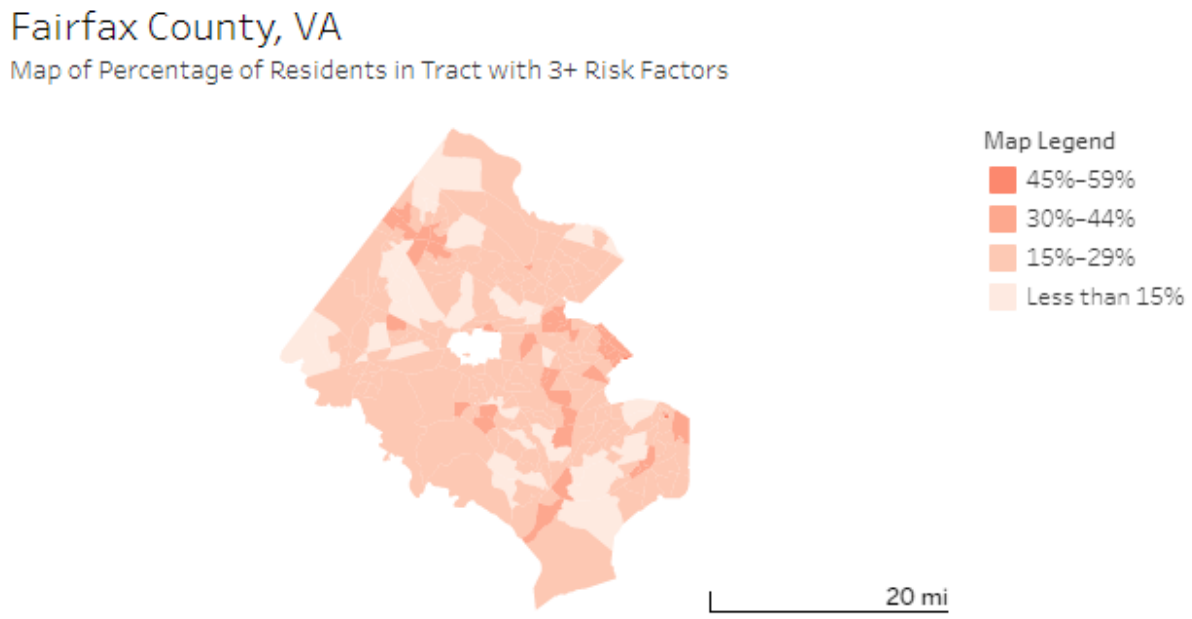

Figure 14: Community Resilience Estimate[35]

The estimate is categorized into three groups: zero risks, one or two risks, and three or more risks. The CRE for Fairfax County is 14.72 percent, meaning that 167,857 of county residents have three or more risk factors.

The combination of data and analysis described in this section provides a comprehensive representation of Fairfax County's risk, vulnerability, and resilience to all hazards.

7.3. New Hazard Risk Challenges or Obstacles to Be Monitored in the Next Planning Cycle

The Fairfax County Planning Committee identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- The risk of cyber-related incidents on critical infrastructure and key resource sites
- Climate change causing increased precipitation intensity and quantities, increased extreme heat, increased storm severity, and increased coastal (Potomac River) flooding
- Increases in the number of excessive rainfall events that impact new areas with floods

[35] Community Resilience Estimates, U.S. Census Bureau

8. Mitigation Actions

8.1. Goals and Objectives

The Fairfax County Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**. In addition, the *Fairfax County Emergency Operations Plan (EOP),* dated June 2019, defines the primary goal of mitigation as reducing "loss of life and property by lessening the impact of disasters," which is achieved through "regulations, local ordinances, land use and building practices, and mitigation projects that reduce or eliminate long-term risk from hazards and their effects." (*Fairfax County EOP,* p. 81). The link between the goals of the *NOVA HMP* and the *EOP* increases the likelihood of success in implementing mitigation actions.

8.2. Status of Previous Actions

Fairfax County monitors actions and tracks progress through the periodic review, evaluation, revision, and update of the NOVA HMP. Some projects that contribute to risk reduction have been completed or are currently in progress but have not been included in this plan due to one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and resulting risk reduction.

The Fairfax County Mitigation Actions list includes previously identified actions from the 2006, 2010 and 2017 plans. Four actions from the 2006 plan were carried forward for the 2022 NOVA HMP update. Twelve actions from the 2010 plan were carried forward, and one was noted as completed and removed from the list. Nine actions from the 2017 plan were carried forward and three were noted as complete.

A comprehensive list of previous mitigation actions, including descriptions of progress made and current status, is presented in **Attachment 3** of this annex.

8.3. New Mitigation Actions

In addition to the actions carried forward from previous plans, the Fairfax County Planning Team identified two new mitigation actions to include in this plan to address expansion and strengthening of the Department of Emergency Management and Security's continuity program by increasing the resilience of county operations and coordinate with FEMA to re-evaluate flood zones and update Flood Insurance Rate Maps (FIRMs) as a basis for future National Flood Insurance Program Activities. **Attachment 3** of this annex includes a table that summarizes each new and continued action with descriptions of the proposed activity, priority level, estimated cost, and lead agency.

8.4. Action Plan for Implementation and Integration

The Fairfax County Department of Emergency Management and Security (DEMS) is responsible for coordinating county departments and agencies participating in hazard mitigation activities. The DEMS-designated Mitigation Coordinator is responsible for implementing the mitigation plan on two levels: implementation of the jurisdiction's actions and facilitating implementation of the multi-jurisdictional regional plan. Tasks to ensure that the jurisdiction's actions are implemented are integrated into the *Action Plan for Implementation and Integration* (which includes the prioritized list of Mitigation Actions), and plan maintenance procedures described in the next section.

The *Fairfax County Emergency Operations Plan (EOP),* dated June 2019, (p. 82) defines criteria for project eligibility under the Hazard Mitigation Grant Program (HMGP), stating that a project must meet the following requirements:

- Conform to the State Hazard Mitigation Plan.
- Conform to environmental, historical, and economic justice issues.
- Provide a long-term solution.
- Demonstrate cost effectiveness.
- Comply with program regulations.
- Be consistent with overall mitigation strategies.

The Action Plan for Implementation and Integration describes how the County's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 31: Action Plan for Implementation and Integration of Mitigation into Existing Plans and Procedures, Fairfax County

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plan.	Continue to coordinate with the Department of Planning and Development and other applicable departments to incorporate current and emerging risks and actions into planning efforts.
Review/update land development regulations for consistency with mitigation goals.	Continue coordination with the Department of Planning and Development and Land Development Services regarding future land use projects.
Review/update building/zoning codes for consistency with mitigation goals.	Work with the Department of Planning and Development and Land Development Services regarding county zoning ordinances and consistency with mitigation goals.
Maintain regulatory requirements of floodplain management program (NFIP).	Support the Department of Public Works and Environmental Services Stormwater Division, which is responsible for floodplain management.
Enhance floodplain management through the Community Rating System (CRS).	Work with Land Development Services and the Department of Public Works and Environmental Services on reviews of floodplain management and mapping.
Review/Update economic development plan and policies for consistency with mitigation goals.	Work with Fairfax County Department of Economic Initiatives and Economic Development Authority to ensure consistency in plans.
Continue public engagement in mitigation planning.	Continue to promote awareness of hazards and incorporate public feedback into planning processes for resident feedback.
Identify opportunities for mitigation education and outreach.	Identify opportunities to conduct community outreach to promote the importance of mitigation projects.
Review/update stormwater plans and procedures for consistency with mitigation goals.	Work with the Department of Public Works and Environmental Services Stormwater Division to discuss plans and procedures on a more frequent basis.

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Review/update emergency plans to address evacuation and sheltering.	Continue to work with partner agencies on the Shelter Annex.
Maintain ongoing enforcement of existing policies.	Support the Department of Planning and Development and Land Development Services with any applicable enforcement policies.
Monitor funding opportunities.	DEMS will continue to monitor funding sources and coordinate with departments on projects that support mitigation actions.
Incorporate goals and objectives into day-to-day government functions.	DEMS will incorporate the concept of mitigation into day-to-day government functions, including continual monitoring of the action items identified in the 2022 update.
Incorporate goals into day-to-day development policies, reviews, and priorities.	Continue work with the Department of Planning and Development and Land Development Services to incorporate mitigation into day-to-day activities.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 32: Fairfax County Plan Maintenance Responsibilities for the *Northern Virginia Hazard Mitigation Plan* (Base Plan)

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update processes. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP Base Plan**, the Fairfax County Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in the fifth year

Table 33: Fairfax County Jurisdiction Annex Maintenance Procedures

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with jurisdiction planning team. 2. Review the status of all mitigation actions, using the *Mitigation Action Implementation Worksheet* (**NOVA HMP Base Plan, Section 3, Attachment A**).	• Produce an annual report that includes the following: • Status update of all mitigation actions • Summary of any changes in hazard risk or vulnerabilities and capabilities • Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	1. Schedule the annual plan evaluation with jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the *Planning Considerations Worksheet* (**NOVA HMP Base Plan, Section 3, Attachment C**).	• Submit the annual report to the NOVA HMP Project Team Point of Contact
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

Mitigation actions presented in the Fairfax County Jurisdiction Annex may be reviewed, revised, and updated at any time. In addition, the *Fairfax County EOP*, p. 83, stipulates that "DEMS (Department of Emergency Management and Security) will contact all agencies for post-disaster mitigation activities and notify them of their role in these operations." This will ensure that mitigation actions remain current and positioned for potential funding should it become available.

Fairfax County will continue to partner with multiple jurisdictions and regional entities to plan and identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan.

10. Annex Adoption

The Fairfax County Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation Plan*.

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Documentation of Public Participation

Public Hazard Survey – Screenshots of the Survey Promotion

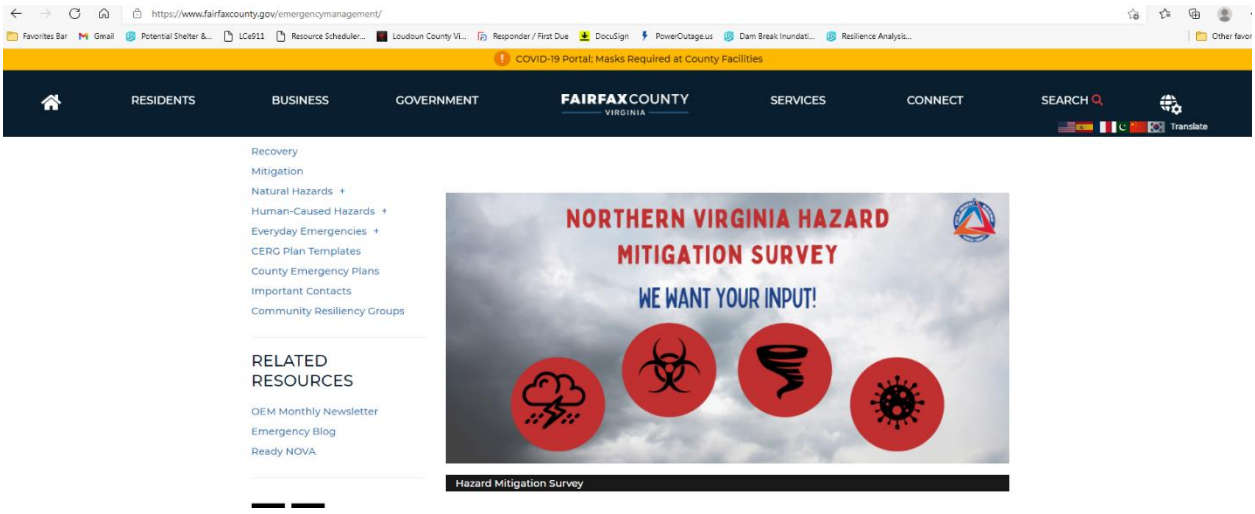

Figure 15: Fairfax County DEMS Webpage

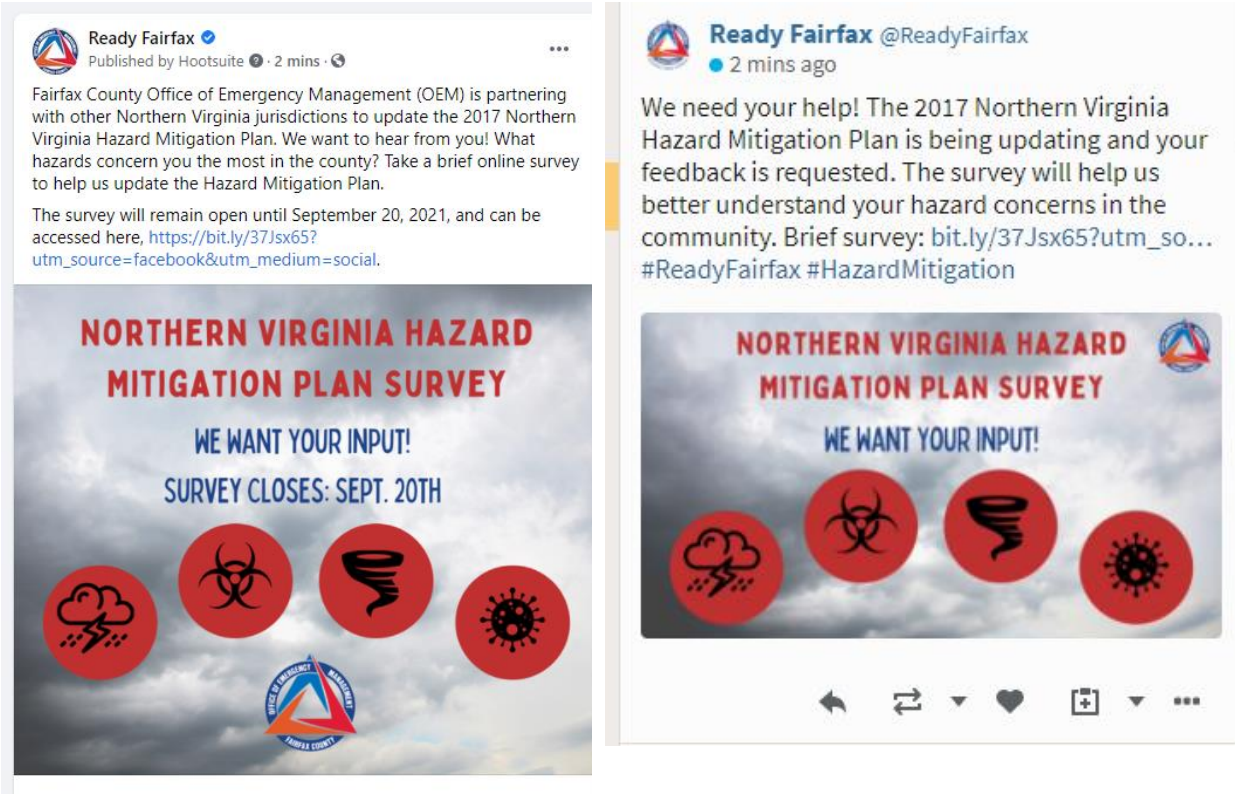

Figure 16: Social Media – Twitter and Facebook

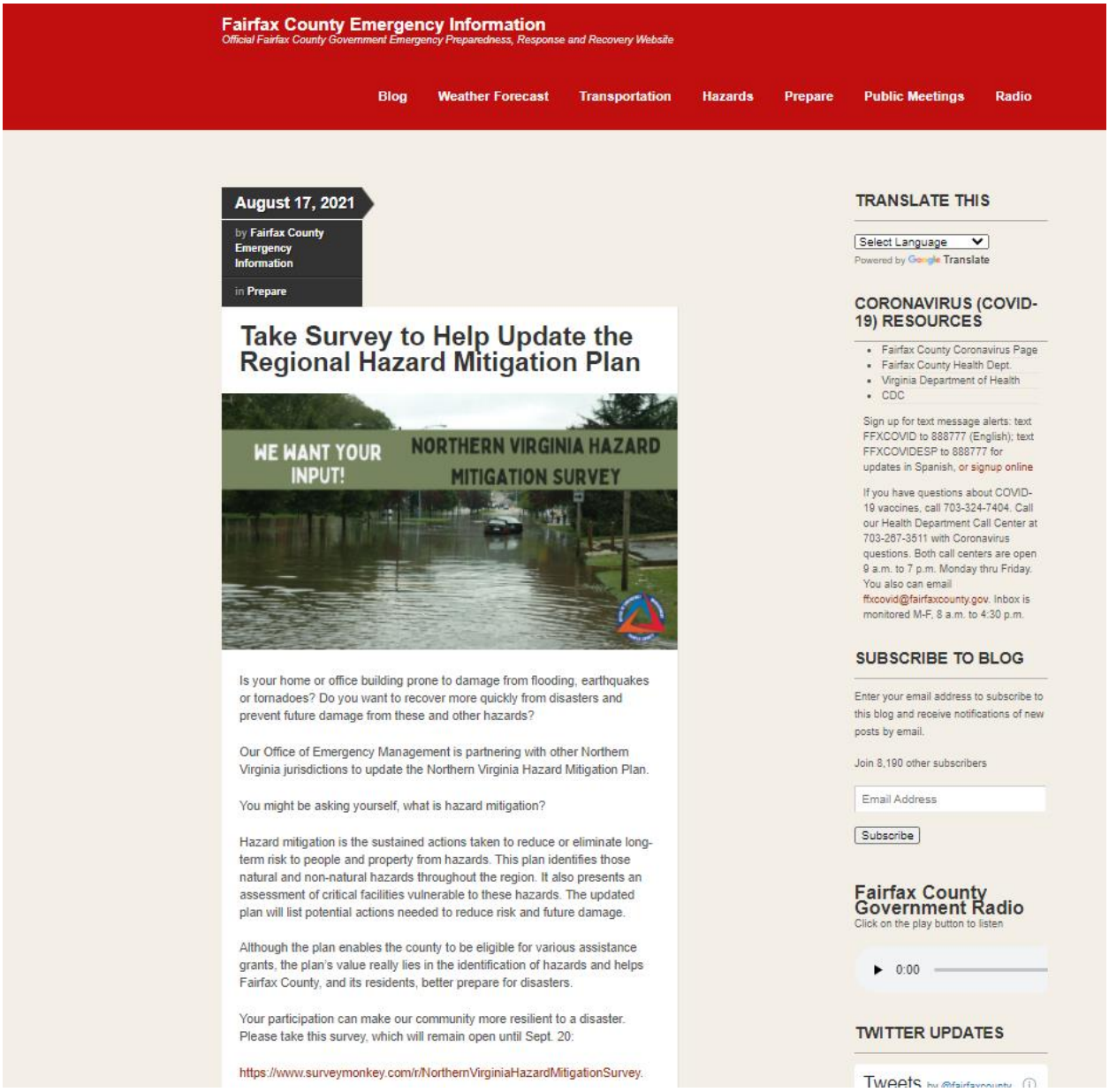

Figure 17: Fairfax County Emergency Blog

Figure 18: Fairfax County Government Twitter

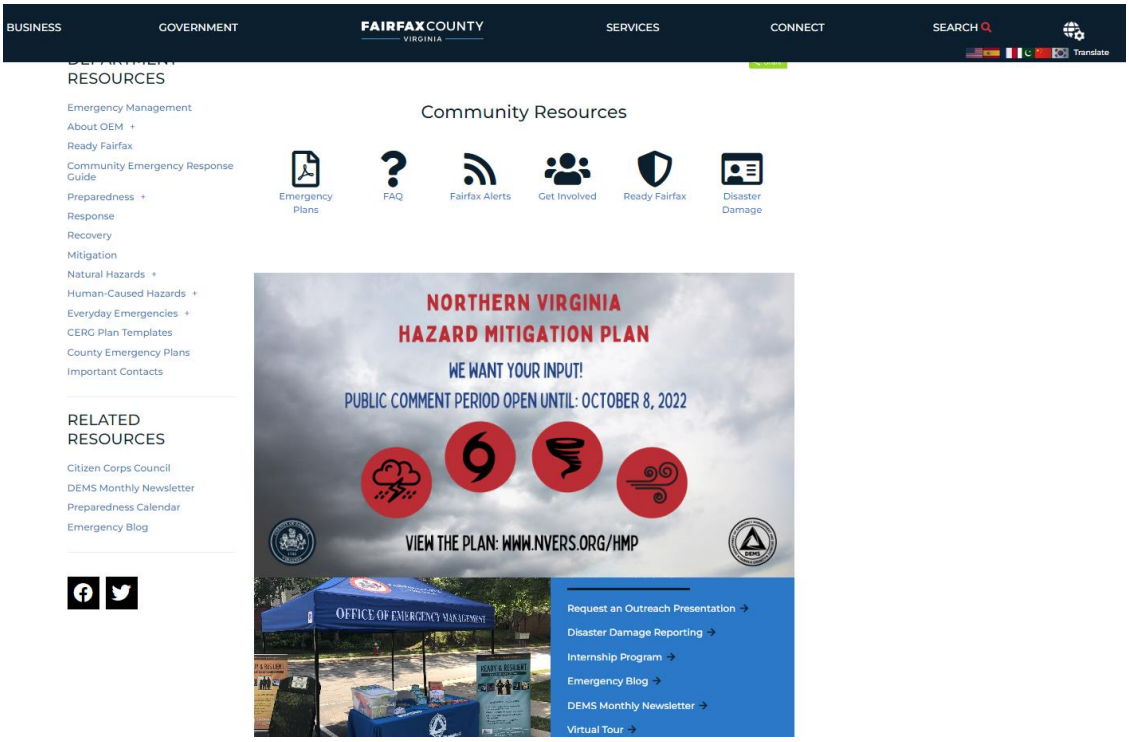

Figure 19: Final Draft Public Comment Website

Figure 20: Final Draft Public Comment Facebook

Figure 21: Final Draft Public Comment Twitter

11.3. Attachment 3: Mitigation Actions

Table 34: Previous Mitigation Actions

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment	Current Status	Projected Completion
2006-2	Continue to develop and implement flood proofing solutions for structures by analyzing flood causes and responsibilities. Continue to develop and implement flood proofing solutions for structures using the County's mapping of the regulatory floodplain based on the ultimate development condition flows, neighborhood drainage improvement projects, and projected climate change conditions.	DPWES: Stormwater	• Dam Failure • Flood • High Wind/ Severe Storm • Winter storm	County Funding	Ongoing	Initiate service request within 48 hours of receiving the request.	High	These projects are completed when the County attorney. We are responsible and the efforts are ongoing. The language for this action has been modified slightly for the 2017 plan, but the intent remains unchanged.	In Progress/ Retaining	To be completed in the 2022–2027 planning cycle.
2006-5	Continue to install remote lake level sensors, data collectors/alarms, stream flow gauges, tide gauges and rain gauges at critical locations throughout the County to allow for earlier warning of potential flooding.	DPWES: Stormwater	• Dam Failure • Flood • High Wind/ Severe Storm	FEMA Hazard Mitigation Assistance Grants, US Army Corps of Engineers, County Funding, and VDEM	Ongoing	Prioritize installation of gauges within one year of substantial completion and as resources allow Interim measure still the same.	High	These projects are ongoing and competed as funding becomes available. Need VDEM to approve placement of the gauges.	In Progress/ Retaining	To be completed in the 2022–2027 planning cycle.
2006-13	Identify need for backup generators, communications,	Park Authority	• All Hazards	UASI funding,	July 2014	Conduct generator	Medium	This program will be	In Progress/ Retaining	To be completed

	and/or vehicles at critical public facilities. Develop means to address identified shortfalls.			County funding, and VDEM grant		survey to identify which facilities require a backup generator by January 2012. Successful grant application package.		completed when funding becomes available.		in the 2022-2027 planning cycle.
2006-28	Continue to implement building and development standards as required under the National Flood Insurance Program.	Land Development Services	• All Hazards	FEMA Hazard Mitigation Assistance Grants, US Army Corps of Engineers, County Funding, VDEM	Ongoing	Implement one new standard (at least at County facilities) every year.	Medium	This task is ongoing; as updates are made to building and development standards, they are reviewed and incorporated as appropriate. All new policies and procedures are in accordance with the National Flood Insurance Program (NFIP). Currently, Land Development Services sends out reminder notices in advance of know whether events. LDS also does a standard site inspection	Forever ongoing due to standards continually changing.	To be completed in the 2022-2027 planning cycle.

								during construction and after each significant weather event to ensure erosion and other controls worked and/or whether additional efforts and clean-up are required.		
2010-6	Continue to employ a broad range of warning systems throughout the County.	Office of Emergency Management	• Dam Failure • Drought • Earthquake • Extreme Temperatures • Flood • High Wind/ Severe Storm • Karst/Sinkholes/Subsidence • Landslides • Tornado • Wildfire • Winter storm	UASI funding, DHS grants, County funding	Ongoing	Successfully send out an alert using all available methods.	High	DEMS launched the new Fairfax Alerts system in the summer of 2014 and continues to look for new ways to alert residents including social media and WEA. Completed alert and warning annex for the EOP. Maintain and expand alert capabilities using all technology currently available.	Forever ongoing as things change.	Completed by the next planning cycle.

2010-12	Identify funding opportunities to replace vulnerable or undersized culvert stream crossings with bridges or larger culverts to reduce flood hazards. Consider future climate projections when identifying "vulnerable and undersized."	Park Authority	• Dam Failure • Flood • High Wind/ Severe Storm	FEMA Hazard Mitigation Assistance Grants	Ongoing	Develop list of vulnerable or undersized culverts by January 2012. Continue funding and stick to the replacement schedule.	High	PA has a trail development strategy plan that addresses this concern. Have developed a list of culverts to replace and have created schedule for replacement. (Trail master plan and trail elements are in that plan.) Funding is ongoing. 23,000 acres of parkland and 1,700 miles of trails.	Ongoing project, retain for next plan.	To be completed in the 2022–2027 planning cycle.
2010-16	Upgrade the New Alexandria/Belle View pump station fuel oil storage tanks from underground to above-ground storage.	DPWES: Stormwater	• Flood • High Wind/ Severe Storm	County Funding	August 2021	Complete Design by June 2017.	High	The existing tanks were abandoned in place and all documentation was submitted to DEQ and fire marshal. The new tanks will be registered when installation and testing is completed.	In progress	
2010-17	Continue to seek voluntary buyouts of FEMAs repetitive	DPWES: Stormwater	• All Hazards	FEMA Hazard Mitigation	Ongoing	Continue to pursue buyouts for properties	High	These projects are completed	Ongoing	To be completed in the

	loss properties within the floodplain.			Assistance Grants, County Funding		that meet FEMA's benefit-cost ratio.		as funding is available.		2022–2027 planning cycle.
2010-20	Collaborate with FEMA to develop risk maps for the Cameron Run Watershed and the Belle View communities. Consider future climate projections in this map development.	DPWES: Stormwater	• All Hazards	FEMA Hazard Mitigation Assistance Grants and County funding	Ongoing		High	Progress is controlled by FEMA's schedule.	Ongoing	To be completed in the 2022–2027 planning cycle.
2010-21	Develop an outreach program aimed at assisting private dam owners with proper operation and maintenance.	DPWES: Stormwater	• Dam Failure • Flood • High Wind/ Severe Storm	Hazard Mitigation Grant Program – 5% initiative funds FEMA has a national dam safety program: unsure if funding is available Virginia Floodplain Management Fund (administered by DCR Division of Dam Safety and Floodplain Management)	July 2017		High	This program will be completed when funding becomes available.	Ongoing	To be completed in the 2022–2027 planning cycle.

2010-23	Identify gaps in current Recovery Planning efforts within the County.	Office of Emergency Management	• All Hazards	County Funding	July 2011	Established metrics for review of plan by February 2011. Continue to review and update recovery plan as needed.	Medium	In 2012, Fairfax County published the Pre-Disaster Recovery Plan, which is scheduled to be revised in 2017. During that process, gaps will be identified and readdressed. Pre-Disaster Recovery plan was updated in 2020.	Ongoing, always improving upon.	To be completed in the 2022–2027 planning cycle.
2010-26	Use fee, simple and/or permanent easement to prevent development in the highest priority undeveloped floodplain (and/or wetlands) areas. Work with land trusts to purchase the land or conservation easements. Use these areas as public open space for passive recreational uses.	Park Authority	• Flood	FEMA Hazard Mitigation Assistance Grants, County Funding	December 2013	Ongoing, continue to achieve goal of preserving open spaces.	Medium	Yes, continue to work with land trust/ transfers. Press for more open space. It is a day-to-day operation.	Completed, but ongoing. Seeking additional funding for future projects.	To be completed in the 2022–2027 planning cycle.
2010-27	Continue development of a comprehensive River Flood Response System for New Alexandria/ Belle View and Huntington in partnership with the National Weather Service and the U.S. Army Corps of Engineers.	DPWES: Stormwater	• Flood • High Wind/ Severe Storm	FEMA Hazard Mitigation Assistance Grants, US Army Corps of Engineers,	Ongoing	None	Medium	The projects are completed as funding becomes available Huntington now has their levee installed. Realigning flood	Ongoing.	To be completed in the 2022–2027 planning cycle.

				County Funding				responses plan for Alexandria and Belle View based on new levee in Huntington		
2010-29	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner. Provide information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.	DPWES: Stormwater	• Flood • High Wind/ Severe Storm	County Funding	Ongoing		Medium	This action was reassigned to DPWES-Stormwater. It is performed annually as part of the CRS Program.	Ongoing	To be completed in the 2022–2027 planning cycle.
2010-30	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, meeting or exceed building code standards, upgrade of electrical panels to accept generators, etc.	Office of Emergency Management	• Flood • High Wind/ Severe Storm	FEMA Hazard Mitigation Assistance Grants	Ongoing		Medium	This is completed as funding becomes available.	Ongoing	To be completed in the 2022–2027 planning cycle.
2010-32	Encourage public and private water conservation plans, including consideration of rainwater catchment system.	Park Authority, Stormwater, DPWES: Stormwater, Northern Soil and Water Conservation Authority	• Drought	County Funding	Ongoing		Low	This is completed as funding becomes available. The FCC Office of Environmental and Energy Coordination program (called HomeWise) educates the	Ongoing, Low priority	To be completed in the 2022–2027 planning cycle.

								public on water and electricity.		
2010-33	Work with the Virginia Department of Forestry to review local zoning and subdivision ordinances to identify areas to include wildfire mitigation principles.	Park Authority	• Wildfire	FEMA Hazard Mitigation Assistance Grants	Ongoing		Low	Natural Resources Group and the Virginia Department of Forestry, along with local forestry departments meet regularly and share wildfire mitigation plans and plan activities such as controlled burns.	Completed	
2017-1	Develop an Emergency Action Plan for the Huntington Levee Project.	DPWES: Stormwater	• Dam Failure • Flood	FEMA Hazard Mitigation Assistance Grants	December 2018		High		Completed 2018	
2017-3	Secure funding to purchase additional equipment/trucks to enhance our current level of service to be able to dedicate one piece of equipment/truck to each police station within Fairfax County or identify other resources to accomplish this need.	DPWES: Stormwater	• Winter storm	County Funding	June 2020	Secure funding to purchase at least two additional/trucks /pieces of equipment each year for the next four years or establish a contract that would dedicate resources to each County police station by November 2017.	High		Ongoing	

2017-4	Coordinate with and support the Virginia Department of Transportation in the identification and resolution of road flooding and drainage issues related to VDOT roadways. In the prioritization scheme, consider climate change impacts.	DPWES: Stormwater. Change this to FCDOT as the lead for this project; they can work side by side.	• Dam Failure • Flood • High Wind/ Severe Storm	VDOT Maintenance Funding	Ongoing	Prioritization and implementation of higher priorities.	High		Ongoing	To be completed in the 2022–2027 planning cycle.
2017-5	Armor stream bank and construct a flood wall to prevent stream bank erosion and flooding at the Noman M. Cole, Jr. Pollution Control Plan.	DPWES: Wastewater	• Flood • High Wind/ Severe Storm	County Funding	February 2018	Construction project management review and inspections.	High		Completed 2018	
2017-6	Design and construct safe rooms in critical facilities to house personnel and community members during high wind events.	Office of Emergency Management	• Earthquake • High Wind/ Severe Storm • Tornado • Winter storm	FEMA Hazard Mitigation Assistance Grants, County Funding	Ongoing		High	This action replaces 2010-11 and provides for storm proofing any critical facilities, not only shelters. DEMS discusses mitigation measures and finding sources before, during, and after construction with builders.	Ongoing	To be completed in the 2022–2027 planning cycle.
2017-7	Provide emergency utility capabilities for critical facilities. This includes but is not limited to providing generator and emergency water hookups.	Office of Emergency Management	• All Hazards	FEMA Hazard Mitigation Assistance Grants, County Funding	Ongoing		High	This action replaces 2010-1. DEMS discusses mitigation measures and funding	Ongoing	To be completed in the 2022–2027 planning cycle.

								sources before, during, and after construction with builders.		
2017-8	Improve the County's Community Rating System (CRS) classification from Class 6 to Class 5 by documenting services that are currently being provided.	DPWES: Stormwater	• Dam Failure • Flood	County Funding	Ongoing		Medium		Ongoing	To be completed in the 2022–2027 planning cycle.
2017-9	Provide routine inspections and maintenance of dams to ensure they are functional.	DPWES: Stormwater	• Dam Failure • Flood • High Wind/ Severe Storm	County Funding	Ongoing	Routine Maintenance	Medium		Ongoing	To be completed in the 2022–2027 planning cycle.
2017-10	Continue to implement flood mitigation projects for communities in Fairfax County that are exposed to severe flooding risk. Include updated climate data when identifying communities.	DPWES: Stormwater	• Dam Failure • Flood • High Wind/ Severe Storm	FEMA Hazard Mitigation Assistance Grants, County Funding	Ongoing		Medium	Identifying new projects as rainfall totals and flooding patterns change. Executing modeling to determine the best option.	Ongoing	To be completed in the 2022–2027 planning cycle.
2017-11	Update flood information website to include a link to the Office of Emergency Management website and the private dam owners' outreach materials.	DPWES: Stormwater	• Dam Failure • Flood	County Funding	Check links at least once every year		Low	Updating information based on new rainfall totals and flooding patterns. Executing modeling to	Ongoing	To be completed in the 2022–2027 planning cycle.

								determine the best option.		
2017-12	Support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction where feasible. Use FEMA HMA programs where appropriate. Consider climate data in these mitigation projects.	DPWES: Stormwater	• Flood • High Wind/ Severe Storm	FEMA Hazard Mitigation Assistance Grants	Ongoing		Medium	Action carried over from previous plan; still relevant and necessary. Identifying new projects as rainfall totals and flooding patterns change. Executing modeling to determine the best option.	Ongoing	To be completed in the 2022–2027 planning cycle.

Table 35: New Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment
2022-1	Strengthen Department of Emergency Management and Security's Continuity Program	DEMS Continuity Program	• All Hazards	County funds, grants	Ongoing	Being able to effectively prepare for and mitigate against disruptions that may hamper the operations of the County.	High	Although the Continuity Program is not the primary responder for the identified hazards, it plays a critical role in increasing the resilience of county operations, preparing the County to operate in adverse conditions, and in mitigating the impact of realized hazards.
2022-2	Work with FEMA to re-examine flood zones and update FIRMS. Use this information to reevaluate NFIP activities.	DPWES: Stormwater	• Flood	FEMA Hazard Mitigation Assistance Grants, County's capital budget	Ongoing	Multi-year project; meet FEMA deadlines throughout project.	Medium	Use this information to reevaluate NFIP activities.

Northern Virginia Hazard Mitigation Plan

Annex 7-A: Town of Clifton

November 2022

Town of Clifton

IEM

Town of Clifton Overview

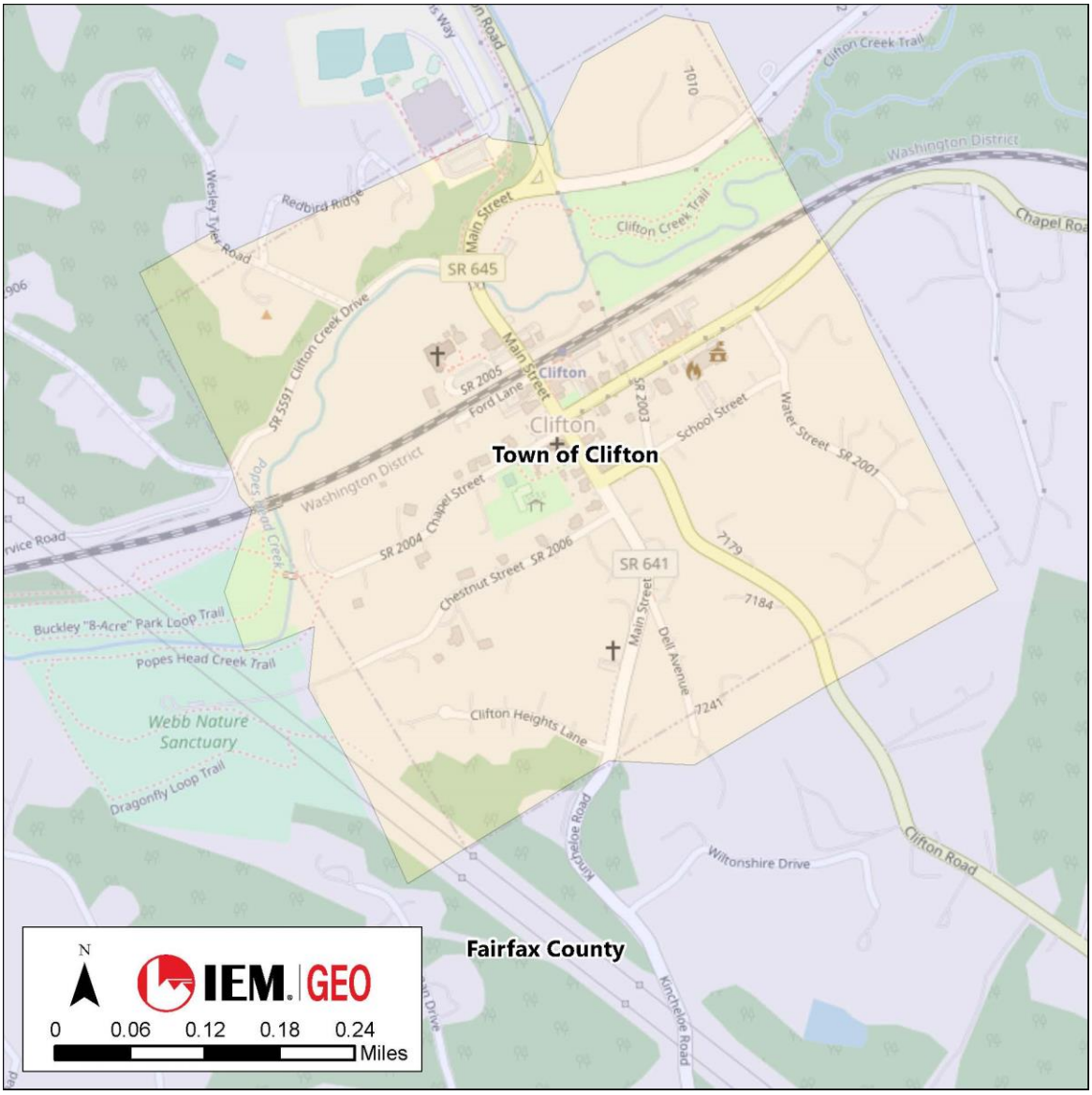

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1902	0.25 sq. mi.	243	P.O. Box 309, Clinton, VA 201124	+/- 90	High Wind/Severe Storms and Winter Weather

Town of Clifton Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

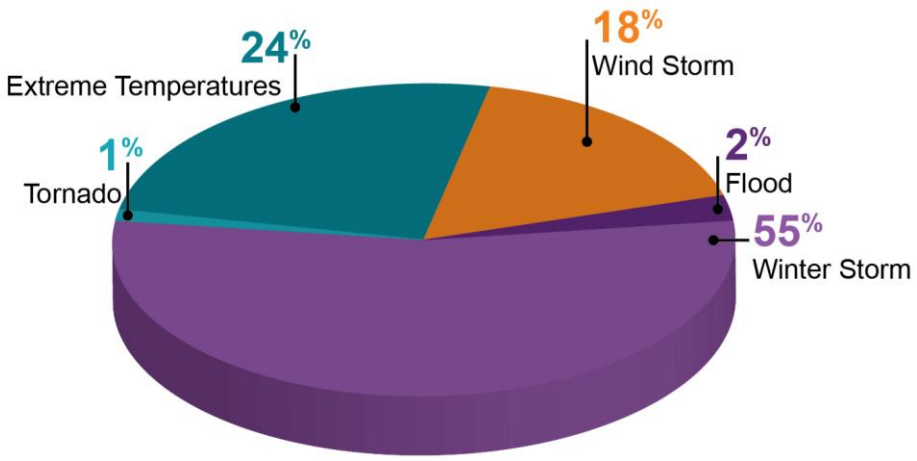

Figure 1: Percentage of Hazards

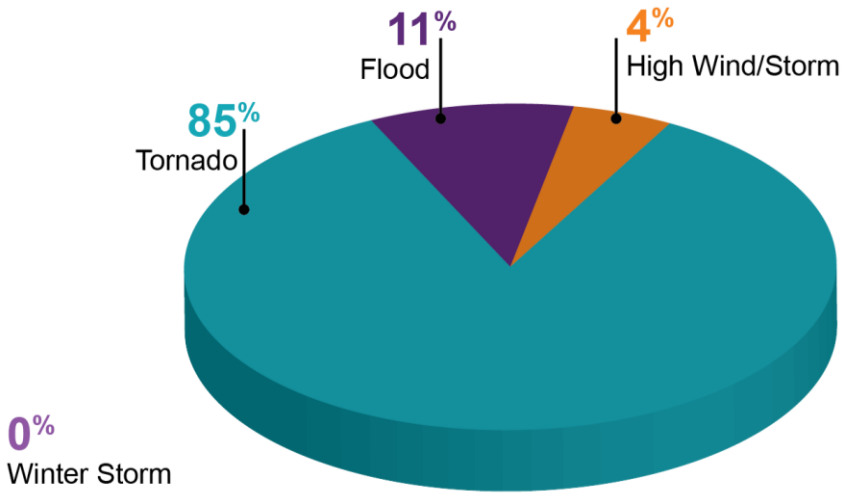

Figure 2: Property Damage Percentages from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Ranking of Natural Hazards by Risk

Hazard	Hazard Ranking
Winter Weather	**High**
Flood	**High**
High Wind/Severe Storm	**High**
Dam Failure	**High**
Tornado	**Medium**
Drought	**Medium**
Extreme Temperatures	**Medium**
Earthquake	**Medium**
Wildfire	**Low**
Sinkhole/Karst	**Low**
Landslide	**Low**

Community Lifelines/Critical Assets and Mitigation Capabilities

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	1
Food, Water, Shelter	-
Health and Medical	-
Energy	2
Communications	-
Transportation	-
Hazardous Materials	-
Education	2
Cultural/ Historical	District
High Hazard Dams	-

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for Town of Clifton

Capability	Ranking
Planning and Regulatory	Moderate
Administrative and Technical	Low
Safe Growth	Low
Financial	Low
Education and Outreach	Moderate

Hazard Mitigation Plan Point of Contact

Table 5: Point of Contact Information

Contact Type	Contact Information
Point of Contact	Lynn Screen Councilmember lscreen@cliftonva.gov

Town of Clifton

This annex presents the following jurisdiction-specific information provided by the Town of Clifton for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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List of Figures

1. Jurisdiction Profile

Established	1902
Total Land Area	0.25 sq. mi
Geographic Region	Piedmont/Coastal Plain
Persons Per Household	2.55
Persons Per Square Mile	
Median Age	54.2
Elevations	197 feet

1.1. Location

Located in the southwest of Fairfax County, the Town of Clifton is surrounded by unincorporated county land.

1.2. History

The area now occupied by the Town of Clifton was first settled by Europeans in the early 1700s. The Town, originally known as Devereux Station, arose with the advent of the railroad and developed as a direct result of the Civil War, when it was site where Union Army troops were stationed. The military railroad that served the troops was modernized after the war and incorporated as the Orange and Alexandria Railroad Company, aiding in the area's development. In 1868 the Town was named Clifton Station and in 1869, a post office was established. Incorporated in 1902, the Town became a retreat for wealthy residents from Washington, D.C., and was the site of hotels, hot springs, and commercial development. The small town of about 200 is also referred to as the "Brigadoon" of Virginia, and has been favored by U.S. presidents, first ladies, Supreme Court justices, congressmen, senators, and other Washington notables. The Town's population grew moderately in the decades between 1970 and 2010 and has since declined slightly.

1.3. Demographics, Economy, and Governance

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context to the entire plan.

Table 6: Population and Growth Rate

Year	Population	Population Change
1980	170	
1990	176	3.5%
2000	185	5.1%
2010	282	52.4%
2020	243	-13.8%

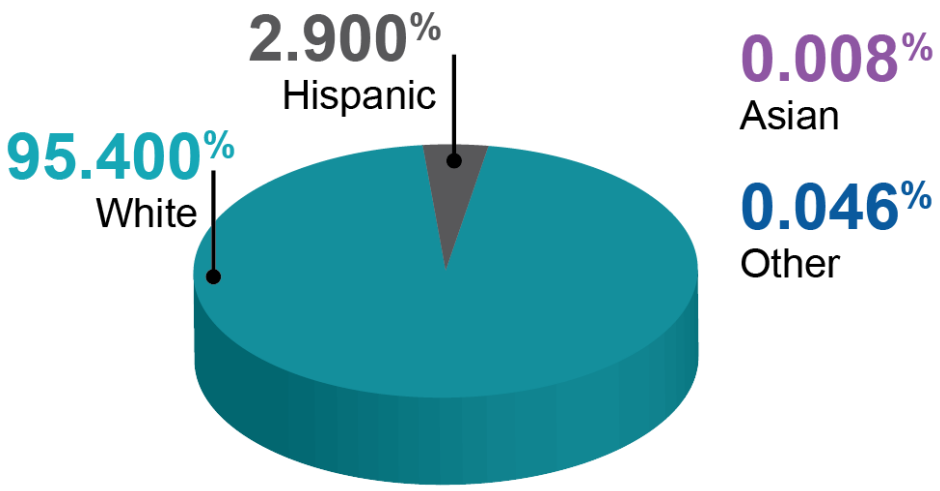

Figure 4: Race and Ethnicity Demographics*

*Due to how people view Race and Ethnicity and answer the questions in the Census, there is overlapping of responses and results equal greater than 100% of the population.

Table 7: Economic Data

Economy	Data
Median Household Income (2020)	$182,500
Unemployment Rate (September 2021)	2.9%
Per Capital Income (2019)	$84,373
Percentage Below Poverty (2019)	0.5%

The Town's governing body consists of a mayor and five council members, one of whom serves as vice mayor. Approximately 99% of the Town residents speak English as their main language; 1.15% speak other languages, predominantly Spanish.

1.4. Built Environment and Community Lifelines

The information presented in this section related to Community Lifelines and Critical Assets in the Town of Clifton has been collected from multiple sources, including Hazus (Version 4.2) and government websites. Critical facility data extracted from the Hazus Level 1 assessment indicates that the Town has approximately five critical and historic assets. Due to the time lag in collecting and verifying data, as well as the method of documenting location and jurisdiction used in Hazus, this may not reflect the current inventory maintained by the Town.

Table 8: Number of Assets per Community Lifeline/Sector[1]

Lifeline/Sector	Number of Assets
Safety and Security	1
Food, Water, Shelter	-
Health and Medical	-
Energy	2
Communications	-
Transportation	-
Hazardous Materials	-
Education	2
Cultural/Historical	District
High Hazard Dams	-

1.4.1. Safety and Security

Fairfax County owns and operates the one fire station that serves the Town of Clifton.

1.4.2. Food, Water, Shelter

Food commodities are available throughout the Town from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

All Town residences maintain individual wells and a majority of them connect to the Town sewage line; some maintain their own septic systems.

The Hazus database does not identify schools that might be used as public shelters.

1.4.3. Health and Medical

The Town of Clifton is served by healthcare and medical facilities offering patient care, urgent care, emergency rooms, and other healthcare services located in Fairfax County.

1.4.4. Energy

Town residences maintain their own propane/natural gas tanks for fuel.

1.4.5. Communications

The Hazus database does not identify Town-level communication/broadcast facilities.

Most communications and information systems and infrastructure in the United States are privately owned; however, Fairfax County maintains authority and control over public safety communications for fire, police, and other responding agencies for the Town of Clifton. In recent years, the federal

[1] Source: Fairfax County, Hazus-MH

government has taken a stronger role in protecting information and communications infrastructure, which may also present a challenge in relation to disaster impacts. Increasing reliance on this infrastructure by individuals, businesses, and government may result in vulnerabilities; emergency managers should take such possibilities into consideration during pre- and post-incident planning and operations.

1.4.6. Transportation

The Town of Clifton is served by the following major highways:

- State Routes 641 and 645

One a railroad runs through the Town.

The maintenance of transportation facilities and systems is the responsibility of the owner or entity with authority, such as municipal, county, state, and federal highway departments or agencies; toll and rail authorities; and the military. The Virginia Department of Transportation (VDOT) maintains most primary and secondary roads in Fairfax County.

The Hazus database identifies no transportation assets for the Town of Clifton.

1.4.7. Hazardous Materials

The Hazus database identifies one oil refinery, one natural gas facility, and thirteen natural gas pipeline locations within Fairfax County; however, these are not identified at the Town level.

1.4.8. Education

The Town has a private preschool at the Presbyterian church. There is one vacant educational facility in Clifton but outside the Town's jurisdiction.

1.4.9. Recreational, Cultural and Historic Sites, and Assets

The Town of Clifton maintains the community's park system to provide recreational facilities and services and support the preservation of environmentally sensitive land and resources and areas of historic and cultural significance.

The Town of Clifton was declared a national historic district by the U.S. Department of the Interior in 1985 and it maintains a historic preservation program that identifies and designates historic sites and structures. The Architectural Review Board administers the provisions of the Clifton Historic Overlay District and provides guidance to property owners on appropriate measures for preserving and protecting historic properties and buildings. In addition, the Board has approval authority for any repairs or construction to historic buildings through the Certificate of Appropriateness application and review process. These sites are assets that provide significant context to the Town's development over time and contribute to the community's tourism economy.

1.5. Growth and Development Trends

The Town's population grew moderately between the 1970s and 2010, and it has declined slightly since then. Future growth and development are limited in the Town due to its small size and historic designation.

The 2009 Comprehensive/Master Plan was in the process of being updated during this planning cycle, but it will be reviewed for the next update to determine whether any impacts have occurred in relation to development.

The Town controls the land use policies and practices within its jurisdiction and will continue to be a planning partner with the County as well as regional entities to identify hazard mitigation opportunities related to growth and development.

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the Town of Clifton followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Team, the Town supported the local planning process requirements by coordinating with Fairfax County and representatives from other Town departments and agencies.

Table 9: Local Planning Group Participants

Name	Position/Title	Department/Agency
Greg Zebrowski	Assistant Coordinator of Planning and Policy Analysis	Fairfax County Department of Emergency Management and Security

The jurisdiction identified its chief hazard mitigation planning responsibility as representing the Town, in coordination with the Fairfax County representative, to the Emergency Managers Group. The Town also identified the following tasks as elements of its mitigation planning responsibilities:

- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Public outreach activities
- Implement the Plan
- Maintain the Plan

The Town of Clifton planning participants coordinated primarily by means of virtual meetings with Fairfax County during the planning process, and, as needed, independently to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A.**

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a Public Hazard Survey, which was posted and advertised on the Fairfax County website. The survey was

opened on August 8th, 2021, and closed on November 3rd, 2021, with over 1,000 responses coming in over that period of time. The Town of Clifton had a few responses from those that work in the town but do not live there.

There were two questions that got almost the same answer from everyone that took the survey, and those responses identified the natural hazard of climate change and the non-natural hazard of the pandemic to be the most concerning hazards for those who resided in the Northern Virginia Area.

In addition to the survey, the public was offered the opportunity to review and provide input to the Draft 2022 Plan update. Notification of the Draft Plan release was made through the same County web link. Documentation of the public survey and draft plan review is included in **Attachment 2 of Annex 7, Fairfax County**.

3. Jurisdiction-Specific Hazard Event History

The Town of Clifton's comprehensive hazard history is combined with Fairfax County's, and described in **Sections 4 and 5, Base Plan**.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,478 recorded natural meteorological events that took place in Fairfax County between January 1, 1950, and May 2021. The County and its municipalities have been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 10: Federal Disaster and Emergency Declarations (2017–2021), Fairfax County[2]

Declaration	Date	Hazard	Assistance Type
DR-4512-VA	4/2/2020 (continuing)	COVID-19 Pandemic	Individual Assistance, Public Assistance
EM-3448-VA	3/13/2020 (continuing)	COVID-19 Pandemic	Public Assistance (Category B)
EM-3403-VA	9/11/2018	Hurricane Florence	Public Assistance (Category B)

The Town of Clifton Planning Team highlighted winter weather, high wind/severe thunderstorms, and floods as significant hazards that have occurred since the 2017 plan. Data related to these hazard events is included in **Annex 7, Fairfax County**.

[2] Source: FEMA

4. Hazard Risk Ranking

After developing hazard profiles, the Town of Clifton conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step Hazard Risk Ranking methodology is detailed in **Section 4, Base Plan**.

The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5, Base Plan**, and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II** of this Plan.

Table 11: Town of Clifton - Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.7	3.5	7.2	**High**
Flood	1.7	4.2	5.9	**High**
High Wind/Severe Storm	2.7	3.2	5.9	**High**
Dam Failure	1.0	4.5	5.5	**High**
Tornado	1.3	4.2	5.5	**Medium**
Drought	2.0	3.2	5.2	**Medium**
Extreme Temperatures	2.7	2.5	5.2	**Medium**
Earthquake	1.7	3.2	4.9	**Medium**
Wildfire	1.0	3.0	4.0	**Low**
Sinkhole/Karst	1.0	2.5	3.5	**Low**
Landslide	1.0	2.5	3.5	**Low**

Table 12: Town of Clifton - Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	3.0	5.8	8.8	**High**
Terrorism	1.0	6.4	7.4	**High**
Cyber Attack	2.0	4.7	6.7	**High**
Civil Unrest	1.3	5.0	6.3	**Medium**
Communication Disruption	1.3	3.7	5.0	**Medium**
Hazardous Materials	1.0	3.9	4.9	**Low**
Active Violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, the Town of Clifton evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high- or medium-risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter Weather, Flood/Flash Flood, High Wind/Severe Storm, and Dam Failure
- **Medium:** Tornado, Drought, Extreme Temperatures, and Earthquake

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, and Cyber Attack
- **Medium:** Civil Unrest, and Communication Disruption

All other hazards are ranked as “low,” signifying a minimal risk to the Town of Clifton. Other hazard information for the Town of Clifton is presented in the **Base Plan**.

4.1. Additional Hazard Risk Considerations

Volume II of the *2022 Northern Virginia Hazard Mitigation Plan* addresses non-natural hazards identified by the jurisdiction.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

Annex 7, Fairfax County includes a statistical compilation of the number of events and related impacts for the two highest-ranked hazards for the Town of Clifton: winter weather and high wind/severe storm events.

5.1. National Flood Insurance Program

The Town of Clifton is a participant in the National Flood Insurance Program (NFIP).

Table 13: Town of Clifton National Flood Insurance Program Status[3]

Community Number	510186
Initial FHBM Identified	3/28/1975
Initial FIRM Identified	5/2/1977
Current Eff Map Date	9/17/2010
Reg-Emer Date	5/2/1977

Table 14: Town of Clifton NFIP Policy and Claims Statistics[4]

Policies In Force	8
Premiums Paid	$8,176
Total Claims	3
Total Payment	$48,969

[3] FEMA NFIP Community Status Report, September 9, 2021
[4] FEMA NFIP Community Status Report, September 9, 2021

Table 15: NFIP Status, as of NFIP

Category	NFIP Topic	Source of Information	Comments
Insurance	How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Policies: 5 Premium: $5,837 Coverage: $2,550,000
Insurance	How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	EMA NFIP or Insurance Specialist	Claims paid: 3 Total amount: $48,969 Substantial damage claims: 0
Insurance	How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA)	Unknown
Insurance	Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	This information is not available. Information from the State NFIP Coordinator or the FEMA Insurance Specialist must be compared against those properties within a floodplain that lack any NFIP policy coverage.
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	The Community FPA is a Professional Engineer licensed in the Commonwealth of Virginia. The FPA is not a Certified Floodplain Manager.
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	Yes, floodplain management in the Town is managed with overlay districts within the Town's zoning ordinance.

Category	NFIP Topic	Source of Information	Comments
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	The Town provides the following NFIP administration services: * Administers permit requirements for all improvements within the floodplain; * Performs engineering technical review of all required aspects of floodplain applications; * Interprets mapping using GIS provided by state agencies.
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	Funding for a dedicated CFM position and a GIS staff position.
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Compliance History	Are there any outstanding compliance issues (i.e., current violations)?		No
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		Unknown

5.2. Population

Estimates of the number of residents in the Town of Clifton vulnerable to each hazard are presented in the various hazard sections in the **Base Plan**.

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations.

The Overall CDC SVI for Fairfax County, including the Town of Clifton is presented in **Annex 7, Fairfax County**.

5.3. Built Environment and Community Lifelines and Assets

Using the best Hazus data available, scenarios were run at the county level for earthquake, flood, and hurricane wind to determine potential exposure of buildings, infrastructure, and the economy. Due to the size of Clifton, information from Hazus is not specific to the Town, information presented in **Annex 7, Fairfax County** includes the Town of Clifton.

Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events.[5] The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA.

Based on 100- and 500-year flood scenarios using Hazus, there are no critical facilities in the floodplain within the Town of Clifton.

5.4. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

5.5. Economy

Information related to economic vulnerability are presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets and presented in **Annex 7, Fairfax County**.

5.6. Cultural/Historical

Information related to the vulnerability of cultural and historical assets are presented in the hazard-specific sections of the **Base Plan**.

Historic structures and sites are frequently more vulnerable to flood hazards because, historically, cities and towns have tended to develop along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile assets.

The Town of Clifton Overlay District serves to identify and protect its significant historical and cultural landmarks. The Architectural Review Board oversees the provisions of the Overlay District through the Certificate of Appropriateness process and grants approval of applications for any plans for construction, repair, alteration, or modification of buildings and structures in the Town. The historic designation assists in ensuring that appropriate measures are applied in post-disaster impact conditions to protect cultural and historical assets from inappropriate repair, demolition, or redevelopment.

[5] Although Fairfax County maintains a separate critical facilities inventory, information used in this analysis is extracted from the Hazus critical facilities database to maintain consistency with other jurisdictions.

6. Capability Assessment

The Town of Clifton reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

6.1. Capabilities Assessment Summary, Ranking, and Gap Analysis

The Town ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction has limited capabilities within this category and is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities within this category and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities within this category, but improvement is needed in order to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities within this category as demonstrated by its authorities, programs, plans and/or resources, and can implement most mitigation actions.

Table 16: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	Moderate
Administrative and Technical	Low
Safe Growth	Low
Financial	Low
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary

The Town utilizes the all-hazards approach when developing any jurisdictional plans, including emergency operations, continuity of operations, and hazard-specific plans, as well as the Hazard Mitigation Plan.

The following plans have been newly developed or updated since the 2017 HMP:

- Town of Clifton Comprehensive Plan, update in progress as of October 2021
- Fairfax County Community-Wide Energy and Climate Action Plan (CECAP)
- Fairfax County Pre-Disaster Recovery Plan, dated April 2020
- Chesapeake Bay Ordinance (includes erosion control)
- The Town is carrying out a comprehensive streetscape project.
- The Communications Committee and Arts Council and Historical Preservation Society are the Committees responsible for promoting Clifton.[6]
- The Town is currently working with FEMA to update flood maps.

Capability Analysis: Moderate

The Town of Clifton depends on Fairfax County for most plans and regulations that link to emergency response, recovery, and hazard mitigation. At the time of this update, the Town's Comprehensive/Master Plan, dated 2009, was being updated and it was noted that, although climate change was addressed in the former plan, this would allow the opportunity to include all hazards and projects. In addition, the capability assessment confirmed that projects or actions can be incorporated into the Capital Improvement Plan, as needed. The Town maintains a Floodplain Ordinance that addresses stormwater management. Most zoning ordinances are enforced through the County and Town partnership. The Town notes the following areas for improvement:

- Improved relationship with the County for operations support; volunteer government can make things challenging.
- Support of VDOT is crucial to complete work and accomplish tasks and goals.
- Need to increase comprehensive planning and develop solid relationships with the VDOT.
- Need to develop comprehensive plans that can work toward a shared vision, address the issues and challenges, and resolve them.

[6] http://www.clifton-va.com/committees/

- Obtain assistance in procuring grants for mitigation through the County, to provide funding and support to help them complete projects; find grant opportunities they may not know they qualify for.

6.1.2. Administrative and Technical Capabilities Summary

- The Town currently has an engineer or professional trained in construction practices related to buildings and infrastructure; however, Planning Commission and committee members are volunteers.
- The Town depends on Fairfax County for planners and engineers with an understanding of natural and/or manmade hazards.
- The Town Clerk may assist with grant writing, but this is not defined as a specific job duty.
- There are no personnel for emergency management, GIS, or education related to the community's vulnerability to hazards.
- The Town coordinates with the County for use of Everbridge as an emergency warning system for internal and external notification and warning.

The Town identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and implementation of the plan:

- Fairfax County Department of Emergency Management and Security
- Fairfax County Floodplain Administrator

Capability Analysis: Low

The Town of Clifton has a limited staffing capability to identify, develop, and implement mitigation actions; the Town is dependent on Fairfax County for many Town services. The Town notes the following areas for improvement:

- Need an enhanced outdoor warning system
- Need better emergency communication among police and fire departments
- Need a tracking system for low-lying and flood-prone roads and properties in order to better prepare responders and public works personnel for flash flood events.
- Need improved relationship with the County for warning and operations support

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6.1.3. Safe Growth Capabilities Summary

- Growth guidance instruments include environmental policies that maintain and restore protective ecosystems; however, they do not currently provide incentives to development that is located outside of protective ecosystems.
- The Capital Improvement Program currently does not provide funding for hazard mitigation projects identified in the NOVA HMP.

Capability Analysis: Low

The Town of Clifton has limited safe growth regulatory and enforcement capabilities to prevent or limit inappropriate development in identified hazard areas and protect the natural environment; it is largely dependent on Fairfax County to carry these out.

6.1.4. Financial Capabilities Summary

- Current capital improvement projects address maintenance of buildings, infrastructure, historic railroad car, gazebo, green space, lights, and sewer transfer to the County.
- The Town has the authority to levy taxes for specific purposes, such as a meal tax, but this not yet being used.
- The Town does not impose impact fees for new development.
- The Town does not participate in the Community Development Block Grant program, but it does participate in other federal and state funding programs, such as the current COVID relief.

Capability Analysis: Low

The Town of Clifton has identified the following methods of for improving financial capabilities:

- Look into different grants to support funding for the Town.
- Utilize COVID funding.
- Leverage relationship with VDOT to help with traffic issues and establish the Town as a small village that discourages speeding.
- Increase walkability and traffic safety through funding. Look at various funding sources that can increase walkability and safer traffic flow.
- Determine whether VDOT can support the Town being removed from Google Maps and other GPS maps so it can be more secluded and not just a “pass-through.”

6.1.5. Education and Outreach Capabilities Summary

- Town of Clifton’s historical preservation groups and historical society are proactive in educating about the importance and protection of cultural and historical assets.
- Fairfax County is designated as a Storm Ready community, which includes the Town in components of public education and training.
- The Town is partnered with Fairfax County and local schools to participate in the Student Tools for Emergency Planning (STEP) program curriculum, which includes fifth-grade students packing emergency preparedness bags.

Community Rating System initiatives within the NFIP program can increase public awareness of and involvement in hazard mitigation.

Capability Analysis: Moderate

Jurisdictions have multiple opportunities to promote hazard mitigation and increase the involvement of stakeholders and the public. There is a critical need to inform additional stakeholders and the public about the benefits of hazard mitigation planning and implementation. The Town relies significantly on Fairfax County to implement education and outreach related to hazard mitigation. Virginia Department of

Emergency Management mitigation staff can also provide technical assistance to support increased jurisdictional involvement. Many hazard mitigation education tools and materials are available from state agencies, as well as from disaster preparedness and response organizations such as the American Red Cross, FEMA, and faith-based organizations with disaster response missions. The Town noted the following areas for improvement in relation to education and outreach:

- Partner with Fairfax County for more education opportunities; work with residents to increase educational opportunities.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, the Town of Clifton identified activities related to each natural hazard that support risk reduction.

Table 17: Summary – Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and international building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	• Public education and operational plans address preparedness and response to reduce risk.
Flood/Flash Flood	• Floodplain administration and regulations prohibit inappropriate activities and future development in the floodplain. • Stormwater management program and projects address flood prevention and risk reduction.
High Wind/Severe Storm	• State and international building codes provide wind-load design regulation.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Severe Winter Weather	• Public education and operational plans address preparedness and response to reduce risk.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Non-Natural Hazards	• Public education and operational plans address preparedness and response to reduce risk. • Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.

Hazard	Activity
Climate Change	• Ongoing resilience planning and utilizing the Community-wide Energy and Climate Action Plan will allow for identification and mitigation of climate change-related issues in future planning cycles.

7. Resilience to Hazards

7.1. National Risk Index

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of "low risk" is defined by lower loss due to natural hazards, lower social vulnerability, and higher community resilience. The NRI is a dataset and online tool developed by FEMA and other partners to help illustrate communities in the United States at risk for 18 natural hazards. Hazard risk is calculated based on data for a single hazard type and reflects the relative risk for that hazard type; it should be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local Hazard Risk Ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently from the hazards in this plan so a direct hazard-to-hazard comparison of risk cannot be determined. The NRI is a county-level risk ranking, which includes the Town and is presented in **Annex 7, Fairfax County, Section 7.4**.

7.2. Community Resilience Estimates

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household level risk factors.

The index produces aggregate-level (Census tract, county, and state) small area estimates that help determine how at-risk specific neighborhoods might be to disasters due to characteristics that may make specific segments of the population more vulnerable to the impacts and consequences of disasters. The 10 risk factors[7] include the following:

1. Income-to-poverty ratio
2. Single or zero caregiver household
3. Unit-level crowding
4. Communication barrier
5. Aged 65 years or older
6. Lack of full-time or year-round employment (household)
7. Disability
8. No health insurance coverage
9. No vehicle access (household)

[7] The Community Resilience Estimates are developed by the U.S. Census Bureau; initial release date, August 10, 2021. Methodology is described at the U.S. Census Bureau Community Resilience Methodology page (https://www.census.gov/programs-surveys/community-resilience-estimates/technical-documentation/methodology.html).

10. No broadband internet access (household)

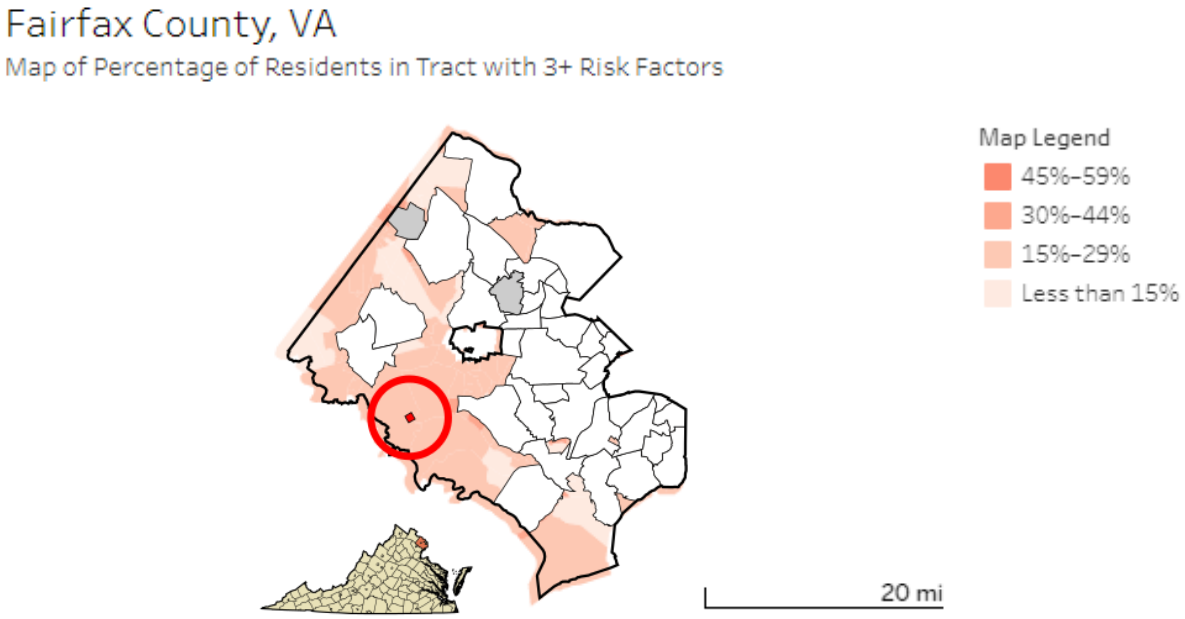

Figure 5: Community Resilience Estimate[8]

The estimate is categorized into three groups: zero risks, one or two risks, and three or more risks. The CRE for Fairfax County is 14.72 percent, meaning that 167,857 of county residents have three or more risk factors.

The combination of data and analysis described in this section provides a comprehensive representation of Fairfax County's risk, vulnerability, and resilience to all hazards.

7.3. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

The Town of Clifton Planning Team identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- The risk of cyber-related incidents on critical infrastructure and key resource sites.
- Impacts of climate change.
- Increases in the number of excessive rainfall events that impact new areas with flooding.

[8] Community Resilience Estimates, U.S. Census Bureau

8. Mitigation Actions

8.1. Goals and Objectives

The Town of Clifton Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

The Town of Clifton did not submit mitigation actions in the 2017 NOVA HMP, so it did not perform a review of previous actions. The Town will initiate the action implementation process to monitor and track progress through the periodic review and evaluation of the plan in the next planning cycle and updated NOVA HMP. Some risk-reduction projects that have been completed or are currently in progress may not have been included in this update for one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and resulting risk reduction.

8.3. New Mitigation Actions

The Town of Clifton Planning Team identified four new mitigation actions to include in this plan. Proposed actions address risks consistent with the jurisdiction's highest risk hazards (i.e., flood/flash flood and winter weather) as well as actions that address hazard mitigation education programs for all hazards.

8.4. Action Plan for Implementation and Integration

The Town of Clifton submitted four (4) new actions that will be implemented in the upcoming planning cycle. Town Council in collaboration with the Planning Committee is responsible for coordinating the implementation of the hazard mitigation activities. The designated Mitigation Coordinator will monitor the implementation of the jurisdiction's actions and participate in the implementation of the multi-jurisdictional regional plan as it relates to the Town of Clifton. Tasks to ensure that the Town's actions are implemented are integrated into the *Action Plan for Implementation and Integration* (which includes the prioritized list of Mitigation Actions) as well as plan maintenance procedures described in the next section. The *Action Plan for Implementation and Integration* describes how the Town's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 18: Action Plan for Implementation and Integration, Town of Clifton

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into the local comprehensive plan.	When it is updated, the Town will include local safety and environmental concerns, including mitigation actions as applicable.
Review/update land development regulations for consistency with mitigation goals.	Continue coordination with Fairfax County Department of Planning and Development regarding future land use projects. Potential area of focus is Chesapeake Bay Watershed regulation, which keeps land division minimal and preserves water source.

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Review/update building/zoning codes for consistency with mitigation goals.	Work with Zoning Administrator regarding town zoning ordinances and consistency with mitigation goals.
Maintain regulatory requirements of floodplain management program (NFIP).	Support the Fairfax County Public Works and Environmental Services responsible for floodplain management.
Continue public engagement in mitigation planning.	Continue to promote awareness of hazards and incorporate public feedback into planning processes and seek resident feedback supporting mitigation. Achieve a better understanding of population demographics and concerns.
Identify opportunities for mitigation education and outreach.	Identify opportunities for collaboration with Fairfax County to conduct community outreach to promote awareness of the importance of mitigation projects.
Review/update stormwater plans and procedures for consistency with mitigation goals.	County will address this at their level with Town input.
Review/update emergency plans to address evacuation and sheltering.	County will address this at their level with Town input.
Maintain ongoing enforcement of existing policies.	Continue coordination with the County on applicable enforcement policies.
Monitor funding opportunities.	Work with Fairfax County to collaborate on mitigation opportunities by sharing mitigation funding or project availability and by attending countywide mitigation meetings.
Incorporate goals and objectives into day-to-day government functions.	The Town will strive to incorporate the concept of mitigation into day-to-day government functions, including continual monitoring of the action items identified in the 2022 update. The plan will be used to better understand the community and its needs and desires. The plan will be a working plan, not a stagnant plan.
Incorporate goals into day-to-day development policies, reviews, and priorities.	Work with the Planning Commission, Architecture Review Board, and Committee on Environment to incorporate mitigation into day-to-day activities.
Other	Participate in the Great ShakeOut annual drill, tornado drills, and other similar programs as applicable and able.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 19: Town of Clifton Plan Maintenance Responsibilities for the Northern Virginia Hazard Mitigation Plan, Base Plan

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to Fairfax NOVA Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the /NOVA Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update processes. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP, Base Plan**, the Town of Clifton Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**. The Town's maintenance method and schedule may coincide with that of Fairfax County and be conducted simultaneously.

9.2.1. Plan Maintenance Schedule

- **Monitor:** annually and/or following major disaster(s)
- **Evaluate:** annually and/or following major disaster(s)
- **Update:** annual tasks over the five-year planning cycle; planning process in fifth year

Table 20: Town of Clifton Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with jurisdiction planning team. 2. Review the status of all mitigation actions, using the *Mitigation Action Implementation Worksheet* (**Section 3, Attachment A, NOVA HMP Base Plan**).	• Produce an annual report that includes the following: ▪ Status update of all mitigation actions ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities ▪ Summary of activities conducted for the *Action Plan for Implementation and Integration*
Evaluating the Annex	1. Schedule the annual plan evaluation with the jurisdiction planning team. 2. Evaluate the current hazard risks, vulnerabilities, and mitigation capabilities using the *Planning Considerations Worksheet*, (**Section 3, Attachment C, NOVA HMP Base Plan**).	• Submit the annual report to the /NOVA HMP Project Team Point of Contact
Updating the Annex	1. Coordinate with Fairfax County and the Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

Mitigation actions presented in this Jurisdiction Annex may be reviewed, revised, and updated at any time.

The Town of Clifton will continue to be a planning partner with multiple jurisdictions and regional entities, including Fairfax County, to identify hazard mitigation opportunities that reduce the risk of the hazards identified in this plan.

10. Annex Adoption

The Town of Clifton Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation Plan.*

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this Jurisdiction]

11.2. Attachment 2: Documentation of Public Participation

Public Hazard Survey – Screenshot of the Survey Promotion

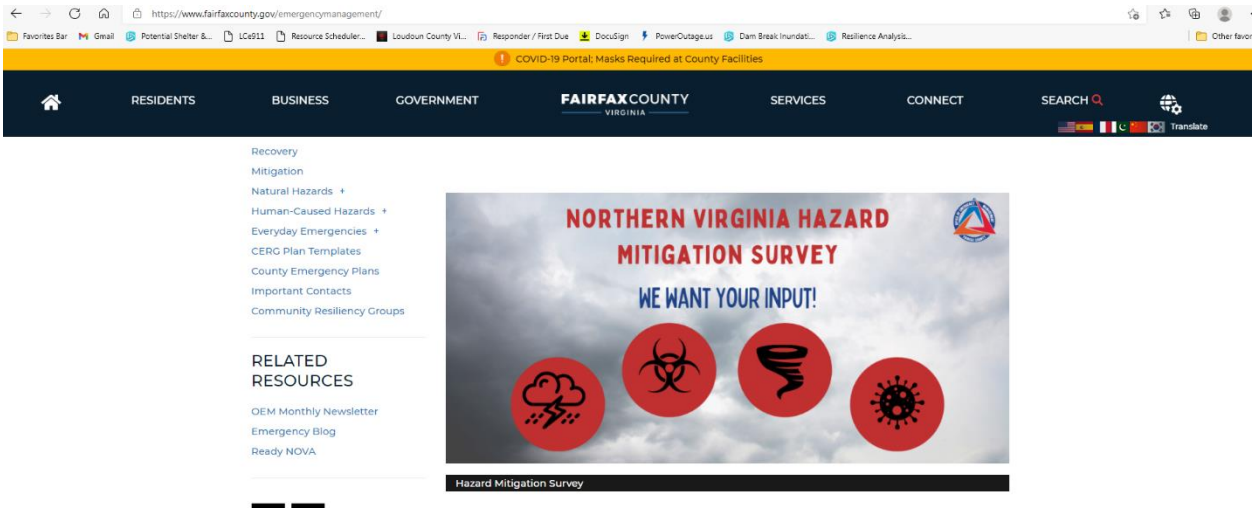

Figure 6: Fairfax County OEM Webpage

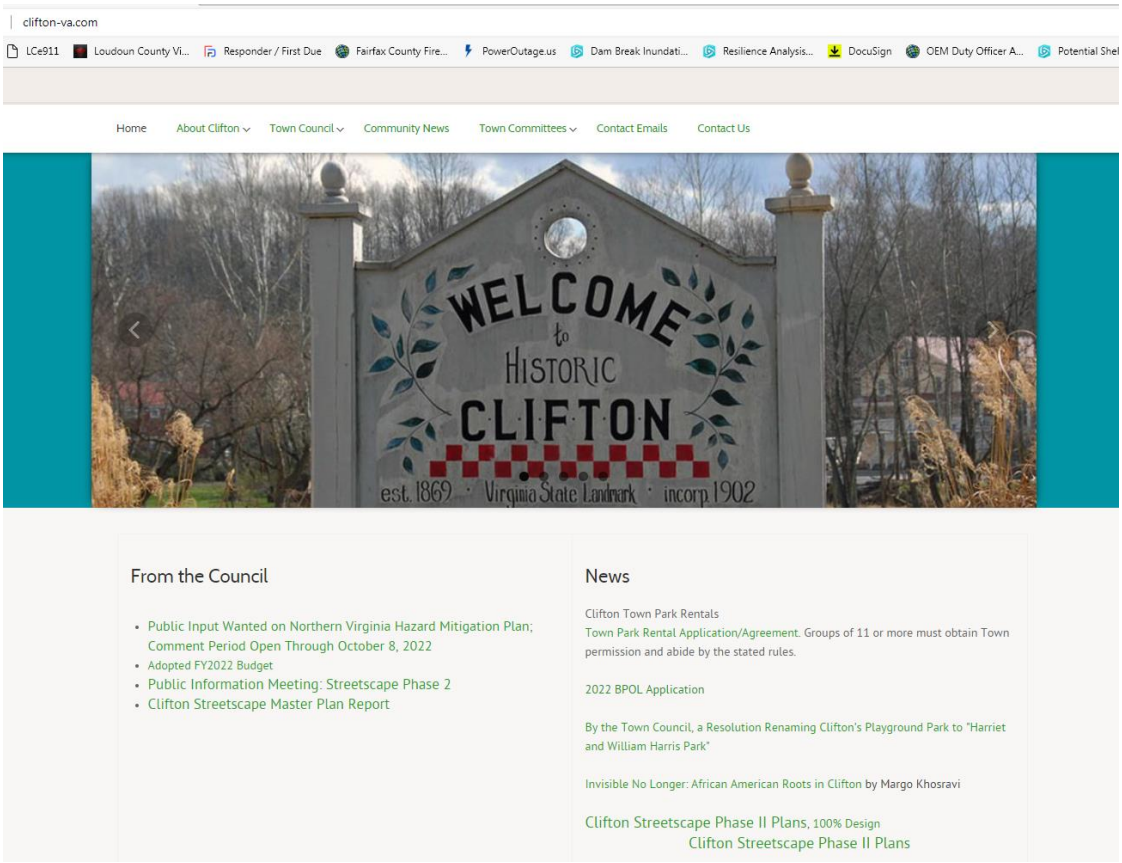

Figure 7: Final Draft Public Comment Announcement

11.3. Attachment 3: Mitigation Actions

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard(s)	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-1	Work with FEMA to re-examine flood zones and update FIRMS. Use this information to reevaluate NFIP activities.	Town personnel or volunteers and Fairfax County Department of Planning and Development	• Flood	FEMA Unified Hazard Mitigation Assistance Funding, Fairfax County or Town funds	Ongoing	Multi-year project; meet FEMA deadlines throughout the project.	Medium	Use this information to reevaluate NFIP activities.
2022-2	Continue to implement building and development standards as required under the NFIP.	Town personnel or volunteers and Fairfax County Department of Planning and Development	• All Hazards	Hazard Mitigation Assistance grant funding, US Army Corps of Engineers, Fairfax County or Town funds, VDEM		Implement one new standard every year.	Medium	This task is ongoing as building and development standards are updated; these are reviewed and incorporated as appropriate. All new policies and procedures comply with the NFIP.

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard(s)	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-3	Develop an outreach/education program aimed at promoting hazard mitigation for the residents of and visitors to Clifton.	Town personnel or volunteers and Fairfax County Department of Emergency Management and Security	• All Hazards	Fairfax County or Town funds			High	This program will be completed when funding becomes available.
2022-4	Work with the Virginia Department of Transportation (VDOT) to expand and fortify the Town's bridge infrastructure to ensure evacuation capability and pedestrian safety.	Town personnel or volunteers	• Earthquake • Flood/Flash Flood • High Wind/ Severe Storm • Sinkhole/ Karst • Landslide • Tornado • Winter Weather • Wildfire	VDOT			High	

Northern Virginia Hazard Mitigation Plan

Annex 7-B: Town of Herndon

November 2022

Town of Herndon Overview

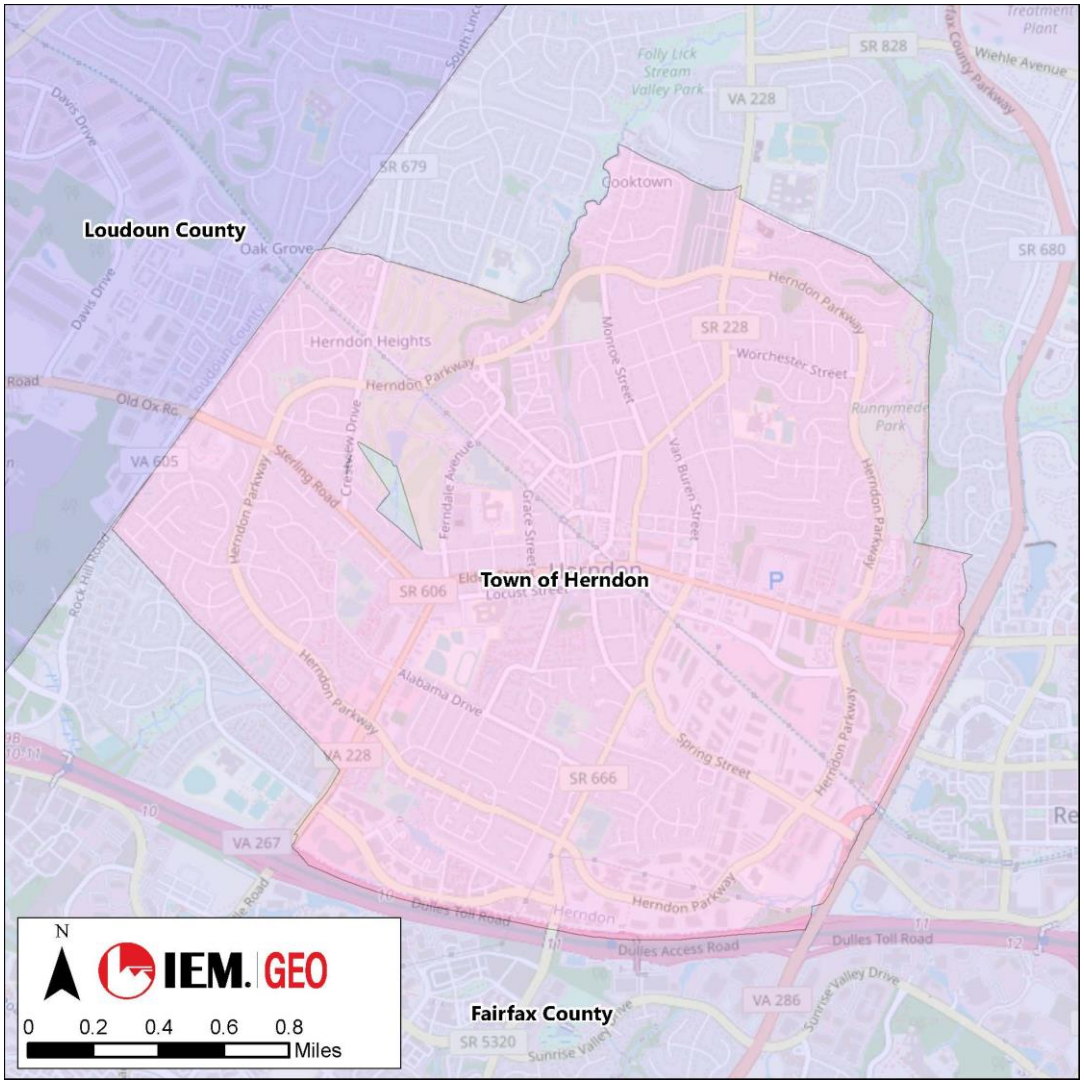

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1879	4.29 sq. mi.	24,367	777 Lynn Street, Herndon, VA 20170	7,920	Winter Weather, Flood/Flash Flood, High Wind/ Storm

Town of Herndon's Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

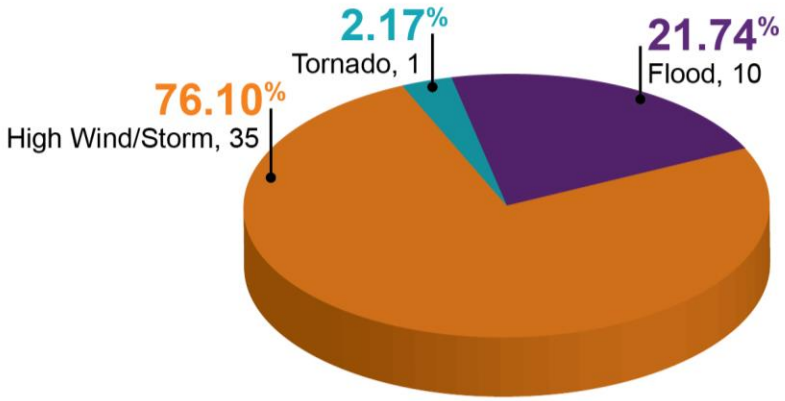

Figure 1: Number/Percentage of Hazard Events

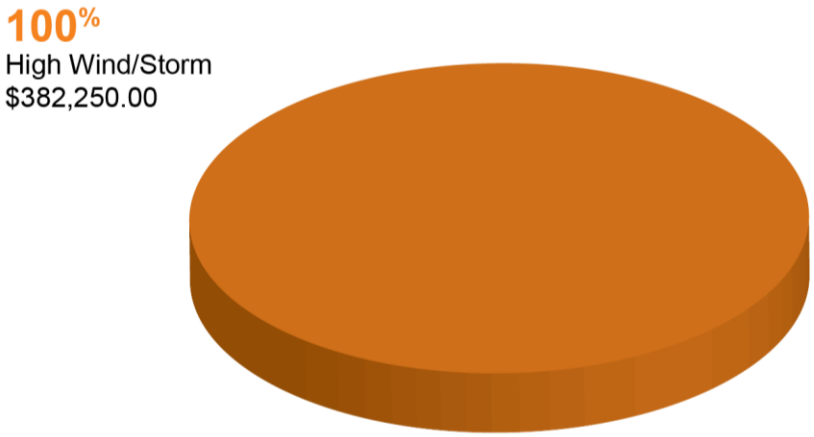

Figure 2: Property Damage Costs from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Ranking of Natural Hazards by Risk

Hazard	Hazard Ranking
Winter Weather	**High**
Flood/Flash flood	**High**
High Wind/Severe Storm	**High**
Dam Failure	**High**
Tornado	**Medium**
Drought	**Medium**
Extreme Temperatures	**Medium**
Earthquake	**Medium**
Wildfire	**Low**
Sinkhole/Karst/Land subsidence	**Low**
Landslide	**Low**

Community Lifelines/Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	6
Food, Water and Shelter	2
Health and Medical	-
Energy	2
Communications	-
Transportation	8 highway bridges
Hazardous Materials	-
Education	26
Cultural/Historical	District
High Hazard Dams	-

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking, Town of Herndon

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	Moderate
Safe Growth	High
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Point of Contact

Table 5: Point of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Mark Dale, Lieutenant Town of Herndon Police Department 571-455-5407 Mark.Dale@Herndon-va.gov 397 Herndon PW Herndon, VA 20170

Town of Herndon

This annex presents the following jurisdiction-specific information provided by the Town of Herndon for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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List of Tables

List of Figures

1. Jurisdiction Profile

Established	1879
Total Land Area	4.29 sq. mi.
Geographic Region	Piedmont/Coastal Plain
Persons Per Household	3.17
Persons Per Square Mile	5,220
Median Age	35.5
Elevations	361 feet

1.1. Location

Located in the northwest of Fairfax County. The Town of Herndon is bounded by Loudoun County on the west, the unincorporated areas of Dranesville on the north, Reston on the east, and Hunter Mill on the south. Herndon is part of the suburban ring of Washington, D.C.

1.2. History

Incorporated in 1879, the area on which the Town was built was originally granted to Thomas Culpeper by King Charles II of England in 1688. Much of the downtown was destroyed by a fire on March 22, 1917 but was rebuilt with brick instead of wood. Much of the early development was agricultural, but the building of the railroad in the 1850s encouraged more residential growth. The Town population grew significantly in the decades between 1970 and 2010.

1.3. Demographics, Economy, and Governance

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context to the entire plan. The 2020 U.S. Census population estimate for the Town of Herndon is 24,367, an approximate 4.6% increase since 2010. The Town is densely populated with 5,220 residents per square mile.

Table 6: Population and Growth Rate

Year	Population	Percent Increase over Previous Census
1970	4,301	-
1980	11,449	166.2%
1990	16,143	41%
2000	21,655	34.2%
2010	23,292	7.6%
2020	24,367	4.6%

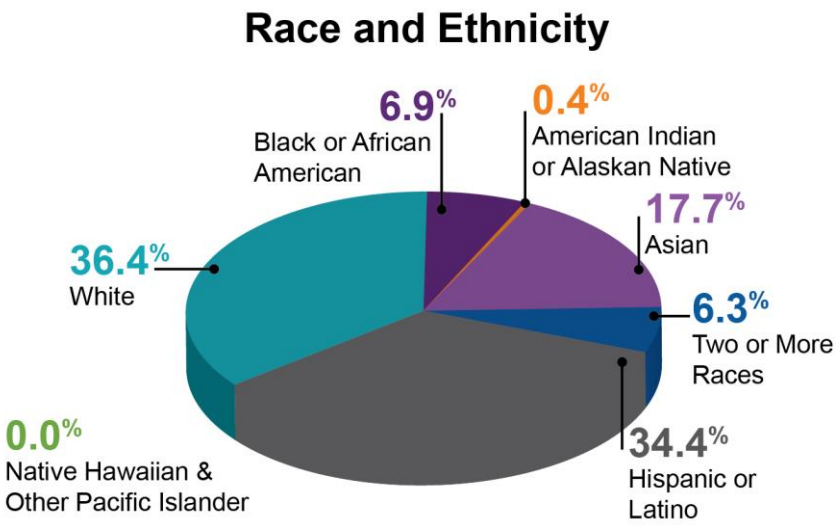

Figure 4: Race and Ethnicity Demographics from 2020 Census*

*Due to how people view Race and Ethnicity and answer the questions in the Census, there is overlapping of responses and results equal greater than 100% of the population.

Table 7: Economic Data

Economy	Data
Median Household Income (2019)	$111,371
Unemployment Rate (September 2021)	4.1%
Per Capita Income (2019)	$45,008
Percentage Below Poverty (2019)	6.3%

Approximately 44 percent of the town residents speak only English, while 56 percent speak other languages, predominantly Spanish.

1.4. Built Environment and Community Lifelines

The information related to Community Lifelines and critical assets in the Town of Herndon presented in this section has been collected from multiple sources, including Hazus (Version 4.2), and government websites. Data extracted from the Hazus Level 1 assessment indicates that the Town has an estimated 45 critical and historic assets. Due to the time lag in collecting and verifying data, and the method of documenting location and jurisdiction used in Hazus, this may not reflect the current inventory maintained by the Town of Herndon.

The Town of Herndon maintains a detailed list of community lifeline facilities, sites, and critical assets.

Table 8: Number of Assets per Community Lifeline/Sector[1]

Lifeline/Sector	Number of Assets
Safety and Security	6
Food, Water, Shelter	2
Health and Medical	-
Energy	2
Communications	-
Transportation	8 highway bridges
Hazardous Materials	-
Education	26
Cultural/Historical	District
High Hazard Dams	-

1.4.1. Safety and Security

One police station and four fire stations serve the Town. In addition, the Herndon Emergency Operations Center provides a multi-agency coordination center for all-hazard response.

1.4.2. Food, Water, Shelter

Food commodities are available throughout the Town from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

The Town of Herndon provides water and sewer services for its residents. Two potable water facilities are identified for the Town in the Hazus database.

The Hazus database does not identify schools that might be used as public shelters.

1.4.3. Health and Medical

The Hazus database does not identify health and medical facilities offering patient care, urgent care, emergency rooms, and other healthcare services in the Town of Herndon.

1.4.4. Energy

There are two utility companies that provide services to the Town of Herndon – Dominion Energy and Columbia Gas of Virginia.

1.4.5. Communications

The Hazus database does not identify town-level communication/broadcast facilities.

[1] Source: Fairfax County, Hazus-MH

Most communications and information systems and infrastructure in the United States are privately owned; however, Fairfax County maintains authority and control over public safety communications for fire, police, and other responding agencies for the Town of Herndon. In recent years, the federal government has taken a stronger role in protecting information and communications infrastructure, which may also present a challenge in relation to disaster impacts. Increasing reliance on this infrastructure by individuals, businesses, and government could cause vulnerabilities that emergency managers should take into consideration in pre- and post-incident planning and operations.

1.4.6. Transportation

The Town of Herndon is served by the following major highways and commuter rail lines:

- State Routes 228 and 606
- Washington Metropolitan Area Transit Authority (WMATA) Metrorail—Silver Line

Hazus identifies eight highway bridges in the Town. The maintenance of transportation facilities and systems is the responsibility of the owner or entity with authority, including municipal, county, state, and federal highway departments, and agencies; toll and rail authorities; and the military. The Virginia Department of Transportation maintains most primary and secondary roads in Fairfax County, except for the Dulles Toll Road, which is under the authority of the Metropolitan Washington Airports Authority (MWAA), and the George Washington Memorial Parkway, which is under the authority of the National Park Service. Metrorail maintains the authority for the operation and maintenance of the commuter rail system.

The Washington Dulles International Airport is located less than five miles from the Town of Herndon. The Hazus database identifies transportation assets at the county level only.

1.4.7. Hazardous Materials

The Hazus database identifies one oil refinery, one natural gas facility, and thirteen natural gas pipeline locations within Fairfax County; however, these are not identified at the town level.

1.4.8. Education

There are 26 public and private educational facilities listed in the Hazus database for the Town of Herndon.

1.4.9. Recreational, Cultural and Historic Sites, and Assets

The Herndon Parks and Recreation Department develops and maintains the community's park system to support recreation and the residents' health through the preservation of environmentally sensitive land and resources and areas of historic significance as well as the provision of recreational facilities and services.

The Town of Herndon maintains a historic preservation program that identifies and designates historic sites and structures. The Historic District Review Board provides guidance to property owners on appropriate measures for preserving and protecting historic properties and buildings. In addition, the Board educates the community on historic preservation and publishes guidelines that describe the Board's oversight and regulatory responsibilities for the Town's four historic districts an additional sites and structures. Historic District Overlay Guidelines educating property owners about appropriate changes to historic structures were most recently published in October 2020.

These sites are designated by the National Register of Historic Places, Virginia Landmarks Register, and/or the Historic Overlay District. Historic assets are addressed in the Town's Comprehensive Plan. The four Historic Overlay Districts are recognized under the Zoning Ordinance to provide regulations over and above the regular zoning protection to prevent the destruction of or encroachment upon such areas and structures, and to prevent the creation of environmental influences adverse to the purposes of these assets. These sites serve as an asset by providing significant context to the Town's development over time and contributing to the community's tourism economy.

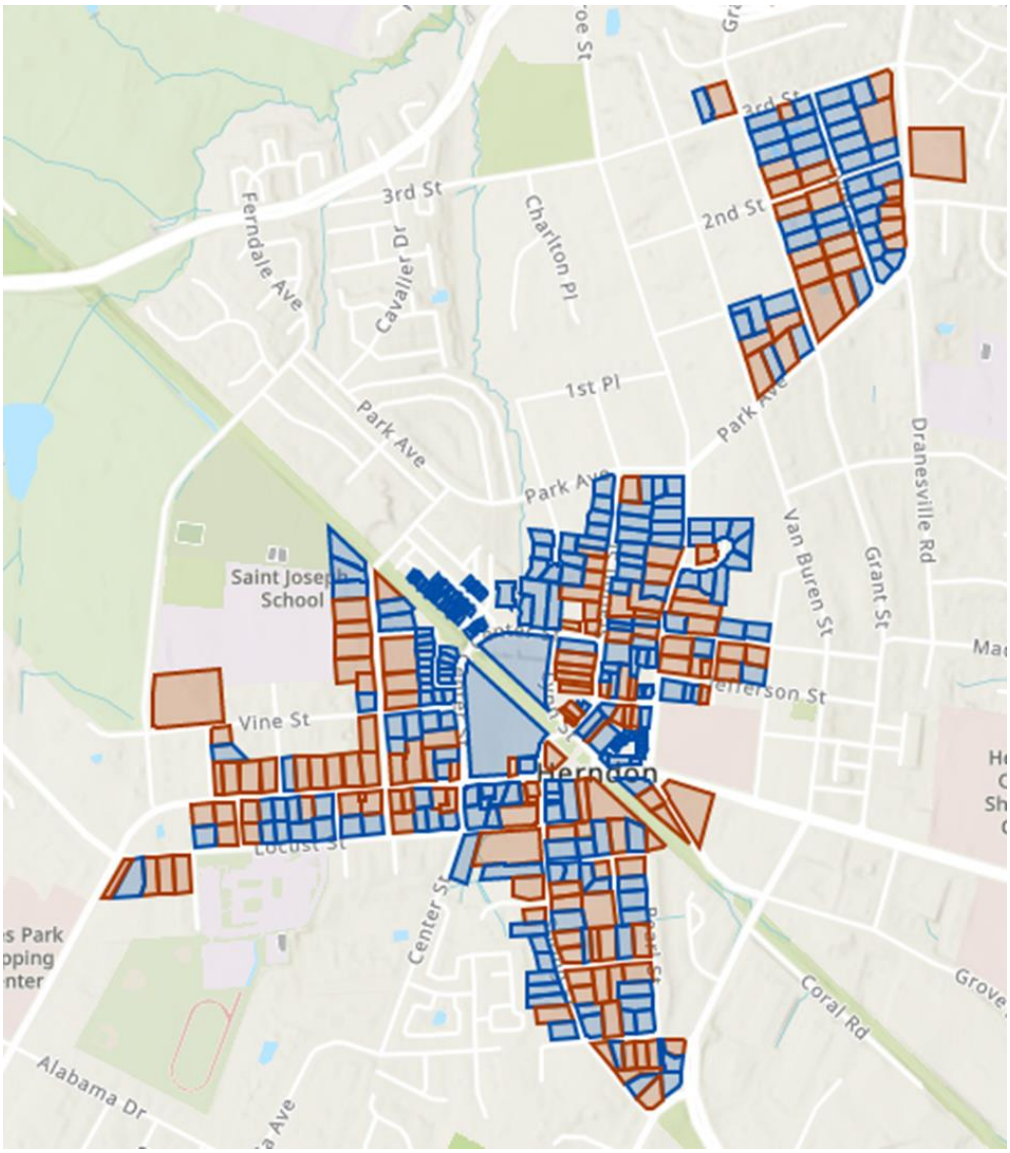

Figure 5: Town of Herndon Historic Overlay District Properties (Contributing and Non-Contributing)[2]

[2] Town of Herndon Department of Community Planning, https://www.herndon-va.gov/departments/community-development/planning-policy/heritage-preservation

1.5. Growth and Development Trends

The Town's population grew rapidly between the 1970s and 2000s, more than quadrupling during those decades. Since 2010, the rate of population growth stabilized, with the most recent change showing a 6.6% growth rate between 2010 and 2020.

The Town's 2030 land use plan indicates business corridors (pink), office parks (light blue), and the area designated for Regional Corridor Mixed Use (purple) which includes the Herndon Metrorail Station with a pedestrian bridge. The area in dark pink with the dotted border represents the Downtown Master Plan which is detailed in the Town's Comprehensive Plan. Areas in light yellow indicate neighborhood conservation areas. All areas in green indicate open space or recreational land uses.

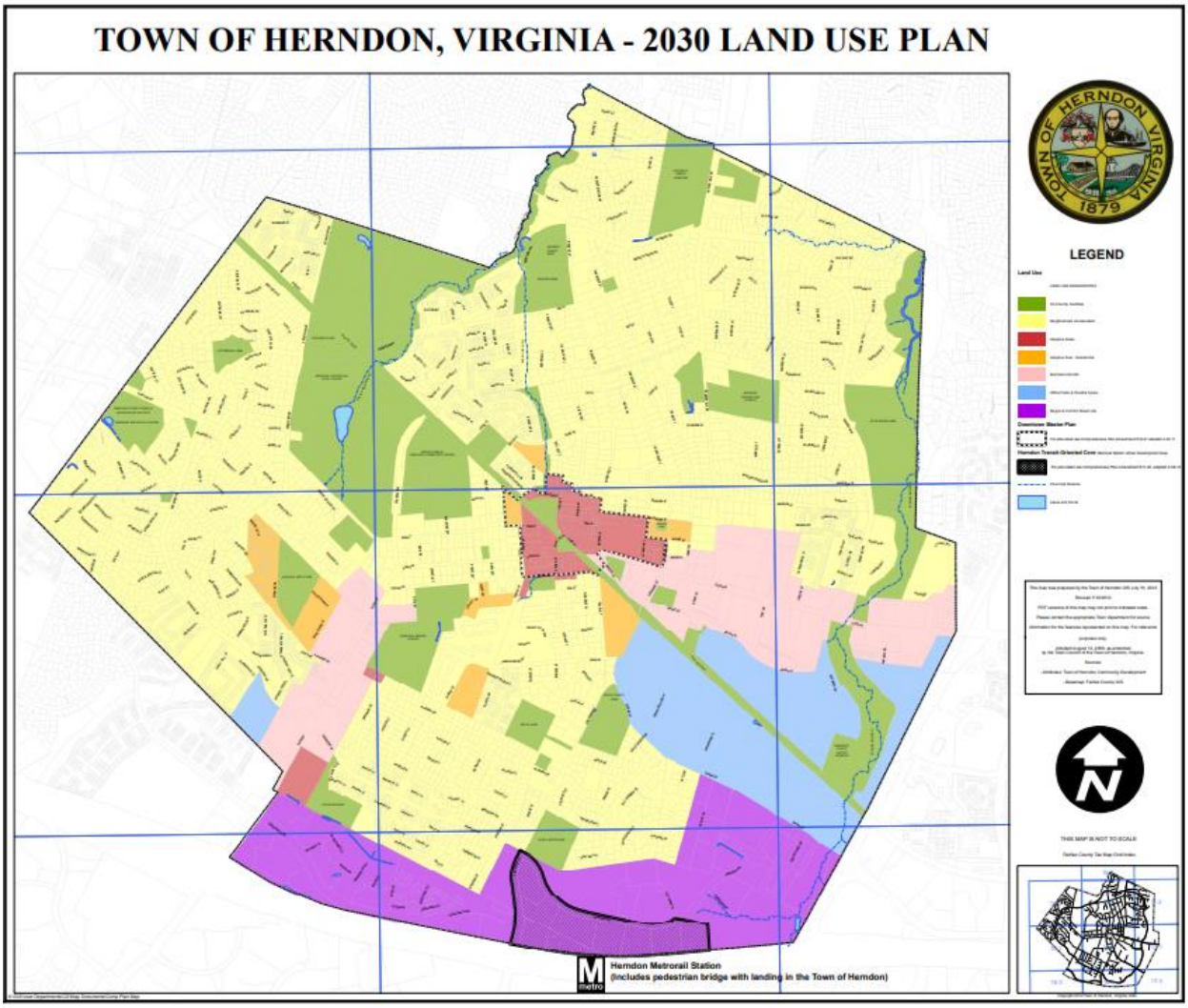

Figure 6: Town of Herndon 2030 Land Use Plan[3]

[3] Town of Herndon; https://www.herndon-va.gov/home/showpublisheddocument/3620/635986400070270000

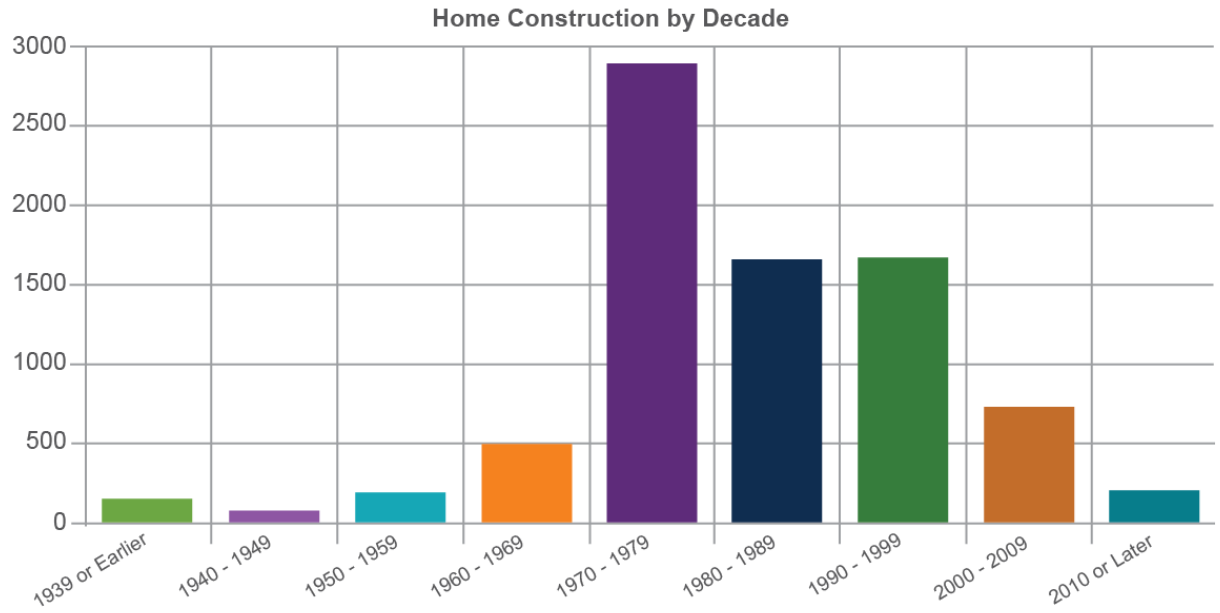

Figure 7: Home Construction by Decade, Town of Herndon[4]

Demands for increases in development and infrastructure in the future may result in pressures to build in areas that are susceptible to impacts from natural hazards such as floods. Land-use controls through the county's ordinances and regulations provide some protection against this pressure but should be continuously monitored for new demands that could increase hazard risks in the future.

The Town of Herndon controls the land use policies and practices within its jurisdiction and will continue to be a planning partner with the county and regional entities to identify hazard mitigation opportunities related to growth and development that reduce risk.

[4] Point2Homes.com. Retrieved at: https://www.point2homes.com/US/Neighborhood/VA/Herndon-Demographics.html

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the Town of Herndon followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Team, the Town supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction.

Table 9: Local Planning Group Participants

Name	Position/Title	Department/Agency
Mark Dale	Lieutenant	Town of Herndon Police Department
David Stromberg	Zoning Administrator	Community Development
Tammy Chastain	Deputy Director	Town of Herndon Public Works

The Town identified its chief hazard mitigation planning responsibility as representing the Town in coordination with the Fairfax County representative to the Emergency Managers Group. The Town also identified the following tasks as part of its mitigation planning responsibilities:

- Conduct a Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Conduct a Capabilities assessment
- Develop a Mitigation strategy
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Lead Public outreach activities
- Implement of the Plan
- Maintain the Plan

Town of Herndon planning participants coordinated primarily by means of virtual meetings with Fairfax County during the planning process, and as needed, independently to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A.**

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a Public Hazard Survey, which was posted and advertised on the Police Department's Facebook and Twitter pages. The survey was opened on August 8th, 2021, and closed on November 3rd, 2021, with over 1,000 responses coming in over that period of time. The Town of Herndon had 15 responses from those who reported living in the Town.

There were 2 questions that got almost the same answer from everyone that took the survey, and those responses identified the natural hazard of climate change and the non-natural hazard of the pandemic to be the most concerning hazards for those who resided in the Northern Virginia Area.

In addition to the survey, the public was offered the opportunity to review and provide input to the Draft 2022 Plan update. Notification of the Draft Plan release was made social media pages. Documentation of the public survey and draft plan review is included in **Attachment 2 of Annex 7, Fairfax County**.

3. Jurisdiction-Specific Hazard Event History

The Town of Herndon's comprehensive hazard history is combined with Fairfax County, and described in **Sections 4 and 5, Base Plan**.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,478 recorded natural meteorological events that took place in Fairfax County between January 1, 1950, and May 2021. The county and its municipalities have been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 10: Federal Disaster and Emergency Declarations (2017–2021), Fairfax County[5]

Declaration	Date	Hazard	Assistance Type
DR-4512-VA	4/2/2020 (continuing)	COVID-19 Pandemic	Individual Assistance, Public Assistance
EM-3448-VA	3/13/2020 (continuing)	COVID-19 Pandemic	Public Assistance (Category B)
EM-3403-VA	9/11/2018	Hurricane Florence	Public Assistance (Category B)

The Town of Herndon Planning Team highlighted severe thunderstorms, snowstorms, and the March 2018 winter storm as significant hazards that have occurred since the 2017 plan. Data related to these hazard events is included in **Annex 7, Fairfax County**.

[5] Source: FEMA

4. Hazard Risk Ranking

After developing hazard profiles, the Town of Herndon conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan**.

The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5, Base Plan**, and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II of the Base Plan**.

Table 11: Hazard Risk Ranking Summary, Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.7	3.5	7.2	**High**
Flood/Flash flood	1.7	4.2	5.9	**High**
High Wind/Severe Storm	2.7	3.2	5.8	**High**
Dam Failure	1.0	4.5	5.5	**High**
Tornado	1.3	4.2	5.5	**Medium**
Drought	2.0	3.2	5.2	**Medium**
Extreme Temperatures	2.7	2.5	5.2	**Medium**
Earthquake	1.7	3.2	4.9	**Medium**
Wildfire	1.0	3.0	4.0	**Low**
Sinkhole/Karst/Land subsidence	1.0	2.5	3.5	**Low**
Landslide	1.0	2.5	3.5	**Low**

Table 12: Hazard Risk Ranking Summary, Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	3.0	5.8	8.8	**High**
Terrorism	1.0	6.4	7.4	**High**
Cyber Attack	2.0	4.7	6.7	**High**
Civil Unrest	1.3	5.0	6.3	**Medium**
Communication Disruption	1.3	3.7	5.0	**Medium**
Hazardous Materials	1.0	3.9	4.9	**Low**
Active Violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, the Town of Herndon evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter weather, Flood/Flash Flood, High Wind/Severe Storm, and Dam Failure
- **Medium:** Tornado, Drought, Extreme Temperatures, and Earthquake

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, and Cyber Attack
- **Medium:** Civil Unrest, and Communication Disruption

All other hazards are ranked as “low,” signifying a minimal risk to the Town of Herndon.

4.1. Additional Hazard Risk Considerations

Volume II of the *2022 Northern Virginia Hazard Mitigation Plan* addresses non-natural hazards identified by the jurisdiction. During the needs assessment process, the Town of Herndon identified the risk of cyber-related incidents on Critical Infrastructure/Key Resources (CI/KR). This hazard should be monitored in the next planning cycle to identify potential incidents, define risks and vulnerabilities, and develop a potential mitigation strategy.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. A discussion of community assets potentially at risk during a hazard event accompanies the data.

Annex 7, Fairfax County includes a statistical compilation of the number of events and related impacts for the two highest-ranked hazards for the Town of Herndon, severe winter weather and flood/flash flood.

5.1. National Flood Insurance Program

The Town of Herndon is a participant in the National Flood Insurance Program (NFIP).

Table 13: National Flood Insurance Program Status, Town of Herndon[6]

Init FHBM Identified	6/14/1974
Init FIRM Identified	8/1/1979
Current Effective Map Date	9/17/2010
Reg-Emer Date	8/1/1979

Table 14: NFIP Policy and Claims Status, Town of Herndon [7]

Policies In-Force	101
Premiums Paid	Unknown
Total Claims	16
Total Payment	$19,000

Table 15: NFIP Status, as of October 11, 2021[8]

Category	NFIP Topic	Source of Information	Comments
Insurance	How many NFIP policies are in the community? What is the total premium and coverage?	FEMA Risk Map – March 2020	70 Policies
Insurance	How many claims have been paid in the community? What is the total amount of paid claims? How many of the	FEMA Risk Map – March 2020	16 Paid Claims totaling $19,000

[6] FEMA NFIP Community Status Report, September 9, 2021
[7] FEMA NFIP Policy Information by State and Community Report, February 29, 2020
[8] Town of Herndon, Floodplain/NFIP Administrator Richard Smith, PE

Category	NFIP Topic	Source of Information	Comments
	claims were for substantial damage?		
Insurance	How many structures are exposed to flood risk within the community?	FEMA Risk Map – March 2020	Between 40 -45 structures under current effective FEMA maps; 15 structures under draft FEMA maps
Insurance	Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	This information is not available. Information from the State NFIP Coordinator or the FEMA Insurance Specialist must be compared against those properties within a floodplain that lack any NFIP policy coverage.
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	The Community FPA is a Professional Engineer licensed in the Commonwealth of Virginia. The FPA is not a Certified Floodplain Manager.
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	Yes. Floodplain management in the Town is managed with overlay districts within the Town's zoning ordinance. The Senior Civil Engineer serves as the Floodplain Manager and administers all necessary permits and reviews of improvements within the floodplain limits. The Zoning Administrator administers the overlay district which addresses the RPA areas through a Special Exception process. Both staff members combine to enforce the Floodplain Ordinance.
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	The Town provides the following NFIP administration services: • Administers permit requirements for all improvements within the floodplain • Performs engineering technical review of all required aspects of floodplain applications

Category	NFIP Topic	Source of Information	Comments
			• Interprets mapping using GIS provided by state agencies
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Funding for a dedicated CFM position and a GIS staff position	Community FPA
Compliance History	Is the community in good standing with NFIP?	Yes	State NFIP Coordinator, FEMA NFIP Specialist, community records
Compliance History	Are there any outstanding compliance issues (i.e., current violations)?	No	Community FPA
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	Unknown. This occurred prior to either the current Zoning Administrator or my employment with the Town. (The Zoning Administrator administers the Floodplain Overlay District within the Town).	Community FPA

5.2. Population

Estimates of the number of residents in the Town of Herndon vulnerable to each hazard are presented in the various hazard sections in the **Base Plan**.

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations.

The Overall CDC SVI for Fairfax County, including the Town of Herndon is presented in **Annex 7, Fairfax County**.

5.3. Built Environment and Community Lifelines and Assets

The Town of Herndon provided a list of thirty-seven town-owned sites and structures as part of its critical facilities inventory. The listing identifies the location (including address, latitude, and longitude), construction type, roof type, building value, contents value, property in open value, and total insured value of all assets. The inventory does not identify whether facilities are in hazard-prone areas such as flood zones and was not categorized by the FEMA Community Lifelines, but this could be addressed in the next planning cycle by sorting the sites in the Lifeline categories and creating GIS maps of the sites overlaid on flood zones, wildfire risk areas, and other areas susceptible to specific hazards.

Using the best Hazus data available, scenarios were run at the county level for earthquake, flood, and hurricane wind to determine potential exposure of buildings, infrastructure, and economy. Information presented in **Annex 7, Fairfax County** includes the Town of Herndon.

Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events.[9] The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

Table 16: Community Lifelines/Critical Facilities Exposed to FEMA Floodplains, Town of Herndon[10]

Facility Type	Total Number	In 100-Year Floodplain	In 500-Year Floodplain
Highway Bridges	8	5	0

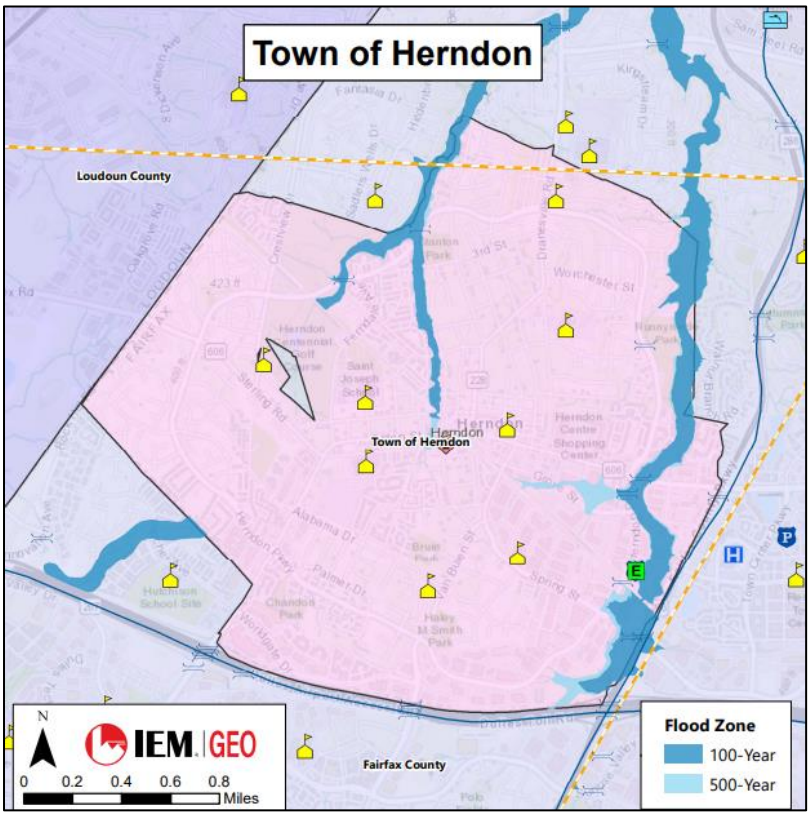

Figure 8: Critical Facilities Exposed to FEMA Floodplains, Town of Herndon[11]

[9] Although Fairfax County maintains a separate critical facilities inventory, information used in this analysis is extracted from the Hazus-MH critical facilities database to maintain consistency with other jurisdictions.
[10] Source: Hazus-MH
[11] Hazus 100- and 500-Year Flood Scenarios, August 3, 2021.

Overlaying the critical facilities in Herndon on the mapped flood zones illustrate that the only facilities within the 100- or 500-year floodplains are highway bridges.

5.4. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

5.5. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets and presented in **Annex 7, Fairfax County**.

5.6. Cultural/Historical

Information related to the vulnerability of cultural and historical assets are presented in the hazard-specific sections of the **Base Plan**.

Historic structures and sites are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original sites affects their historical value, there are challenges to protecting these fragile sites.

The Town of Herndon has significant historical and cultural landmarks that are identified and protected by overlay districts. The *Historic District Overlay Guidelines*, adopted on November 17, 2020, provide a process and detailed procedures that may be applied in post-disaster impact conditions to protect cultural and historical assets from inappropriate repair, demolition, or redevelopment. As a Certified Local Government, under the Virginia Department of Historic Resources, the Town of Herndon indicates its commitment to protect and maintain these assets.

6. Capability Assessment

The Town of Herndon reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience

- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the Town completed a Jurisdiction Needs Identification Questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary, Ranking, and Gap Analysis

The Town of Herndon ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction has limited capabilities within this category and is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities within this category and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities within this category, but improvement is needed in order to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities within this category as demonstrated by its authorities, programs, plans and/or resources, and can implement most mitigation actions.

Table 17: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	Moderate
Safe Growth	High
Financial	Moderate
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary

The Town utilizes the all-hazards approach when developing any jurisdictional plans, including emergency operations, continuity of operations, and hazard-specific plans, as well as the hazard mitigation plan.

The following plans have been newly developed or updated since the 2017 HMP:

- Town of Herndon 2030 Comprehensive Plan
- Town of Herndon Adopted FY 2021–FY 2026 Capital Improvement Program

- Fairfax County Community-Wide Energy and Climate Action Plan (CECAP)
- Fairfax County Emergency Operations Plan, dated June 2019
- Fairfax County Pre-Disaster Recovery Plan, dated April 2020

While currently working with FEMA to update flood maps, the Town also maintains a Floodplain Management Plan, Flood Response Plan, and Historic Preservation Plan. Additionally, the Town is a part of Fairfax County's Radiological Emergency Plan and Disaster Recovery Plan, and regional Evacuation Plan. During the COVID-19 pandemic, the Town implemented temporary Continuity of Governmental Operations procedures.

Capability Analysis: High

Significant planning and regulatory tools are in place within the Town of Herndon and illustrate successes in integrating hazard mitigation planning with existing planning mechanisms. This demonstrates that the Town recognizes the benefit of incorporating hazard mitigation in local planning and regulatory processes such as the Comprehensive Plan, Capital Improvement Plan, and land development and floodplain regulations and how to use these to develop and implement mitigation actions. Area of improvement for this capability include following and updating codes and increasing economic planning activities. The Town also identifies the need to monitor the plan to incorporate the other organizations and partnerships identified throughout the plan to enhance this capability.

6.1.2. Administrative and Technical Capabilities Summary

- The staff of the Community Development and Public Works departments include planners, engineers, and a floodplain manager who are integrated into mitigation planning and understand natural and non-natural hazards.
- A contracting firm is used to provide the surveying function for the Town.
- The Information Technology Department includes personnel skilled in GIS that can provide hazard related data and mapping support.
- The Police Department currently executes emergency management duties and includes a one-person Emergency Management Department.
- Staff with grant writing capabilities are available in the Community Development, Public Works, and Police Departments.
- The Town coordinates with Everbridge as an emergency warning system for internal and external notification and warning.

Capability Analysis: Moderate

The Town of Herndon has a sufficient staffing capability to provide for significant coordination for the purpose of mitigation planning and action implementation. While this is identified as sufficient at the current time, the need for continued funding for positions through general budget and grant opportunities and the need for ongoing education, training, and exercises offers an area for improvement.

6.1.3. Safe Growth Capabilities Summary

- Growth guidance instruments such as future land-use policies, zoning regulations, and maps identify natural hazard areas such as floodplains and discourage or prohibit development or redevelopment within these areas.

- The Comprehensive Plan includes a transportation element that addresses the appropriate placement and utilization of transportation systems.
- Environmental policies and the Chesapeake Bay Preservation Overlay district encourage appropriate development to protect ecosystems.
- Public safety plans and procedures address emergency evacuation and other safety measures associated with safe growth.
- The capital improvement program integrates hazard mitigation projects identified in the hazard mitigation plan.
- The building code and floodplain regulations provide for a Base Flood Elevation (BFE) sufficient to protect property from the 100-year flood event.

Capability Analysis: High

The Town of Herndon has well-established safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment. No additional enhancements are identified at this time.

6.1.4. Financial Capabilities Summary

- The Town has used capital improvement project funding in the past to increase storm drainage and repair roads, and this funding source could be used to fund future mitigation actions.
- The Town has the authority to levy taxes for specific purposes and incur debt through general obligation bonds and/or special tax bonds. These funding sources could be used in the future to complete mitigation actions, although it is likely that other funding sources will be utilized first.
- The Town participates in multiple federal and state funding programs through various disciplines.
- Fees for water, sewer, gas, electric, or stormwater utilities and services and impact fees for new development are a part of the Town's general fund. The general fund could be used to support future mitigation actions and projects.

Capability Analysis: Moderate

Although rising operational costs and limited financial resources are an everyday challenge to most local governments, the Town of Herndon has achieved moderate success in leveraging and combining local, state, and/or federal funding sources to implement mitigation-related projects. The Town notes that public/private partnerships are an unlikely option for funding. The process of identifying potential grants, developing and submitting applications, and managing grant-funded projects is time-consuming and challenging, especially if multiple disasters have occurred simultaneously. In addition, onsite work restrictions imposed during the COVID-19 pandemic between March 2020 and continuing into 2022 have presented challenges in staff availability and coordination. To address these shortfalls, the Town may access technical assistance available to potential applicants provided by many grant programs, seek support from the county, or expand its capabilities to develop and manage mitigation actions through contracted services to enhance this capability.

6.1.5. Education and Outreach Capabilities Summary

- The Town of Herndon historical preservation groups and historical society are proactive in educating about the importance and protection of cultural and historical assets.

- Fairfax County is designated as a StormReady community, which includes the Town in components of public education and training.
- The Fairfax County Park Authority promotes the concepts and actions of the FireWise program.
- The county partners with local schools to participate in the Student Tools for Emergency Planning (STEP) program curriculum, which includes packing an emergency preparedness bag for fifth-grade students.
- Community Rating System initiatives within the NFIP program can increase public awareness of and involvement in hazard mitigation.
- The Town promotes information about recycling and reusing items, does educational outreach about stormwater at the farmers market, and sends out educational flyers and e-newsletters about public works in water bills.

Capability Analysis: Moderate

The Town has existing education and outreach mechanisms that can be utilized to increase awareness about mitigation. This capability can be enhanced by engaging the Virginia Department of Emergency Management mitigation staff to provide technical assistance to support increased jurisdictional involvement. Many hazard mitigation educational tools and materials are available from state agencies, as well as disaster preparedness and response organizations such as the American Red Cross, FEMA, and faith-based organizations with disaster response missions.

As a component of the capability assessment, the Town of Herndon identified activities related to each natural hazard that support risk reduction.

Table 18: Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Dam Failure (including Levees)	• Public education and operational plans address preparedness and response to reduce risk.
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and international building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	• Public education and operational plans address preparedness and response to reduce risk.
Flood/Flash Flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. • Stormwater management program and projects address flood prevention and risk reduction.
High Wind/Severe Storm	• State and international building codes provide for wind load design regulations.
Karst/Sinkhole/Land Subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.

Hazard	Activity
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Winter weather	• Public education and operational plans address preparedness and response to reduce risk.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Non-Natural Hazards	• Public education and operational plans address preparedness and response to reduce risk. • Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate Change	• Ongoing resilience planning and utilizing the *Community-Wide Energy and Climate Action Plan* will allow for the identification and mitigation of climate change-related issues in future planning cycles.

7. Resilience to Hazards

7.1. National Risk Index

The National Risk Index (NRI) is a dataset and online tool developed by FEMA and other partners to help illustrate communities in the United States at risk for 18 natural hazards. Hazard risk is calculated on data for a single hazard type and reflects the relative risk for that hazard type and should be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently from the hazards in this plan so a direct hazard-to-hazard comparison of risk is not able to be determined. The NRI provides an overview of hazard risk, vulnerability, and resilience. The designation of "low risk" is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience. The Town of Herndon is included in the Fairfax County NRI in **Annex 7, Fairfax County**.

7.2. Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household level risk factors.

The index produces aggregate-level (Census tract, county, and state) small area estimates that help determine how at risk specific neighborhoods might be to disasters due to characteristics that may make specific segments of the population more vulnerable to the impacts and consequences of disasters. The 10 risk factors[12] include the following:

1. Income-to-poverty ratio
2. Single or zero caregiver household
3. Unit-level crowding
4. Communication barrier
5. Aged 65 years or older
6. Lack of full-time or year-round employment (household)
7. Disability
8. No health insurance coverage
9. No vehicle access (household)
10. No broadband internet access (household)

[12] The Community Resilience Estimates are developed by the U.S. Census Bureau; initial release date, August 10, 2021. Methodology is described at the U.S. Census Bureau Community Resilience Methodology page (https://www.census.gov/programs-surveys/community-resilience-estimates/technical-documentation/methodology.html).

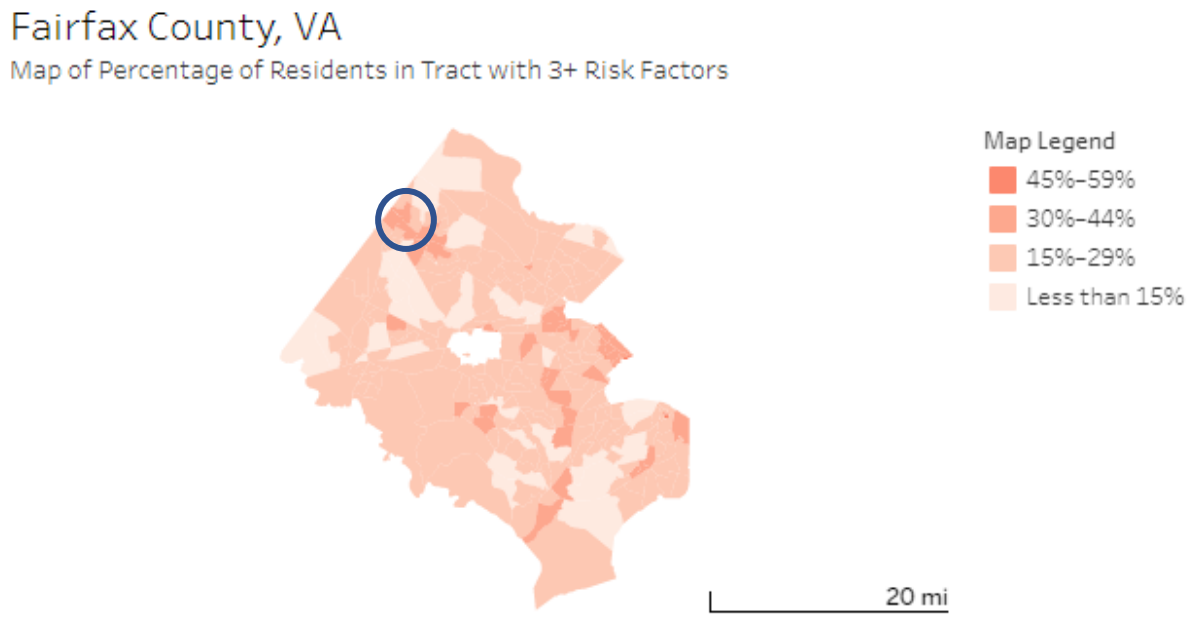

Figure 9: Community Resilience Estimate[13]

The estimate is categorized into three groups: zero risks, one or two risks, and three or more risks. The CRE for Fairfax County is 14.72 percent, meaning that 167,857 of county residents have three or more risk factors.

The combination of data and analysis described in this section provides a comprehensive representation of Fairfax County's risk, vulnerability, and resilience to all hazards.

7.3. New Hazard Risk Challenges or Obstacles to Be Monitored in the Next Planning Cycle

The Town of Herndon Planning Team identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- The risk of cyber-related incidents on critical infrastructure and key resource sites.
- Climate change causing increased precipitation intensity and quantities, increased extreme heat, increased storm severity, and increased coastal (Potomac River) flooding.
- Increases in the number of excessive rainfall events that impact new areas with floods.

[13] Community Resilience Estimates, U.S. Census Bureau

8. Mitigation Actions

8.1. Goals and Objectives

The Town of Herndon Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

The Town of Herndon monitors actions and tracks progress through the periodic review, evaluation, revision, and update of the NOVA HMP. Some projects that contribute to risk reduction have been completed or are currently in progress, but have not been included in this plan for one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and resulting risk reduction.

All five of the Town's previous mitigation actions are in progress and are being carried forward for the 2022 plan update.

8.3. New Mitigation Actions

The Town of Herndon Planning Team identified four new mitigation actions to include in this plan. Proposed actions address risks consistent with the jurisdiction's highest risk hazards—flood/flash flood and winter weather—in addition to actions that address hazard mitigation education programs for all hazards.

The Town of Herndon Jurisdiction Needs Assessment Questionnaire highlighted Fairfax County's *Community-wide Energy and Climate Action Plan (CECAP)*, September 14, 2021, as providing the opportunity to identify actions and strategies to mitigate climate-related hazards and reduce the impact of climate-related events on residents and businesses.

8.4. Action Plan for Implementation and Integration

The new actions, combined with those carried forward from the 2017 plan, result in a total of nine actions that will be implemented in the upcoming planning cycle.

The Town of Herndon Police Department is responsible for coordinating municipal departments and agencies participating in hazard mitigation activities. The department's designated Mitigation Coordinator is responsible for implementing the mitigation plan on two levels: implementation of the jurisdiction's actions and facilitating the implementation of the multi-jurisdictional regional plan. Tasks to ensure that the Town's actions are implemented are integrated into the *Action Plan for Implementation and Integration* (which includes the prioritized list of Mitigation Actions) and plan maintenance procedures described in the next section. The Action Plan for Implementation and Integration describes how the Town's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 19: Action Plan for Implementation and Integration, Town of Herndon

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into the local comprehensive plan.	Continue to coordinate with the Department of Community Development and other applicable departments to incorporate current and emerging risks and actions into planning efforts.
Review/update land development regulations for consistency with mitigation goals.	Continue coordination with the Department of Community Development regarding future land use projects.
Review/update building/zoning codes for consistency with mitigation goals.	Work with Zoning Administrator regarding town zoning ordinances and consistency with mitigation goals.
Maintain regulatory requirements of the floodplain management program (NFIP).	Support the Community Development Department who is responsible for floodplain management.
Continue public engagement in mitigation planning.	Continue to promote awareness of hazards and incorporate public feedback into planning processes and seek resident feedback supporting mitigation.
Identify opportunities for mitigation education and outreach.	Identify opportunities to conduct community outreach to promote the importance of mitigation projects.
Review/update emergency plans to address evacuation and sheltering.	Evacuation has been identified as a priority incident annex to be developed as part of the 2021 update to the Town 's EOP.
Maintain ongoing enforcement of existing policies.	Support the Department of Community Development with any applicable enforcement policies.
Monitor funding opportunities.	Police Department will continue to monitor funding sources and coordinate with Departments on projects that support mitigation actions.
Incorporate goals and objectives into day-to-day government functions.	Police Department will incorporate the concept of mitigation into day-to-day government functions, including continual monitoring of the action items identified in the 2022 update.
Incorporate goals into day-to-day development policies, reviews, and priorities.	Continue work with Departments of Public Works and Community Development to incorporate mitigation into day-to-day activities.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 20: Town of Herndon Plan Maintenance Responsibilities for the Northern Virginia Hazard Mitigation Plan, Base Plan

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to Fairfax County/NOVA Planning Group. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the Fairfax County/NOVA Planning Group. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the Fairfax County/NOVA Planning Group. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP, Base Plan**, the Town of Herndon Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**. The Town's maintenance method and schedule may coincide with that of Fairfax County and be conducted simultaneously.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following a major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in the fifth year

Table 21: Town of Herndon Jurisdiction Annex Maintenance Procedures

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with the jurisdiction planning team. 2. Review the status of all mitigation actions, using the *Mitigation Action Implementation Worksheet* (**Section 3, Attachment A, NOVA HMP Base Plan**).	• Produce an annual report that includes the following: ▪ Status update of all mitigation actions ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities ▪ Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	3. Schedule the annual plan evaluation with jurisdiction planning team. 4. Evaluate the current hazard risks and vulnerabilities and hazard mitigation capabilities using the *Planning Considerations Worksheet*, (**Section 3, Attachment C, NOVA HMP Base Plan**).	• Submit the annual report to the NOVA HMP Planning Project Team Point of Contact.
Updating the Annex	1. Coordinate with Fairfax County and the Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

Mitigation actions presented in the Town of Herndon Jurisdiction Annex may be reviewed, revised, and updated at any time.

The Town of Herndon will continue to be a planning partner with multiple jurisdictions and regional entities, including Fairfax County, to identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan.

10. Annex Adoption

The Town of Herndon Jurisdiction Annex will be adopted simultaneously with the adoption of the *NOVA HMP*.

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Action Worksheets

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Documentation of Public Participation

Figure 10: Town of Herndon HMP Survey Social Media Outreach Twitter

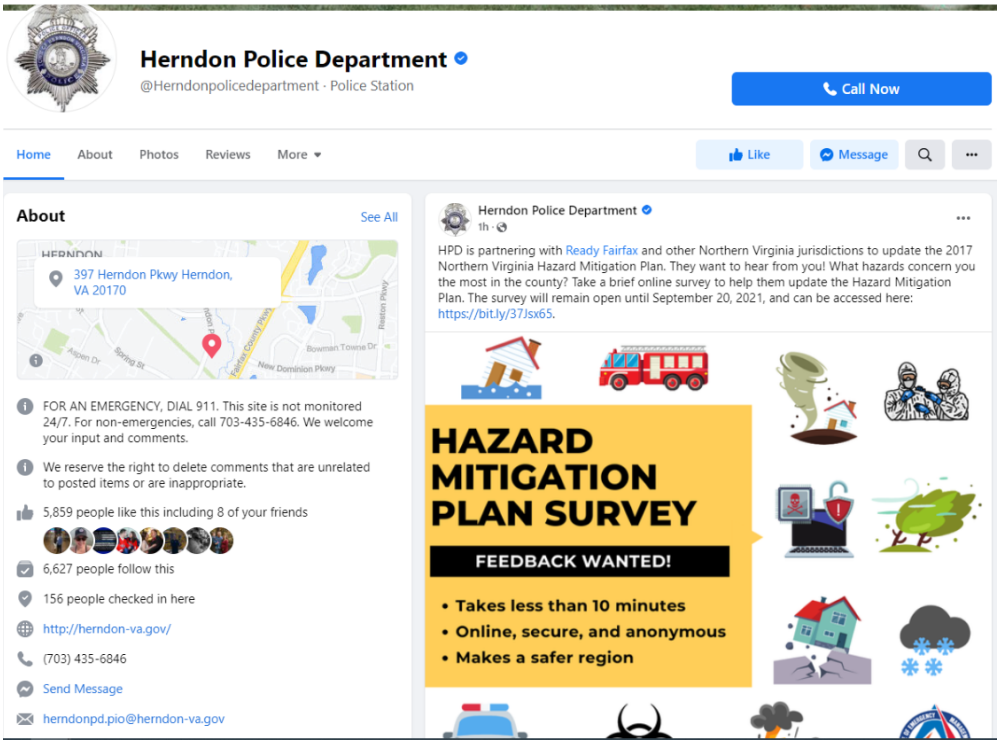

Figure 11: Town of Herndon HMP Survey Social Media Outreach Facebook

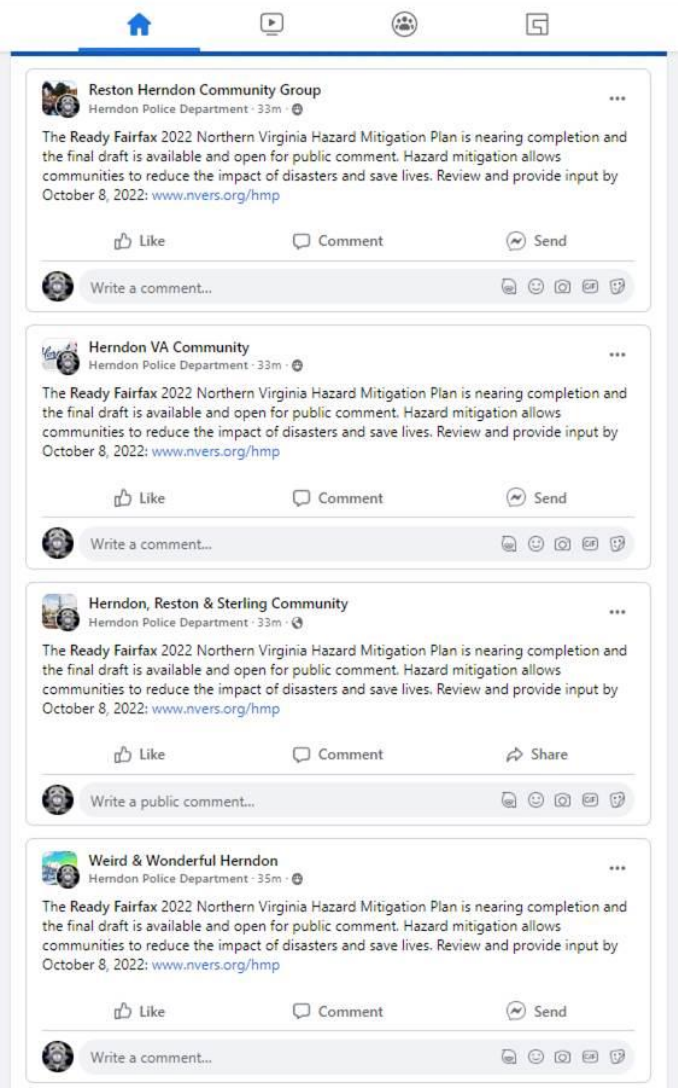

Figure 12: Final Draft Public Comment Social Media Outreach

Figure 13: Final Draft Public Comment Twitter

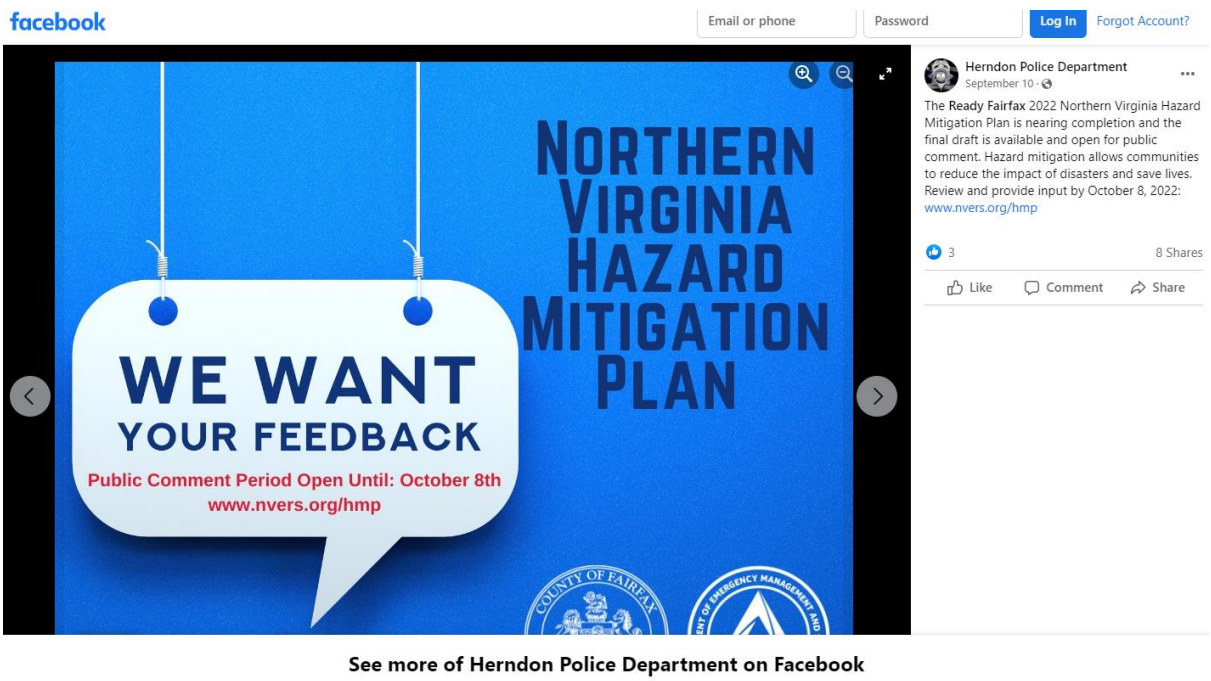

Figure 14: Final Draft Public Comment Facebook

11.3. Attachment 3: Mitigation Actions

Table 22: Previous Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard(s)	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status
2017-1	Purchase and plan for deployment of industrial-grade water pumps to mitigate floodwaters in known flood-prone locations, including roadways.	Public Works	• Flood/Flash Flood • Winter Weather	FEMA Unified Hazard Mitigation Assistance Funding	Ongoing	Identify and prioritize locations for placement of pumps, identify funding.	Medium	In progress
2017-2	Improve flood prone intersections by adding new drainage structures and systems. Two known intersections: 1) Herndon Pkwy and Van Buren Street, 2) Monroe Street and Worldgate Drive.	Public Works	• Flood/Flash Flood • Winter Weather	Currently included in town 2022 CIP budget	Expected completion in 2022	Meet construction milestones and deadlines.	Medium	In progress
2017-3	Evaluate and assess older stormwater systems in the Town to include 5-year CCTV inspections and trenchless repair methods.	Public Works	• Flood/Flash Flood • Winter Weather	FEMA Unified Hazard Mitigation Assistance Funding, town's capital budget	Ongoing	Initiate and follow a plan and schedule for evaluation and assessment.	Medium	In progress

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard(s)	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status
2017-4	Support mitigation of priority flood-prone structures through the promotion of acquisition/demolition, elevation, floodproofing, minor localized flood control projects, mitigation reconstruction, and, where feasible and appropriate, using FEMA HMA programs.	Public Works	• Flood/Flash Flood • High Wind/Severe Storm • Winter Weather	FEMA Unified Hazard Mitigation Assistance Funding	Ongoing	Identify Properties.	Medium	In progress (Currently no repetitive loss properties. Updated NFIP mapping may change properties impacted. Exploring all options, including buyouts.)
2017-5	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct an annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. The review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.	Community Development/ Public Works	• Flood/Flash Flood • High Wind/Severe Storm • Winter Weather	General Funds	Ongoing	Establish a schedule of review.	Medium	In progress

Table 23: New Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment
2022-1	Reclaim Sugarland Run Creek creekbanks to reduce and eliminate destabilization.	Public Works	• Flood • Severe Weather	FEMA Unified Mitigation Assistance Funding, town's capital budget	Ongoing	Complete geomorphic assessment.	Medium	None
2022-2	Work with FEMA to re-examine flood zones and update FIRMS. Use this information to reevaluate NFIP activities.	Public Works	• Flood • Severe Weather	FEMA Unified Hazard Mitigation Assistance Funding town's capital budget	Ongoing	Multi-year project; meet FEMA deadlines throughout project.	Medium	Use this information to re-evaluate NFIP activities.
2022-3	Continue to implement building and development standards as required under the NFIP.	Planning and Zoning	• Flood	Hazard Mitigation Assistance grant funding, US Army Corps of Engineers, town Funding, VDEM				
2022-4	Develop an outreach/education program aimed at promoting hazard mitigation for the residents of Herndon	Police Dept. Planning and Zoning	• All Hazards	Town Funding			High	This program will be completed when funding is available.

Northern Virginia Hazard Mitigation Plan

Annex 7-C: Town of Vienna

November 2022

Town of Vienna Overview

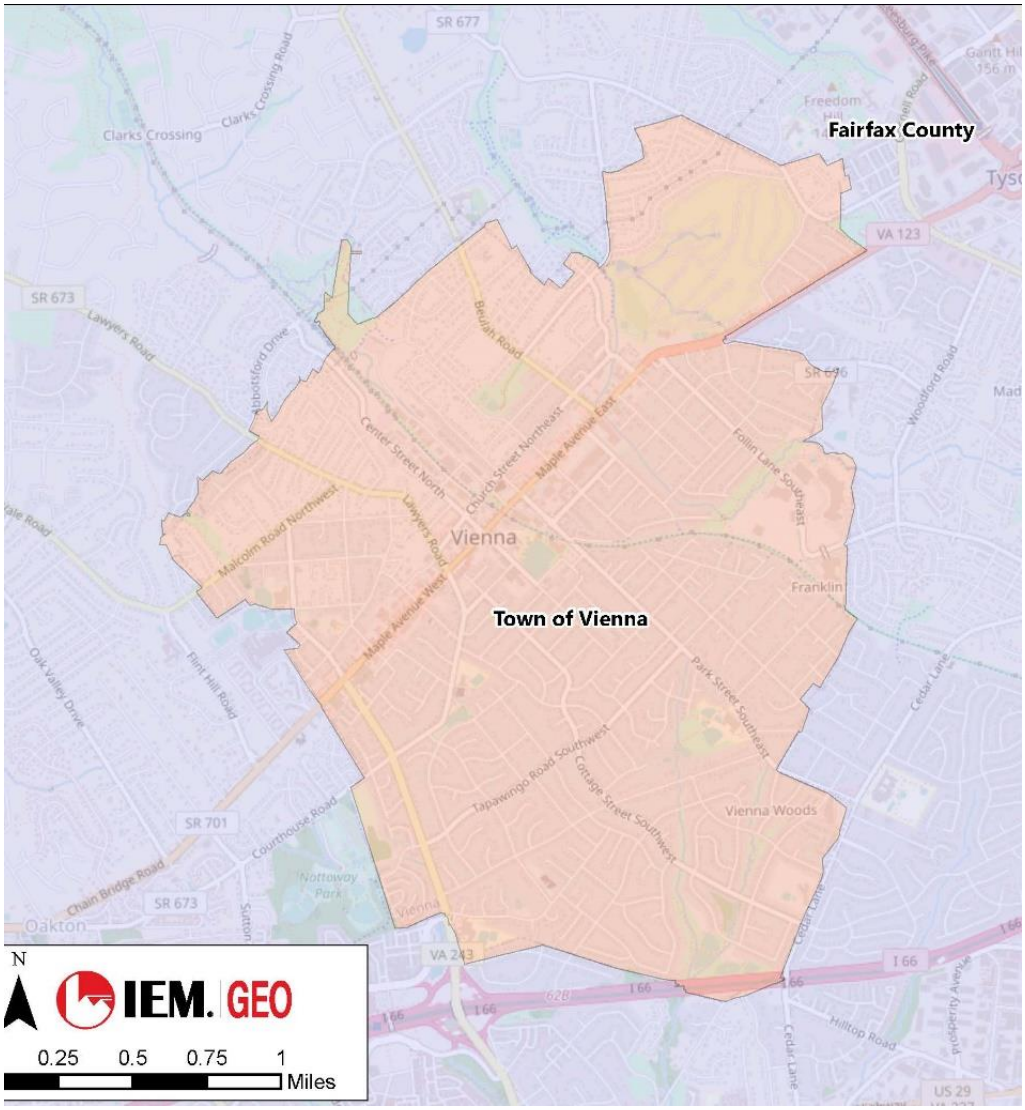

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1890	4.4 sq. mi.	17,004	127 Center St. South, Vienna, VA 22180	5,607	Winter Weather, Flood/Flash Flood, High Wind/Severe Weather

Town of Vienna Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

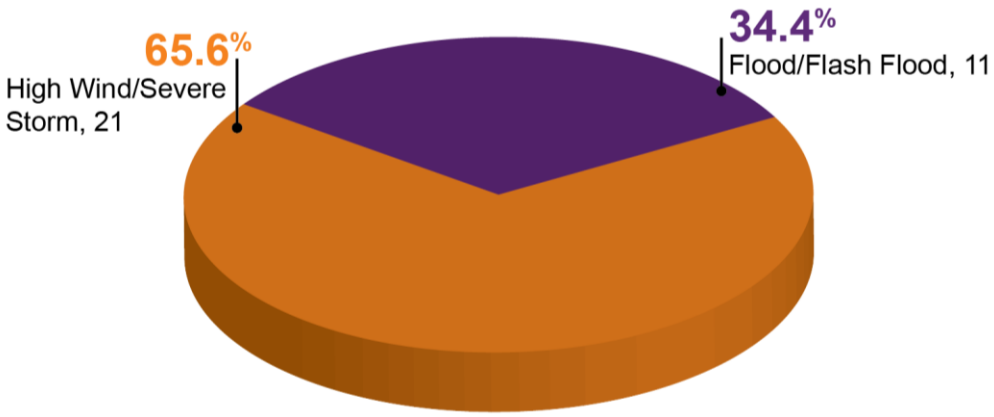

Figure 1: Number and Percentages of Hazard Events

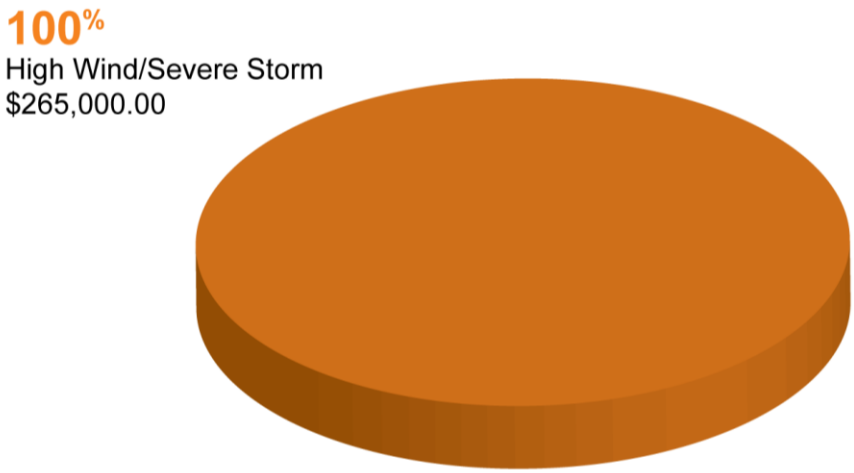

Figure 2: Property Damage Costs from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Ranking of Natural Hazards by Risk

Hazard	Hazard Ranking
Winter Weather	**High**
Flood/Flash Flood	**High**
High Wind/Severe Storm	**High**
Dam Failure	**High**
Tornado	**Medium**
Drought	**Medium**
Extreme Temperatures	**Medium**
Earthquake	**Medium**
Wildfire	**Low**
Karst/Sinkhole/Land Subsidence	**Low**
Landslide	**Low**

Community Lifelines/Critical Assets and Mitigation Capabilities

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifelines/Sectors	Number of Assets
Safety and Security	3
Food, Water, Shelter	-
Health and Medical	-
Energy	2
Communications	-
Transportation	-
Hazardous Materials	-
Education	30
Cultural/Historical	14
High Hazard Dams	-

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking

Capability	Ranking
Planning and Regulatory	Moderate
Administrative and Technical	Moderate
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Point of Contact

Table 5: Point of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Daniel Janickey, Deputy Chief Town of Vienna Police Department 703-255-6397 Dan.Janickey@viennava.gov 215 Center Street S Vienna, VA 22180

Town of Vienna

This annex presents the following jurisdiction-specific information provided by the Town of Vienna for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP).*

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1. Jurisdiction Profile

Geographic Region	Piedmont/Coastal Plain
Persons Per Household	2.91
Median Age	41.3
Elevation	358 feet

1.1. Location

Located in the north-central area of Fairfax County, the Town of Vienna is surrounded by unincorporated land. It is located approximately 5 miles south of the Potomac River and 12 miles west of Washington, D.C.

1.2. History

The area that later became the Town of Vienna was first settled in the 1740s. The Town was named after a doctor, William Hendrick, who agreed to settle there in 1850 if the Town was renamed after his hometown, originally called Vienna (now known as Phelps), in New York State. One of the first armed clashes of the Civil War occurred in the Town on June 17,1861.

1.3. Demographics, Economy, and Governance

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context for the entire Plan.

Table 6: Population and Growth Rate[1]

Year	Population	Annual Percent Increase
1990	14,852	
2000	14,453	-2.69%
2010	15,687	8.54%
2020	17,004	8.40%

[1] United States Census, 1970 – 2020. Town of Vienna, Virginia website. Data USA.

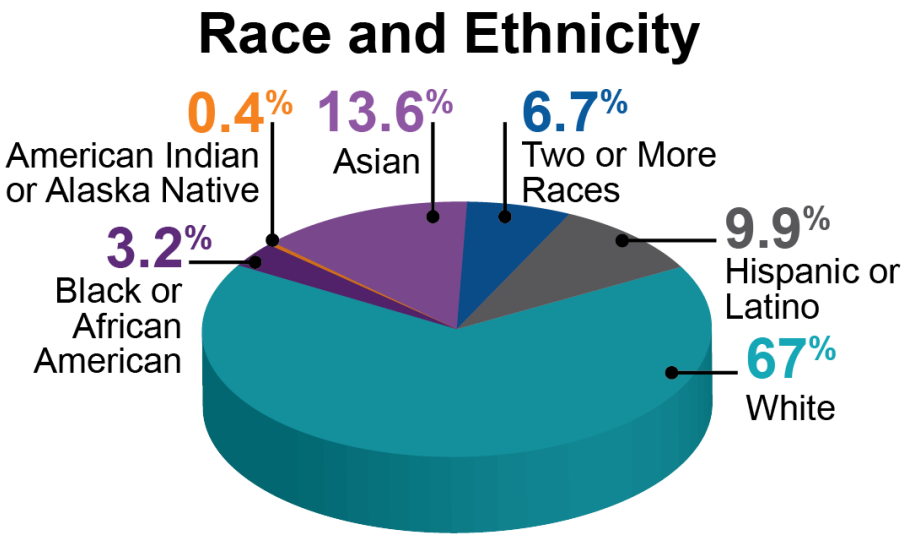


Figure 4: Race and Ethnicity Demographics from 2020 Census*

*Due to how people view Race and Ethnicity and answer the questions in the Census, there is overlapping of responses and results equal greater than 100% of the population.

Table 7: Economic Data

Economy	Data
Median Household Income (2019)	$168,269
Unemployment Rate (June 2021)	2.1%
Per Capital Income (2020)	$76,538
Percentage Below Poverty (2021)	4%

Approximately 74% of Vienna residents speak English as their primary language and 6% speak Spanish. Approximately 78.5% of town residents have attended university, with 39% and 29.5% attaining a bachelor's and graduate degree, respectively, thus indicating a highly-educated workforce.[2] The area has become a hub for telecom and other high-tech companies focused on the internet/online services. Top employers in the area include Navy Federal Credit Union, Fairfax County Public Schools, several major food companies, local government offices, and service industries.[3]

1.4. Built Environment and Community Lifelines

The information presented in this section related to Community Lifelines and critical assets in the Town of Vienna has been collected from multiple sources, including Hazus (Version 4.2), Town participants in the NOVA HMP 2022 update planning process, and government websites. During the planning process, the Town submitted a list of 29 sites or structures that are considered critical assets.

[2] World Population Review, September 2021.
[3] Serfass, Marion. Town of Vienna, 2020 Comprehensive Annual Financial Report, Fiscal Year Ending June 30, 2020. Retrieved November 24, 2021. Retrieved at: https://www.viennava.gov/home/showdocument?id=2819

Table 8: Town of Vienna Critical Assets by Type[4]

Asset Type, by Use	Number of Assets	Value of Assets (Building and Contents)
Cemeteries	3	Not identified
Funeral Home	1	Not identified
Government Buildings	2	$15,750,000
Halls	1	Not identified
Historic Homes	2	Not identified
Maintenance Facilities	2	$8,750,000
Museums	5	$595,000 (value identified for 3 facilities)
Police Station	1	$7,500,000
Storage Facilities	11	$2,900,000
TOTAL	28	$35,445,000

Critical facility data extracted from the Hazus Level 1 assessment (Table 9) indicates that the Town has an estimated 49 critical and historic assets. Due to the time lag in collecting and verifying data and the method of documenting location and jurisdiction used in Hazus, this data does not fully reflect the current inventory maintained by the Town.

Table 9: Number of Community Lifelines and Critical Assets in the Town of Vienna[5]

Sector	Number of Assets
Safety and Security	3
Food, Water, Shelter	-
Health and Medical	-
Energy	2
Communications	-
Transportation	-
Hazardous Materials	-
Education	30
Cultural/ Historical	14
High Hazard Dams	-

1.4.1. Safety and Security

The Town has one Emergency Operations Center and one Fairfax County Fire Station that serves residents. The Town has built a police station which is currently valued at approximately $18 million; they will begin using the new station in the summer of 2022 and have demolished the old station.

[4] Town of Vienna,
[5] Fairfax County, Hazus Data Inventory, August 3, 2021.

1.4.2. Food, Water, Shelter

Food commodities are available throughout the Town from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

The Town of Vienna provides water and sewer services for its residents.

The Hazus database does not identify schools that might be designated as public shelters.

1.4.3. Health and Medical

The Hazus database does not identify any town-level health and medical facilities for Vienna. The Town of Vienna is served by health and medical facilities offering patient care, urgent care, emergency rooms, and other healthcare services located elsewhere in Fairfax County.

1.4.4. Energy

The Town of Vienna is served by Dominion Energy and Columbia Gas of Virginia.

1.4.5. Communications

The Hazus database does not identify town-level communication/broadcast facilities for the Town of Vienna.

Most communications and information systems and infrastructure in the United States are privately owned; however, the Town of Vienna Police Department has its own dispatch. Fairfax County 911 calls within the Town are diverted to the Town. All non-emergency calls go directly to Vienna Police Department. In recent years, the federal government has assumed a stronger role in protecting information and communications infrastructure, which may also present a challenge in relation to disaster impacts. Increasing reliance on this infrastructure by individuals, businesses, and government could cause vulnerabilities that emergency managers should take into consideration in pre- and post-incident planning and operations.

1.4.6. Transportation

The Town of Vienna is served by the following major highways and commuter rail lines:

- Interstate 66
- State Routes 123 and 243
- Washington Metropolitan Area Transit Authority (WMATA) Metrorail – Orange Line

Maintenance of transportation facilities and systems is the responsibility of the owner or entity with authority, including municipal, county, state, and federal highway departments and agencies; toll and rail authorities; and the military. The Virginia Department of Transportation maintains most primary and secondary roads in Fairfax County.

The Hazus database does not identify any transportation assets for the Town of Vienna.

1.4.7. Hazardous Materials

The Hazus database identifies one oil refinery, one natural gas facility, and 13 natural gas pipeline locations within Fairfax County; however, these are not identified at the town level.

1.4.8. Education

The Town is served by Fairfax County Public Schools and a number of private institutions. The Hazus inventory documents 30 facilities with a town address.

1.4.9. Recreational, Cultural and Historic Sites, and Assets

The Town of Vienna maintains the community's park system to provide recreational facilities and services that support the preservation of environmentally-sensitive land and resources as well as areas of historic and cultural significance.

The Town of Vienna recognizes 14 historic properties[6]. Historic Vienna, Inc., a not-for-profit organization, oversees the historic properties in the Town and provides guidance to property owners on appropriate measures for preserving and protecting historic properties and buildings. These sites serve as an asset by providing significant context as to the Town's development over time and contributing to the community's tourism economy.

1.5. Growth and Development Trends

The Town's population has maintained steady growth in the past few decades. Future growth and development are managed by the Planning and Zoning Department.

The Town's 2015 Comprehensive Plan, amended on February 2, 2020[7], describes the jurisdiction's approach to preserving and enhancing its small-town character, which focuses on single-family detached housing supported by adequate retail and services. The plan highlights development pressures for high-density development that surround the Town, primarily in Tysons, MetroWest, and Merrifield, and voices concerns about adverse impacts on traffic and public service facilities. The plan commits the Town to continue monitoring and informing the Fairfax County government of the effects of this type of development on the Town, including potential hazard impacts.

The Town of Vienna controls the land use policies and practices within its jurisdiction and will continue to partner with the county and regional entities to identify hazard mitigation opportunities related to growth and development that reduce risk.

[6] Town of Vienna website. Retrieved at: https://www.viennava.gov/getting-to-know-vienna/history/historic-properties
[7] Town of Vienna 2015 Comprehensive Plan. Retrieved at: 637433006019870000 (viennava.gov)

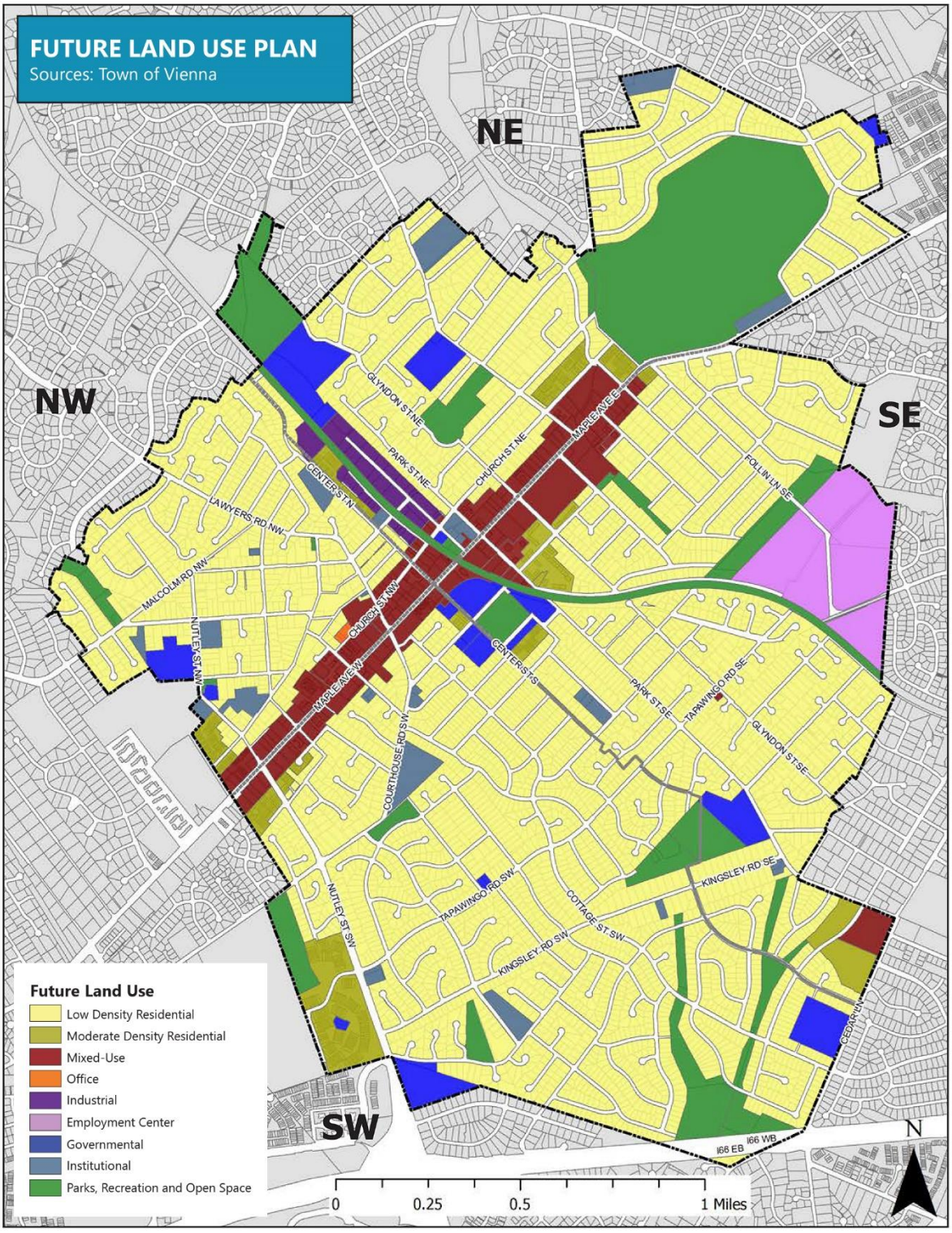


Figure 5: Future Land Use Plan, Town of Vienna[8]

[8] 2015 Town of Vienna Comprehensive Plan, p. 38. Retrieved at: 637433006019870000 (viennava.gov)

The Town of Vienna Planning and Zoning Department is responsible for reviewing and approving all construction projects through a comprehensive process. The Department's website includes a Development Activity Map that identifies specific projects and sites by their status. As of January 2022, there were five projects under review, three approved, eight under construction, and 36 completed.

Figure 6: Town of Vienna Development Activity Map – Completed Projects[9]

The plan review process involves multiple levels of review that include consideration of appropriate land use, such as floodplains, ecological systems, and stormwater impacts.

[9] Town of Vienna Development Authority Website. Retrieved January 8, 2022.

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the Town of Vienna followed the planning process described in **Section 2 in the Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Team, the Town supported the local planning process requirements by coordinating with Fairfax County and representatives from other Town departments and agencies.

Table 10: Local Planning Group Participants

Name	Position/Title	Department/Agency
Daniel Janickey	Deputy Chief of Police	Town of Vienna Police Department
John Jay Sergent	Floodplain/NFIP Administrator	Town of Vienna Planning and Zoning

The chief hazard mitigation planning responsibility is representing the Town in coordination with the Fairfax County representative to the Emergency Managers Group. The Town also identified the following tasks as part of its mitigation planning responsibilities:

- Conduct hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Conduct capabilities assessment
- Develop mitigation strategy
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Conduct public outreach activities
- Implement the Plan
- Maintain the Plan

The Town of Vienna planning participants coordinated primarily by means of virtual meetings with Fairfax County during the planning process, and as needed, independently, to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a Public Hazard Survey, which was posted and advertised on the Town's Twitter and Facebook pages. In addition to the survey, the public was offered the opportunity to review and provide input on the Draft 2022 Plan update. Notification of the Draft Plan release was made on social media pages. Documentation of the public survey and draft plan review is included in **Attachment 2 of Annex 7, Fairfax County**.

The survey was opened on August 8th, 2021, and closed on November 3rd, 2021, with over 1,000 responses coming in over that period of time. The Town of Venna had 28 responses from residents that took the survey, and those responses identified the natural hazard of climate change and the non-natural hazard of the pandemic to be the most concerning hazards for those who resided in the Northern Virginia Area.

3. Jurisdiction-Specific Hazard Event History

The Town of Vienna's comprehensive hazard history is combined with that of Fairfax County and described in **Sections 4 and 5, Base Plan**.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,478 recorded natural meteorological events that took place in Fairfax County between January 1, 1950 and May 2021. The county and its municipalities have been included in three Federal Disaster Declarations and emergencies between May 2017 and May 2021.

Table 11: Federal Disaster and Emergency Declarations (2017–2021), Fairfax County[10]

Declaration	Date	Hazard	Assistance Type
DR-4512-VA	4/2/2020 (continuing)	COVID-19 Pandemic	Individual Assistance, Public Assistance
EM-3448-VA	3/13/2020 (continuing)	COVID-19 Pandemic	Public Assistance (Category B)
EM-3403-VA	9/11/2018	Hurricane Florence	Public Assistance (Category B)

The Town of Vienna's Planning Team highlighted winter weather, floods/flash floods, and high winds/severe storms as significant hazards that have occurred since the 2017 plan. Data related to these hazard events is included in **Section 5, Base Plan**, and **Annex 7, Fairfax County**.

[10] FEMA

4. Hazard Risk Ranking

After developing hazard profiles, the Town of Vienna conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan**.
The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented in the hazard subsections in **Section 5, Base Plan**, and local details are provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II** of this Plan.

Table 12: Town of Vienna - Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.7	3.5	7.2	**High**
Flood/Flash Flood	1.7	4.2	5.9	**High**
High Wind/Severe Storm	2.7	3.2	5.8	**High**
Dam Failure	1.0	4.5	5.5	**High**
Tornado	1.0	4.2	5.2	**Medium**
Drought	2.0	3.2	5.2	**Medium**
Extreme Temperatures	2.7	2.5	5.2	**Medium**
Earthquake	1.7	3.2	4.9	**Medium**
Wildfire	1.0	3.0	4.0	**Low**
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	**Low**
Landslide	1.0	2.5	3.5	**Low**

Table 13: Town of Vienna - Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious disease/public heath	3.0	5.8	8.8	**High**
Terrorism	1.0	6.4	7.4	**High**
Cyber Attack	2.0	4.7	6.7	**High**
Civil Unrest	1.3	5.0	6.3	**Medium**
Communication Disruption	1.3	3.7	5.0	**Medium**
Hazardous Materials	1.0	3.9	4.9	**Low**
Active Violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, the Town of Vienna evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter Weather, Flood/Flash Flood, High Wind/Severe Storm, and Dam Failure
- **Medium:** Tornado, Drought, Extreme Temperatures, and Earthquake

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, and Cyber Attack
- **Medium:** Civil Unrest and Communication Disruption

All other hazards are ranked as “low,” signifying a minimal risk to the Town of Vienna.

4.1. Additional Hazard Risk Considerations

4.1.1. Non-Natural Hazards

Volume II of the *2022 Northern Virginia Hazard Mitigation Plan* addresses non-natural hazards identified by the jurisdiction.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4 in the Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impacts and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

Annex 7, Fairfax County includes a statistical compilation of the number of events and related impacts for the two highest-ranked hazards for the Town of Vienna: winter weather and floods/flash floods.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

The Town of Vienna participates in the National Flood Insurance Program (NFIP).

Table 14: Town of Vienna National Flood Insurance Program Status[11]

Init FHBM Identified	8/2/1974
Init FIRM Identified	2/3/1982
Current Effective Map Date	9/17/2010
Reg-Emer Date	2/3/1982

Table 15: Town of Vienna NFIP Policy and Claims Statistics[12]

Policies In-Force	120
Premiums Paid	$82,120
Total Claims	19
Total Payment	$222,630

Table 16: NFIP Status, as of September 24, 2021

Category	NFIP Topic	Source of Information	Comments
Insurance	How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Unknown
Insurance	How many claims have been paid in the community? What is the	EMA NFIP or Insurance Specialist	Unknown

[11] FEMA NFIP Community Status Report, September 9, 2021
[12] FEMA NFIP Community Status Report, September 9, 2021

Category	NFIP Topic	Source of Information	Comments
	total amount of paid claims? How many of the claims were for substantial damage?		
Insurance	How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA)	Unknown
Insurance	Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	Unknown
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	Community FPA/NFIP Coordinator holds Professional Engineer (PE) and Certified Floodplain Manager (CFM) certifications.
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	Floodplain management is a primary function of Risk Management.
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	The full range of NFIP administrative services (permitting, inspections, outreach, GIS, and engineering analysis) is provided by Planning and Zoning.
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	There are currently no barriers.
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Compliance History	Are there any outstanding compliance issues (i.e., current violations)?		No
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		July 1, 2020

Other hazard information for the Town of Vienna is presented in the **Base Plan**.

5.2. Population

Estimates of the number of residents in the Town of Vienna vulnerable to each hazard are presented in the various hazard sections in the **Base Plan**.

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations. The Overall CDC SVI for Fairfax County, including the Town of Vienna, is presented in **Annex 7, Fairfax County**.

5.3. Built Environment and Community Lifelines and Assets

Using the best Hazus data available, scenarios were run at the county level for earthquakes, floods, and hurricane winds to determine potential exposure of buildings, infrastructure, and the economy. Information presented in **Annex 7; Fairfax County** includes the Town of Vienna.

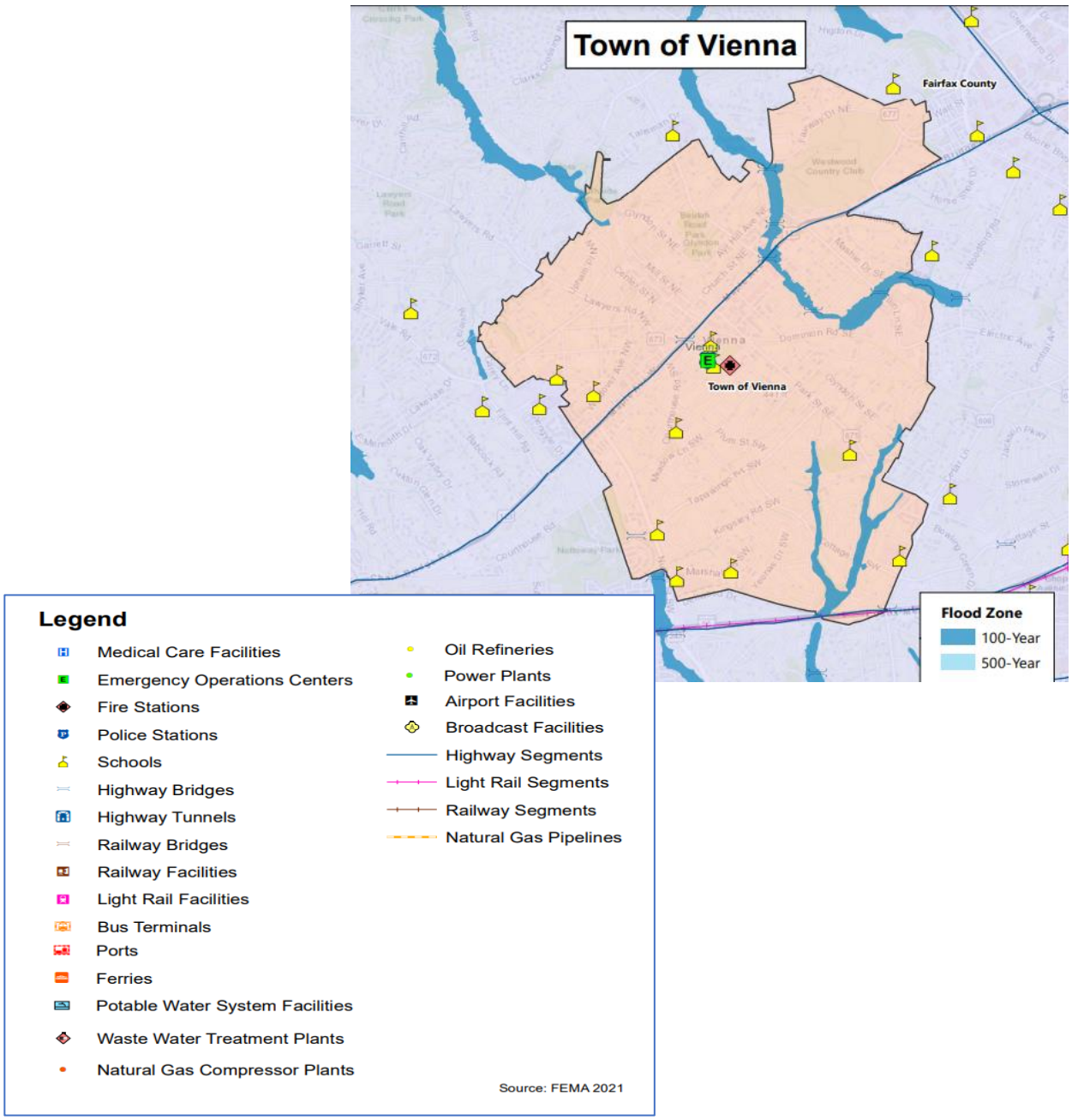
Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events. The vulnerability of critical infrastructure is presented in the lifeline sector categories identified by FEMA.

Table 17: Community Lifelines/Critical Facilities Exposed to FEMA Floodplains, Town of Vienna[13]

Facility Type	In 100-Year Floodplain	In 500-Year Floodplain	TOTAL
Highway Bridges	8	6	14
Highway Segments	1	1	2

[13] Hazus

Figure 7: Critical Facilities in 100- and 500-Year Floodplains, Town of Vienna[14]



[14] Hazus, Flood Scenarios, August 3, 2021.

5.4. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

5.5. Economy

Information related to economic vulnerability is presented in the hazard sections of the **Base Plan**.

5.6. Cultural/Historical

Information related to the vulnerability of cultural and historical assets is presented in the hazard-specific sections of the **Base Plan**.

Historic structures and sites are frequently more vulnerable to flood hazards due to the typical development of a city or town along a waterway. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites.

The Town's provisions for historic properties require oversight of the process for review and approval of applications for any plans related to construction, repair, alteration, or modification of buildings and structures in the Town to ensure that these plans are consistent with historic preservation principles and guidelines. The historic designation assists in making sure that appropriate measures are applied in post-disaster impact conditions to protect cultural and historical assets from inappropriate repair, demolition, or redevelopment.

6. Capability Assessment

The Town of Vienna reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
- Administrative and technical
- Safe growth
- Financial
- Education and outreach

6.1. Capability Assessment Summary, Ranking, and Gap Analysis

The Town ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the Town's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction has limited capabilities within this category and is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities within this category and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities within this category, but improvement is needed in order to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities within this category as demonstrated by its authorities, programs, plans and/or resources, and can implement most mitigation actions.

Table 18: Capability Assessment Summary Ranking for Town of Vienna

Capability	Ranking
Planning and Regulatory	Moderate
Administrative and Technical	Moderate
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary

Vienna utilizes the all-hazards approach when developing any jurisdictional plans, including emergency operations, continuity of operations, hazard-specific plans, and the hazard mitigation plan.

The following plans and studies have been developed or updated since the 2017 HMP:

- Town of Vienna Comprehensive Plan, 2015 Update, amended October 5, 2020.
- Town of Vienna Capital Improvement Plan.
- Town of Vienna 2019 Strategic Plan.
- Town Code, Chapter 17-Subdivision Ordinance, Chapter 18-Zoning Ordinance, and Chapter 18.1- Floodplain Ordinance.
- Multi-Modal Transportation and Land Use Study.
- Fairfax County Community-Wide Energy and Climate Action Plan (CECAP).
- Fairfax County Emergency Operations Plan dated June 2019.
- Fairfax County Pre-Disaster Recovery Plan dated April 2020.

In addition to the plans mentioned above, Vienna maintains a stormwater management plan and a historic preservation plan. The Town's comprehensive, capital improvement, and stormwater management plans address natural and non-natural hazards and mitigation projects. Examples include resiliency planning for extreme weather events and sewer and drainage capital improvements. They are currently in the process of developing an economic development plan.

Capability Analysis: Moderate

The Town of Vienna maintains plans and regulations that support appropriate development and limit impacts in hazard-prone areas. The capability assessment confirmed that projects or actions can be incorporated into the Strategic Plan and Capital Improvement Plan to address priorities that should reduce the risk of specific hazards, such as a flood. The Town maintains a floodplain ordinance and stormwater management plan. The Town has a zoning compliance officer and enforces Chapter 18 of the Town Code, which prohibits construction on land subject to periodic or recurring flooding from stormwater or erosion. The Town is currently working with FEMA to update flood maps and is in the process of preparing an economic development plan. The Town notes the following areas for improvement: increased staffing, increased public education, and enhancement of code and plan enforcement.

6.1.2. Administrative and Technical Capabilities Summary

- The engineer has an understanding of natural and manmade hazards and is trained in construction practices related to buildings and infrastructure.
- The Town has a Floodplain manager, a surveyor, and grant writers.
- The Town Clerk may assist with grant writing, but this is not defined as a specific job duty.
- The Police Department has an emergency manager and staff with the expertise to assess the community's vulnerability to hazards.
- Warnings are issued through the IT Department and Public Information Officer.

Capability Analysis: Moderate

The Town of Vienna currently has limited emergency management staffing capabilities; however, the 2019 Strategic Plan describes establishing an emergency management division and creating an emergency management operations center in the new police facility as action steps with target dates of 2020 and 2022, respectively. The Town identified the following areas for improvement in its administrative and technical capabilities:

- Secure additional staff.
- Look for grant opportunities to expand capabilities.
- Conduct tabletop exercises with the Fairfax County Department of Emergency Management and Security to improve coordination and face time.
- Summary of Safe Growth Capabilities.
- Growth guidance instruments include land use and environmental policies that maintain and protect development in vulnerable areas.
- The capital improvement program provides funding for hazard mitigation projects identified in the NOVA HMP.

Capability Analysis: Moderate

The Town of Vienna has significant safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment.

6.1.3. Safe Growth Summary

- Growth guidance instruments include the Town's zoning ordinance and site plan review requirements.
- The Capital Improvement Program currently does not provide funding for hazard mitigation projects identified in the NOVA HMP.

Capability Analysis: Moderate

The Town of Vienna has a moderate capacity to address growth. The Town is currently undertaking a community intensive effort to clarify, simplify, reorganize, and update its zoning and subdivision ordinance. The current ordinance addresses the floodplain, flood damage prevention, and post-disaster. Additional staffing and enhanced enforcement of codes and plans are needed to increase the Town's capability.

6.1.4. Financial Capabilities Summary

- Current capital improvement projects address roadways and storm drainage.
- The Town has the authority to levy taxes for specific purposes and incur debt through general obligation bonds, but it is unlikely to do so.

The Town imposes impact fees for new subdivisions and utilizes a stormwater utility fee.

- The Town participates in the Community Development Block Grant program and other federal and state funding programs.

Capability Analysis: Moderate

The Town of Vienna has identified the need for funding and more staff positions to improve financial capabilities.

6.1.5. Education and Outreach Capabilities Summary

- The Town publicized the public survey for the NOVA HMP update process by sending out flyers, publishing e-newsletters, advertising at public works, and posting on social media.
- Historic Vienna, Inc. is a local non-profit organization focused on preserving the cultural and historical assets of the community. The organization is proactive in educating the public about the importance and protection of these assets.
- Fairfax County is designated as a StormReady community, which means that the Town is included in components of public education and training.
- The Fairfax County Park Authority promotes the concepts and actions of the FireWise program.
- The county partners with local schools to participate in the Student Tools for Emergency Planning (STEP) program curriculum, which includes teaching fifth-grade students how to pack an emergency preparedness bag.
- Community Rating System initiatives within the NFIP program can increase public awareness of and involvement in hazard mitigation.

Capability Analysis: Moderate

The Town has existing education and outreach mechanisms that can be utilized to increase awareness about mitigation. The Town relies significantly on Fairfax County to implement education and outreach related to hazard mitigation. This capability can be enhanced by having the Virginia Department of Emergency Management mitigation staff provide technical assistance to support increased jurisdictional involvement. Many hazard mitigation educational tools and materials are available from state agencies, as well as disaster preparedness and response organizations such as the American Red Cross, FEMA, and faith-based organizations with disaster response missions.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, the Town of Vienna identified activities related to each natural hazard that support risk reduction.

Table 19: Capability Summary - Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Drought	Public education and operational plans address preparedness and response to reduce risk. Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	State and international building codes provide for seismic design regulations. Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	Public education and operational plans address preparedness and response to reduce risk.

Hazard	Activity
Flood/Flash Flood	Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. Stormwater management program and projects address flood prevention and risk reduction.
High Wind/Severe Storm	State and international building codes provide for wind load design regulations.
Landslide	Land use and environmental policies acknowledge the importance of protecting the natural environment.
Winter weather	Public education and operational plans address preparedness and response to reduce risk.
Tornado	Public education and operational plans address preparedness and response to reduce risk.
Wildfire	Public education and operational plans address preparedness and response to reduce risk.
Non-Natural Hazards	Public education and operational plans address preparedness and response to reduce risk. Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate Change	Ongoing resilience planning and utilizing the *Community-wide Energy and Climate Action Plan* will allow for the identification and mitigation of climate change-related issues in future planning cycles.

7. Resilience to Hazards

7.1. National Risk Index

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of “low risk” is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience. The NRI is a dataset and online tool developed by FEMA and other partners to help illustrate communities in the United States at risk for 18 natural hazards. Hazard risk is calculated on data for a single hazard type and reflects the relative risk for that hazard type and should be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently from the hazards in this plan, so a direct hazard-to-hazard comparison of risk cannot be determined. The NRI is a county-level risk ranking, which includes towns and is presented in **Annex 7, Fairfax County, Section 7.4**.

7.2. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

- Climate change

8. Mitigation Actions

8.1. Goals and Objectives

The Town of Vienna Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

The Town of Vienna reviewed the mitigation actions in the 2017 NOVA HMP to identify the current status. Some projects that contribute to risk reduction may have been completed or are currently in progress, but have not been included in this update for one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and resulting risk reduction.

The Town decided to retain all 12 mitigation actions from previous plans for the 2022 NOVA HMP update.

8.3. New Mitigation Actions

The Town of Vienna Planning Team identified three new mitigation actions that, along with the 12 retained actions, will be implemented in the next planning cycle. Proposed actions address risks consistent with the jurisdiction's highest risk hazards, i.e., floods/flash floods and high winds/severe storms, in addition to actions that address hazard mitigation education programs for all hazards. **Attachment 3** of this annex includes a table that lists the new mitigation actions for the Town of Vienna.

8.4. Action Plan for Implementation and Integration

The Town of Vienna Emergency Management Coordinator in the Police Department is responsible for coordinating the implementation of the hazard mitigation activities. The designated Coordinator will monitor the implementation of the jurisdiction's actions and participate in the implementation of the multi-jurisdictional regional plan, as related to the Town of Vienna. Tasks to ensure that the Town's actions are implemented are integrated into the *Action Plan for Implementation and Integration* (which includes the prioritized list of Mitigation Actions) and plan maintenance procedures described in the next section. The Action Plan for Implementation and Integration describes how the Town's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 20: Action Plan for Implementation and Integration, Town of Vienna

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into the local comprehensive plan.	Continue to coordinate with the Planning and Zoning Department and other applicable departments to incorporate current and emerging risks and actions into planning efforts.

Review/update land development regulations for consistency with mitigation goals.	Continue coordination with the Planning and Zoning Department regarding future land use projects.
Review/update building/zoning codes for consistency with mitigation goals.	Work with the Zoning Administrator regarding Town zoning ordinances and consistency with mitigation goals.
Maintain regulatory requirements of the floodplain management program (NFIP).	Support the Department of Planning and Zoning, which is responsible for floodplain management.
Continue public engagement in mitigation planning.	Continue to promote awareness of hazards and incorporate public feedback into planning processes.
Identify opportunities for mitigation education and outreach.	Identify opportunities to conduct community outreach to promote the importance of mitigation projects.
Review/update emergency plans to address evacuation and sheltering.	Evacuation has been identified as a priority incident annex to be developed as part of the 2021 update to the Town's EOP.
Maintain ongoing enforcement of existing policies.	Support the Department of Planning and Zoning with any applicable enforcement policies.
Monitor funding opportunities.	The Police Department will continue to monitor funding sources and coordinate with Departments on projects that support mitigation actions.
Incorporate goals and objectives into day-to-day government functions.	The Police Department will incorporate the concept of mitigation into day-to-day government functions, including continual monitoring of the action items identified in the 2022 update.
Incorporate goals into day-to-day development policies, reviews, and priorities.	Continue to work with the Departments of Public Works and Planning and Zoning to incorporate mitigation into day-to-day activities.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 21: Town of Vienna Plan Maintenance Responsibilities for the *Northern Virginia Hazard Mitigation Plan,* Base Plan

Activity	Responsibilities
Monitoring the Plan	Represent the jurisdiction during the monitoring process. Collect, analyze, and report data to the NOVA Planning Team. Maintain records and documentation of all jurisdictional monitoring activities. Assist in disseminating reports to stakeholders and the public. Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	Represent the jurisdiction during the evaluation process. Collect and report data to the NOVA Planning Team. Maintain records and documentation of all jurisdictional evaluation activities. Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. Collect and report data to the NOVA Planning Team. Maintain records and documentation of all jurisdictional plan review and revision activities. Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP Base Plan**, the Town of Vienna Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**. The Town's maintenance method and schedule may coincide with that of Fairfax County and be conducted simultaneously.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following a major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in the fifth year

Table 22: Town of Vienna Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with the jurisdiction planning team. 2. Review the status of all mitigation actions, using the *Mitigation Action Implementation Worksheet* (**Section 3, Attachment A, NOVA HMP Base Plan**).	• Produce an annual report that includes the following: ▪ Status update of all mitigation actions ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities ▪ Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	1. Schedule the annual plan evaluation with the jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the *Planning Considerations Worksheet* (**Section 3, Attachment C, NOVA HMP Base Plan**).	• Submit the annual report to the NOVA HMP Project Team Point of Contact
Updating the Annex	1. Coordinate with Fairfax County and the Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

Mitigation actions presented in this Jurisdiction Annex may be reviewed, revised, and updated at any time.

The Town of Vienna will continue to partner with multiple jurisdictions and regional entities, including Fairfax County, to identify hazard mitigation opportunities that reduce the risk of the hazards identified in this plan.

10. Annex Adoption

The Town of Vienna Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation*.

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Action Worksheets

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this Jurisdiction]

11.2. Attachment 2: Documentation of Public Participation

Figure 8: Public Survey Outreach

Figure 9: Public Survey Outreach social media

Keeping it Moving Along the Pipeline

The next time you see Vienna public works staff huddled around a manhole, remember, there's usually no cause for alarm. Each year, the Department of Public Works assesses sanitary sewers, identifies those that are showing signs of deterioration and relines them as needed. The preventive maintenance helps assure trouble-free service to the town's homes and businesses.

"It's all about customer service in the end," said project engineer Frank Torre. "Relining the pipes only requires one day of work and can save weeks of construction impacts, traffic disruption, costs, and headaches if we were to dig and replace the pipes every time they needed repair."

Each sewer location and relining project is carefully planned and executed through a process known as the cured-in-place pipe-lining process (CIPP). CIPP creates a new interior surface inside existing sewer mains, with little noise and disruptions associated with traditional sewer line replacements.

Before any work is done, crews check for obstructions in the public portion of drain system. If there aren't any obstructions, a liner made of fabric and felt resin is inserted underground. As this happens, hot steam is pumped throughout the 8-inch sewer, which helps to unroll and then harden the liner inside the existing sewer pipe. The liner unrolls itself in the sewer pipe, much like putting on a sock. It takes three to four hours for the new liner to cure and cool, after which the crew uses a robotic cutter guided by a special camera to cut openings for private sewer lateral connections to homes or businesses. Residents are then free to use their sewer systems again.

Of course, if pipes are beyond repair, they are replaced. But with annual assessments, the Department of Public Works can often identify priorities before they become sewer emergencies and address problem areas with this cost-effective and efficient sewer lining process - CIPP.

Friendly Reminder: Mind your Manners

The Freeman Store and Museum is one of the most treasured historic landmarks in town. It's listed on the Virginia Landmarks Register and on the National Register of Historic Places. But more and more these days, children left unsupervised have created front-step scenes like this, which is not only disrespectful, but it also creates unsafe conditions for visitors who may slip and fall on the unstable surface. The pebble-throwing happens so frequently, thinly stretched park crews are having a tough time keeping the steps clean. When visiting the Freeman Store with children, please be mindful of their activities and discourage throwing pebbles on the front steps of this 163-year-old treasure!

Public Meetings Move

Due to Town Hall elevator construction, all regular Town Council meetings, Planning Commission meetings and several other public meetings will be held at the Community Center beginning Oct. 11 through the end of 2022. Council conference sessions and some other public meetings will be held at the police department community room. For location details, visit the online Town Calendar: www.viennava.gov/calendar.

Help Mitigate Hazards!

The best time to plan for a disaster is before it happens. That's why the Town of Vienna Police Department is partnering with the Fairfax County Office of Emergency Management to update the Northern Virginia Hazard Mitigation Plan, and the planners need your help! The goal is to minimize or eliminate long-term risks to human life and property from known hazards such as droughts, floods, winter weather, high winds and other major disasters. The final draft of the plan is done, and now the public safety officers want to know what you think! Please review the Vienna portion of the plan at this link: www.nvers.org/hmp and email feedback to NOVA2022PublicComment@iem.com by 5 p.m. on Oct. 8. Your comments will help inform the plan for disaster mitigation and response for the next five years!

www.viennava.gov • OCTOBER 2022 • 5

Figure 10: Final Draft Public Comment Outreach

11.3. Attachment 3: Mitigation Actions

Table 23: Previous Mitigation Actions

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status
2010-1	Assess the roadway structure at various intersections throughout the Town of Vienna to avoid repeated flooding.	Public Works Department	• Flood • High Winds • Severe Storm	Hazard Mitigation Assistance grant funding, County Funding	Ongoing	Identify funding sources by January 2025.	High	Retain
2010-2	Continue to identify and employ a broad range of warning systems throughout the Town of Vienna.	Police Department	• All Hazards	UASI funding, DHS grants, Town/County funding	Ongoing	Identify one new warning system to utilize by December 2025.	High	Retain
2010-3	Conduct annual outreach to FEMA-listed repetitive loss and severe repetitive loss property owners, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance) that can assist them in reducing their flood risk.	Police Department	• Flood • High Winds • Severe Storm	FEMA Unified Hazard Mitigation Assistance funding for qualified structures	Ongoing	Develop outreach materials or identify appropriate outreach materials for dissemination by June 2025.	Medium	Retain
2010-4	Support mitigation of priority flood-prone	Police Department	• Flood	FEMA Unified Hazard	Ongoing	Identify all priority flood-	Medium	Retain

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status
	structures through the promotion of acquisition/demolition, elevation, flood-proofing, minor localized flood control projects, and mitigation reconstruction where feasible. Use FEMA HMA programs where appropriate.		• High Winds • Severe Storm	Mitigation Assistance funding for qualified structures		prone structures by December 2025.		
2010-5	Promote structural mitigation to assure redundancy of critical facilities, including but not limited to roof structure improvement, meeting or exceeding building code standards, upgrading of electrical panels to accept generators, etc.	Police Department	• Flood • High Winds • Severe Storm	FEMA Unified Hazard Mitigation Assistance funding for qualified structures	Ongoing	Query local government building services staff as to the effectiveness of provided information regarding the structural review.	Medium	Retain
2010-6	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct an annual	Police Department	• Flood • High Winds • Severe Storm	General Funds	Ongoing		Medium	Retain

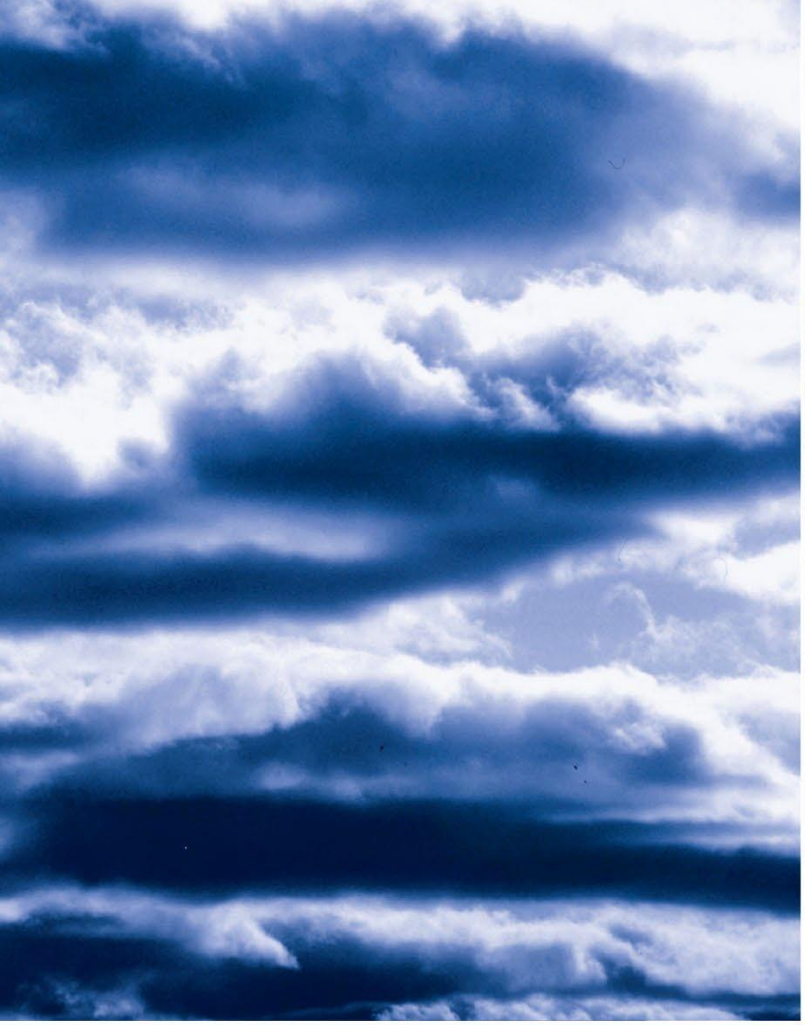
Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status
	review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property, a determination on whether that property has been mitigated, and if so by what means. Provide corrections if needed by filing form FEMA AW-501.							
2017-1	Assess the roadway structure at various intersections throughout the Town of Vienna to avoid repeated flooding.	Public Works Department	• Flood • High Winds • Severe Storm	Hazard Mitigation Assistance grant funding, County Funding	Ongoing	Identify funding sources by January 2022.	High	Retain
2017-2	Continue to identify and employ a broad range of warning systems throughout the Town of Vienna.	Police Department	• All Hazards	UASI funding, DHS grants, Town/ County funding	Ongoing	Identify one new warning system to utilize by December 2022.	High	Retain
2017-3	Conduct annual outreach to FEMA-listed repetitive loss and	Police Department	• Flood • High Winds	FEMA Unified Hazard Mitigation	Ongoing	In partnership with Fairfax County, seek	Medium	Retain

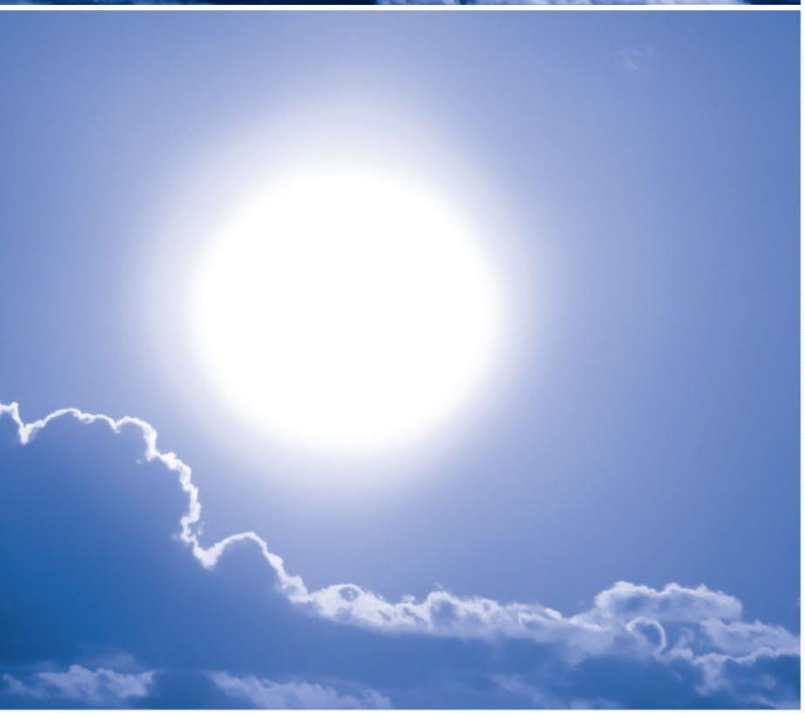
Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status
	severe repetitive loss property owners, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.		• Severe Storm	Assistance funding for qualified structures		to develop outreach materials or identify appropriate outreach materials for dissemination by June 2022.		
2017-4	Support mitigation of priority flood-prone structures through the promotion of acquisition/demolition, elevation, floodproofing, minor localized flood control projects, mitigation reconstruction where feasible. Use FEMA HMA programs where appropriate.	Police Department	• Flood • High Winds • Severe Storm	FEMA Unified Hazard Mitigation Assistance funding for qualified structures	Ongoing	Identify all priority flood-prone structures by December 2022.	Medium	Retain
2017-5	Promote structural mitigation to assure redundancy of critical facilities, including but not limited to roof structure improvement, meeting or exceeding building code standards, upgrading of electrical	Public Works Department	• Flood • High Winds • Severe Storm	FEMA Unified Hazard Mitigation Assistance funding for qualified structures	Ongoing	Query local government building services staff as to the effectiveness of provided information regarding the	Medium	Retain

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status
	panels to accept generators, etc.					structural review.		
2017-6	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct an annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. The review will include verification of the geographic location of each repetitive loss property, a determination on whether that property has been mitigated, and if so, by what means. Provide corrections if needed by filing form FEMA AW-501.	Police Department	• Flood • High Winds • Severe Storm	General Funds	Ongoing	In partnership with Fairfax County, establish a schedule of review and review committee (if necessary) by June 2025.	Medium	Retain

Table 24 New Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard(s)	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-1	Work with FEMA to reexamine flood zones and update FIRMS. Use this information to reevaluate NFIP activities.	Public Works Department	• Flood • High Winds • Severe Storm	FEMA Unified Hazard Mitigation Assistance Funding, Town's capital budget	Ongoing	Multiyear project; meet FEMA deadlines throughout project.	Medium	Use this information to reevaluate NFIP activities.
2022-2	Continue to implement building and development standards as required under the NFIP.	Planning and Zoning Department	• All Hazards	Hazard Mitigation Assistance grant funding, U.S. Army Corps of Engineers, Town funding, VDEM		Implement one new standard every year.	Medium	When updates are made to building and development standards, they are reviewed and incorporated as appropriate. All new policies and procedures are in accordance with the NFIP.
2022-3	Develop an outreach/ education program aimed at promoting hazard mitigation for the residents of Vienna.	Police Department and Planning and Zoning Department	• All Hazards	Town funding			High	This program will be completed when funding becomes available.





Northern Virginia Hazard Mitigation Plan

Annex 8: Loudoun County

November 2022— FINAL

Loudoun County Overview

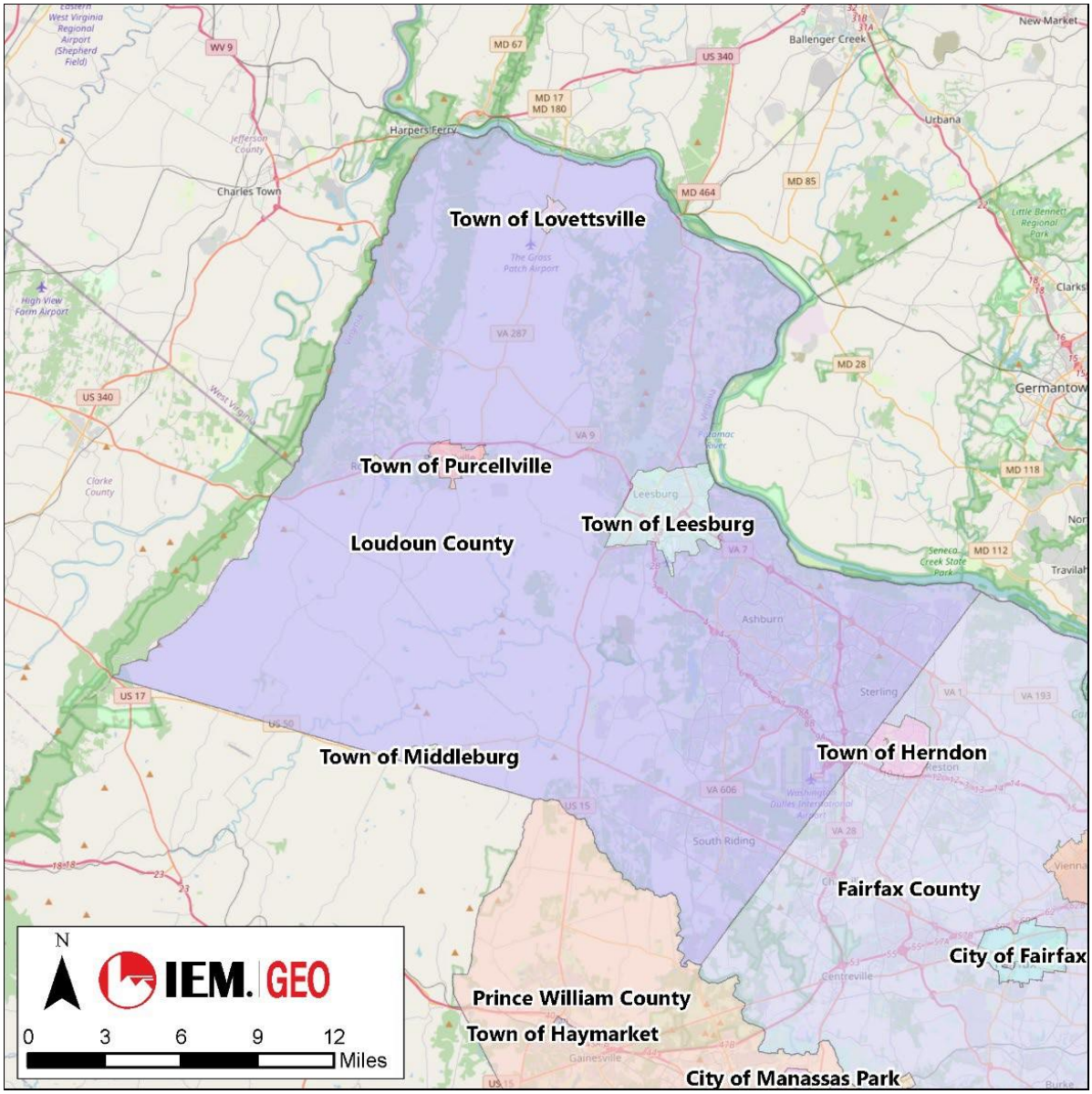


Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1757	520 sq. mi.	421,636	1 Harrison St. Leesburg, VA 201745	142,074	Flood and Severe Storms

Loudoun County's Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI), 1950–June 2021

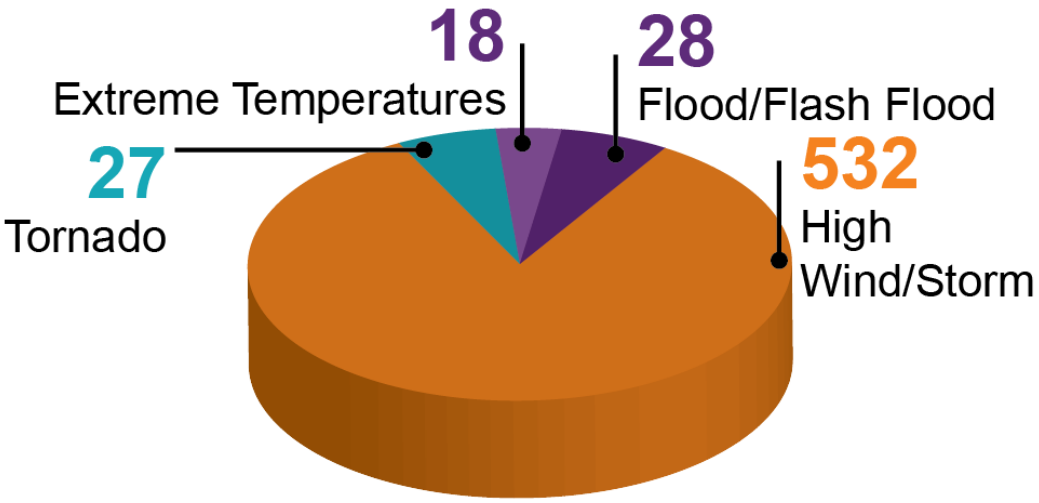


Figure 1: Number of Hazards

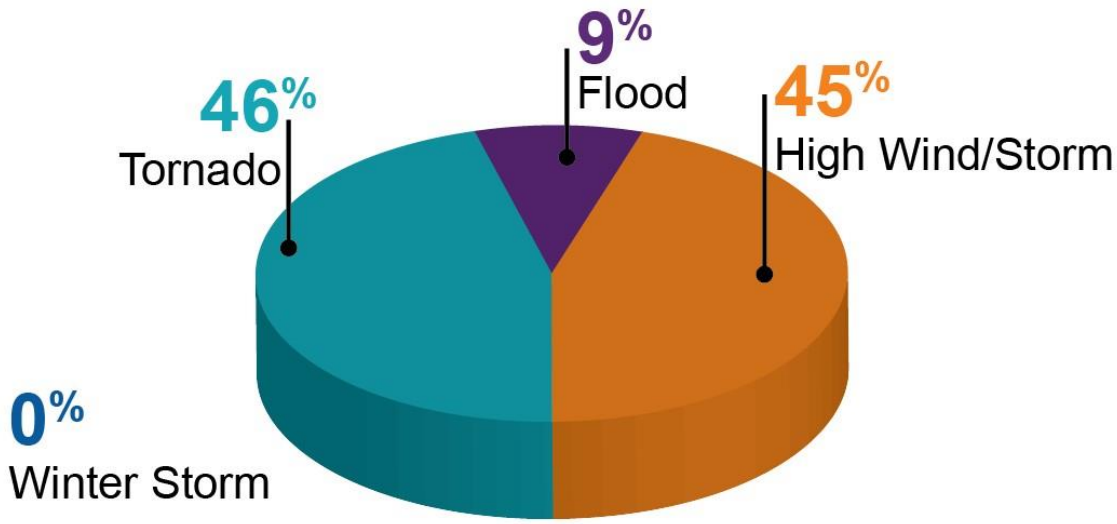


Figure 2: Property Damage Percentages from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Natural Hazard Risk Ranking Summary

Hazard	Hazard Ranking
Winter Weather	**High**
High Wind/Severe Storm	**High**
Flood	**High**
Tornado	**High**
Dam Failure	**Medium**
Drought	**Medium**
Extreme Temperatures	**Medium**
Earthquake	**Medium**
Landslide	**Low**
Wildfire	**Low**
Karst/Sinkhole/Land Subsidence	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	28
Food, Water, Shelter	59
Health and Medical	19
Energy	14
Communications	56
Transportation	922
Hazardous Materials	437
Education	146
Cultural/Historical	22
High Hazard Dams	23

A lifeline enables the continuous operation of government and business functions that are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity. The information related to Community Lifelines and critical assets in Loudoun County is primarily provided by Hazus (Version 4.2). Due to the time lag in collecting and verifying data and the method of documenting location and jurisdiction used in Hazus, this may not reflect the current inventory maintained by Loudoun County. Further information about Community Lifelines is discussed in Section 1.4 of this document.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for Loudoun County

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	High
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Kelly Myers, Assistant Coordinator–Planning Division Loudoun County Office of Emergency Management 703-771-5788–TTY 711 Kelly.Myers@loudoun.gov 801 Sycolin Road, SE Suite 100 Leesburg, VA 20175
Secondary Point of Contact	Jeff Fletcher, Deputy Coordinator 703-771-5788–TTY 711 Jeff.Fletcher@loudoun.gov 801 Sycolin Road, SE Suite 100 Leesburg, VA 20175

Loudoun County

This annex presents the following jurisdiction-specific information provided by Loudoun County for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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1. Jurisdiction Profile

Established	1757
Incorporated Towns	7
Total Land Area	520 square miles (515 on land, 5 on water)
Geographic Region	Piedmont/Coastal Plain
Persons Per Household	3.06
Persons Per Square Mile	810
Median Age	36.2
Elevation	180 to 1,900 feet above sea level

1.1. Location

Located in the northeast region of the Commonwealth of Virginia, Loudoun County is part of the suburban ring of Washington, D.C. The county is partially bounded on north by the Potomac River. Directly across the river are three Maryland counties: Frederick, Montgomery, and Washington.

Loudoun County it is bounded on the east by Fairfax County, on the south by Prince William and Fauquier Counties, and to the west by Clarke County (VA), Jefferson County (WVA), and the Blue Ridge Mountain watershed. The Bull Run Mountains and Catoctin Mountain bisect the county. To the west of the range is the Loudoun Valley. Short Hill Mountain bisects the Loudoun Valley from Hillsboro to the Potomac River.

1.2. History

Loudoun County constitutes a part of the 5-million-acre Northern Neck of Virginia Proprietary granted by King Charles II of England to seven noblemen in 1649. This grant, later known as the Fairfax Proprietary, lay between the Potomac and Rappahannock Rivers. Between 1653 and 1730, Westmoreland, Stafford, and Prince William Counties were formed within the Proprietary, and in 1742 the remaining land was designated Fairfax County.

In 1757, by act of the Virginia House of Burgesses, Fairfax County was divided. The western portion was named Loudoun for John Campbell, the fourth earl of Loudoun, a Scottish nobleman who served as commander-in-chief for all British armed forces in North America and titular governor of Virginia from 1756 to 1759. Leesburg has served continuously as the county seat since 1757.

1.2.1. Loudoun Settlements

In-migration to the area in and around Loudoun County began between 1725 and 1730, while it was owned by Lord Fairfax. Permanent settlers came from Pennsylvania, New Jersey, and Maryland. During the same period, settlers from eastern Virginia, of English Cavalier stock, came to lower Loudoun and established large tobacco plantations. From 1745 to 1760, Germans from Pennsylvania and Maryland formed the settlement at Lovettsville. After General Braddock's defeat by the French at Fort Duquesne in 1755, refugees from the Shenandoah Valley of Virginia settled in the western part of Loudoun County, south of Short Hill. Catoctin Church became the center of that settlement.

For over two centuries, agriculture served as the main driver of the Loudoun County economy which had a relatively constant population of about 20,000. That began to change in the early 1960s, when Dulles

International Airport was built in the southeastern part of the county, with parts of the airport located in both Loudoun and Fairfax Counties. The airport attracted new businesses, workers, and their families to the area and increased tourism in the overall region, including the nation's Capital.

In addition to farm and cattle operations, the region supports large equine and microbrewery industries. In October 2021, the Virginia Equine Alliance generated an economic impact of over $540 million and provided over 5,000 jobs across the Commonwealth.[1] Farms are also expanding their scope and have become a magnet for microbreweries since 2012, when the state allowed these businesses to serve pints instead of samples to visitors.[2] The website VisitLoudoun.org states that there are currently over 30 breweries in the county and the industry is growing.[3]

The 1970 population of 35,500 grew at a moderate pace for the next decade, reaching 87,208 in 1990. Beginning in 1990, the metropolitan region of Washington, D.C. began a period of rapid growth, spurred by the improvement of major transportation routes that enabled the resident population to commute to nearby industry centers. Development in the western areas of Loudoun County and inbound population movement to the area has been fostered by road access. In the last three decades, the population of Loudoun County has nearly quadrupled. The population grew 41% between 1990 and 2020, but growth in population since 1970 is significant at 1,138%.

Today, Loudoun County is a growing, dynamic county of 421,636 residents, renowned for its beautiful scenery, rich history, healthy diversity of expanding business opportunities, comfortable neighborhoods, and high-quality public services.

Due to its location on both the Virginia Piedmont near the Potomac River and its mountainous western region, the county experiences weather of all types, thus increasing the area's vulnerability to a range of hazards, notably flooding and severe storms. In addition to snow melt and rain-related river flooding episodes, low-lying areas of Loudoun County along the Potomac River are also subject to tidal and storm surge flooding. As sea levels rise, permanent inundation of low-lying areas along and near the river shoreline is also a threat. Additionally, winter storms pose significant threats, as evidenced during the 2015–2016 winter season, when snow levels in late January reached between 23 and 31 inches across the county, and ice and blizzard-related wind conditions impacted travel and caused power outages and property damage.

1.3. Demographics, Economy, and Governance

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context for the entire plan. The 2020 U.S. census population estimate for Loudoun County is 421,636, an increase of approximately 35% since 2010. The population density is 810 persons per square mile, significantly lower than other Northern Virginia counties, such as Fairfax County with 2,941.8 residents per square mile. Since 2008, the county has been ranked among the highest in the U.S. in median household income among jurisdictions with a population of 65,000 or more.

1 Roy, Lisa (WUA) and McBride, Sharla (WUSA) (2021, October 28), A deeper look at the cultural and economic importance of horses in Virginia, WUSA9, https://www.wusa9.com/article/features/cultural-economic-importance-horses-middleburg-virginia-salamander-hotel-national-sporting-library/65-0c508db6-0c1b-4d70-bcf5-2337015fc5
2 Freed, Benjamin, (2016, August 11), How Loudoun County Became a Beer-Head's Mecca, The Washingtonian, https://www.washingtonian.com/2016/08/11/Loudoun-county-beer-mecca-breweries/
3 Visit Loudoun, Breweries (ND), https://www.visitloudoun.org/drink/loco-ale-trail/breweries/

Table 6: Population and Growth Rate[4]

Year	Population	Percent Increase over Previous Census
1970	37,150	
1980	57,427	55%
1990	87,208	52%
2000	173,897	99%
2010	312,468	80%
2020	421,636	35%

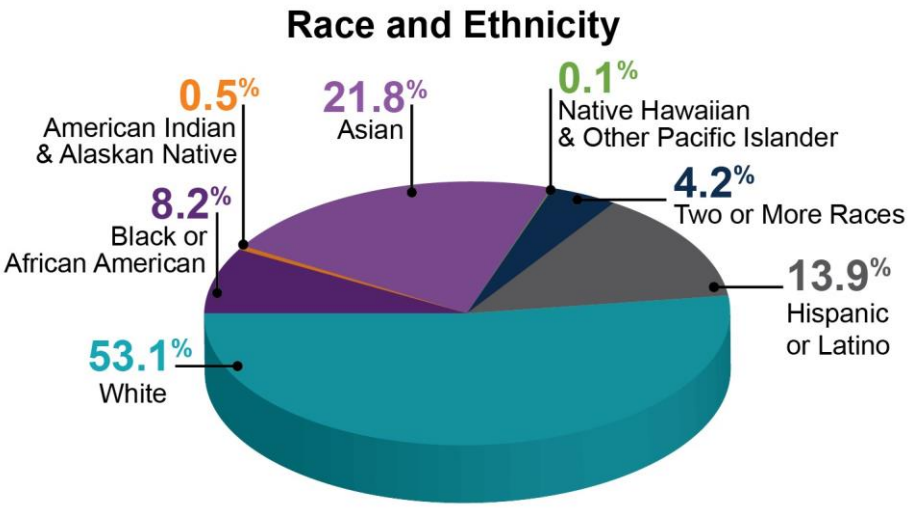


Figure 4: Race and Ethnicity Demographics[5]

Table 7: Economic Data[6]

Economy	Data
Median household income (2021)	$142,299
Unemployment rate (November 2021) (September 2021)	2.1% 2.25%
Per capita income (2019)	$55,744
Median house or condo market value (2021)	$508,100
Percentage below poverty (2019)	3.2%
Number of businesses (2019)	11,028

[4] U.S. Census (1970–2020), City-Data (www.city-data.com), U.S. Census Bureau (www.census.gov), and Loudoun County (www.Loudouncounty.gov)
[5] 2020 U.S. Census
[6] U.S. Census (1970–2020), City-Data (www.city-data.com), U.S. Census Bureau (www.census.gov), and Loudoun County (www.Loudouncounty.gov)

Economy	Data
Most common businesses	Agriculture (1,400 farms), Information and communications technology

Table 8: Urban County Executive Governance[7]

Urban County Executive Governance	Members
Board of Supervisors	9
Constitutional Officers	5
Congressional Districts	1 (VA-10)
Commonwealth's Attorney	1
Commissioner of the Revenue	1
Treasurer	1
County Executive	6
Sheriff	1
Clerk of Circuit Court	1
County Departments/Offices	38

Despite having a high median income, approximately 3.2% of residents live in poverty, the highest group being females between the ages of 1-24, or 17.71% of those impoverished. Rates for all older age groups are higher than those of the male population. It is likely that many of these women are heads of households with dependents under the age of 18.[8]

The county's location in the Washington metropolitan area, its ease of access by car and public transportation, and its highly skilled labor force have attracted an increasingly varied residential and commercial mix. Much of the commercial development in Loudoun County is centered around three stations of Metrorail's Silver Line: the Ashburn Memorial Station, Dulles Airport Metrorail Station, and the Loudoun County Gateway Metrorail Station.

The Loudoun County Department of Economic Development (LCDE)is significant data source for information about current and growth business initiatives. The LCED identified key industry segments as follows:

- Data Centers
- Information and Communication Technology
- Federal Government Contracting
- Aerospace and Defense
- Aviation and Transportation
- Health Innovation and Technology
- Agriculture and Related Businesses

[7] Ibid.
[8] Data USA: Loudoun County, https://datausa.io/profile/geo/loudoun-county-va#housing

The LCDE reported that Loudoun is known as “Data Center Alley” because its data centers are home to more than 3,500 technology companies, including 25+ million square feet of current data centers and with another 4 million square feet under development. Astonishingly, there has not been a single day without data center construction in Loudoun in more than 13 years. Much of the world’s internet traffic passes through Loudoun’s digital infrastructure, making it a key player in the world’s technology economy.

The location of Dulles International Airport in Loudoun County has provided a boost to small businesses for which product shipping is essential to their operations. In an article about Loudoun’s Air Cargo Industry, the LCDE discusses how the agency helped small businesses, such as Georgetown Cupcake and Hypericum Flowers, work through steps needed to manage shipping nationally and internationally.[9]

1.4. Built Environment and Community Lifelines

The information related to Community Lifelines and critical assets in Loudoun County presented in this section has been collected from multiple sources, including Loudoun County Office of Emergency Management, Hazus (Version 4.2), and county government websites. Data extracted from the Hazus Level 1 assessment indicates that Loudoun County has an estimated total of 808 Community Lifelines and critical assets. Due to the time lag in collecting and verifying data and the method of documenting location and jurisdiction used in Hazus, this may not reflect the current inventory maintained by Loudoun County. Additional information about assets is included in the Base Plan.

Table 8 provides a summary of the number of critical assets, by type. Loudoun County maintains a detailed list of Community Lifeline facilities, sites, and critical assets.

Table 9: Number of Community Lifelines and Critical Assets in Loudoun County[10, 11]

Lifeline/Sector	Number of Assets
Safety and Security	28
Food, Water, Shelter	59
Health and Medical	19
Energy	14
Communications	6
Transportation	433
Hazardous Materials	59
Education	145
Cultural/Historical	22
High Hazard Dams	23

[9] Loudoun County Economic Development Council, (2012, May 17), From Flowers to Cupcakes -Loudoun’s Air Cargo Industry, https://biz.loudoun.gov/2012/5/17/from-flowers-to-cupcakes-Loudoun’s-air-cargo-industry/
[10] Loudoun County, Hazus
[11] CountyOffice.gov, Hospitals-Loudoun County, VA (Emergency & Medical Care, https://www.countyoffice.org › Hospitals–Virginia

1.4.1. Safety and Security

Hazus data citing Loudoun County assets to address community Safety and Security included mention of one Emergency Operations Center, 20 fire stations, and eight police stations. Hazus medical data was combined with that found at www.countyoffice.org, a centralized database of government services provided in all 50 states.

1.4.2. Food, Water, Shelter

Food commodities are available throughout Loudoun County from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

Four service providers in Loudoun County provide potable water services: Goose Creek Water Treatment Plant, Hamilton Acres Water Treatment Plant, Kenneth B. Rollins Memorial Water Filtration, and the Town of Purcellville Water Treatment Plant.

Wastewater treatment services are provided in all sectors of the county, although several of those managed by the county are just coming online. These facilities include reservoirs, lift stations, wells, and storage tanks. Hazus reports that there are 30 wastewater treatment plants and services managed by the county and an additional 24 managed by the Town of Round Hill, for a total of 59 wastewater treatment facilities.

1.4.3. Health and Medical

The Hazus program identified four hospitals as being located in Loudoun County:

- Stone Springs Hospital Center
- Inova Loudoun Hospital
- HealthSouth Rehabilitation Hospital
- North Spring Behavioral Healthcare

Additional healthcare resources identified as being located in the county include:

- Three Emergency Services Centers
- Three Health Department Offices
- Three Mental Health Services facilities (in addition to the North Spring facility)

1.4.4. Energy

Fourteen energy assets are identified in the Hazus database as being in Loudoun County. Natural gas pipelines include those maintained by Dominion Transmission Company, Columbia Gas Transmission Company, and Cove Point Pipeline. The county includes three natural gas compressor plants and the Stonewall Power Plant located in Leesburg.

1.4.5. Communications

Most communications and information systems and infrastructure in the United States are privately owned; however, the county maintains authority and control over public safety communications for fire, police, and other responding agencies. Hazus identified one broadcast station (WAGE 1200) as being in

the county, but the Loudoun County Department of Economic Development listed among its business members those who manage local news websites, magazines, and newsletters. Loudoun County is also well served by an array of broadcasters either in the county or the larger surrounding counties, Washington, D.C., and communities directly across the Potomac River in Maryland. On another front, Loudoun County is a national leader in information technologies (IT) communications given the region's concentration of businesses providing IT services.

In recent years, the federal government has taken a stronger role in protecting information and communications infrastructure, which may also present a challenge in relation to disaster impacts. Increasing reliance on this infrastructure by individuals, businesses, and government could cause vulnerabilities which emergency managers should take into consideration in pre- and post-incident planning and operations.

1.4.6. Transportation

U.S. Highway 15 and Virginia Route 7 intersect in Leesburg, providing highway access in all directions. The Point of Rocks bridge on U.S. Highway 15, north of Leesburg, is the only bridge across the Potomac River between it and the Capital Beltway.

Loudoun County is served by the following major highways and commuter lines shown on a map included on the LoudounHistory.org website.

- U.S. Highways: 7, 9, 15, 50, 340
- Loudoun County Parkway
- Dulles Greenway
- Washington Metrorail: Silver Lines

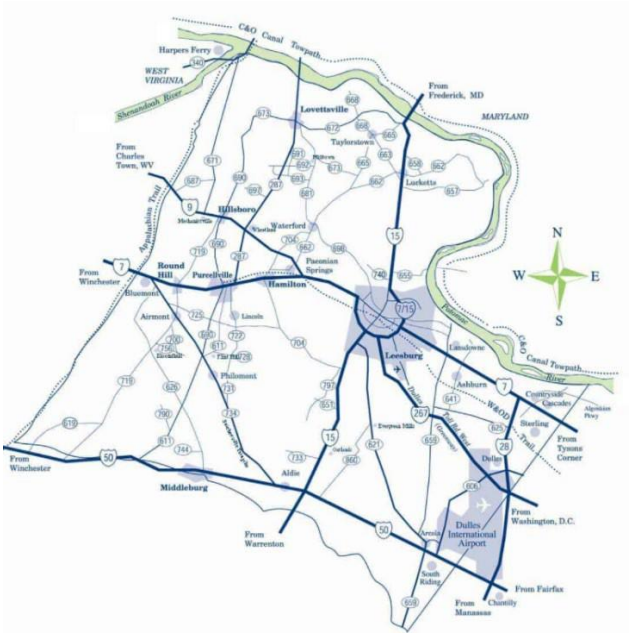


Figure 5: Loudoun County Road and Town Map[12]

[12] The History of Loudoun County, Loudoun County Town and Road Map, https://www.loudounhistory.org/history/history-loudoun/

The maintenance of transportation facilities and systems is the responsibility of the owner or entity with authority, including municipal, county, state, and federal highway departments and agencies; toll and rail authorities; and the military. The Virginia Department of Transportation maintains most primary and secondary roads in Loudoun County, except for the Dulles Toll Road, which is under the authority of the Metropolitan Washington Airports Authority. Loudoun County Transit (LCT) manages local fixed-route bus service from Purcellville through Leesburg and eastern Loudoun County. In keeping with the community's interest in outdoor recreation and environmental preservation, all local buses are equipped with bike racks. LCT also provides paratransit service for eligible persons with disabilities, but fixed-route busses are equipped with wheelchair lifts and are wheelchair-accessible.

Metrorail, operated by the Washington Metropolitan Area Transit Authority, enables commuters, visitors, and area residents a mechanism for travel throughout the Washington, D.C. area. The system is the second busiest in the U.S. and is currently piloting an After-Hours Commuter Service Program.

The Hazus database notes a total of 443 transportation structures, facilities, or segments, including the following:

- Highway bridges: 402
- Highway segments: 39
- Airport facilities: 2

However, it must be noted that the one airport facility listed by Hazus as being in Loudoun County is Leesburg Executive Airport. There are actually two airport facilities in Loudoun County, with Dulles International Airport being the more notable.

1.4.7. Hazardous Materials

The Hazus database identifies a list of assets including 10 natural gas pipelines, three natural gas compressor plants, and one power plant located in Loudoun County. In October 2021, the EPA issued its Toxic Release Inventory (TRI) of chemicals released in the year 2020. The report showed that 9,287 pounds of 19 different chemicals—from 1,2,4 trimethylbenzene and ammonia to xylene and n-hexane—were released through onsite or offsite disposal.[13] The Loudoun County Office of Emergency Management works closely with companies that dispose of chemicals to monitor processes and ensure that hazardous materials are handled safely.

1.4.8. Education

Loudoun County Public Schools (LCPS) is the third largest school division in the Commonwealth of Virginia. Established in 1870, LCPS is in the rapidly growing Washington, D.C., metro area. Loudoun County is the fastest growing county in the Commonwealth of Virginia. Each year, LCPS opens one to three new school facilities to accommodate our growing student population.

LCPS students earned an average SAT score of 1173 (592 Reading and 581 Math). The LCPS Class of 2020 had 54 National Merit Semifinalists and an on-time graduation rate of 96.8%. They earned more than $48.2 million in scholarships. Accreditation was waived by the Virginia Department of Education (VDOE) in 2020 due to the pandemic, but 100% of LCPS schools were fully accredited in 2019. LCPS has a nearly $1.3 billion operating budget and prides itself on competitive starting teacher salaries.[14]

[13] U.S. Environmental Protection Agency, Toxic Release Inventory (TRI), Toxic Release Explorer, Loudoun County Chemical Release Report, https://tinyurl.com/yswvbxct
[14] https://www.lcps.org

A report on LCPS published in *U.S. News and World Report* highlighted key facts:

Table 10: Quick Stats–The Loudoun County School District[15]

Student-Teacher Ratio	14-1
Number of Schools	94
Number of Students	83,606
Minority Enrollment	50%
Economically Disadvantaged	15.3%
Racial Breakdown Percentage	• White: 46.4% • African American: 6.2% • Asian or Asian/Pacific Islander: 22.8% • Hispanic/Latino: 17.9% • American Indian or Alaska Native: 0.6% • Native Hawaiian or other Pacific Islander: 0.1% • Self-identified as being of 2 or more races: 5.6%

At schools in Loudoun County Public Schools, 15.3% of students are eligible for the federal free and reduced-price meal program and 13.9% of students are English-language learners.

Loudoun County has one of the largest public-school districts in the United States, with 198 prekindergarten through twelve grade schools and centers and a diverse student population of 83,606 students. More than 27% of these students are considered economically disadvantaged, and more than 26% of students learn English as a second language.

In addition to these public and private educational facilities within Loudoun County, there are 35 college and university facilities located within its jurisdictional boundaries, including:

- The Art Institute of Washington: Dulles
- Northern Virginia Community College
- George Washington University: Virginia
- George Mason University: Loudoun Campus
- Shenandoah University: Leesburg Campus
- Shenandoah University: Ashburn Campus
- Virginia Polytechnic Institute and State University: Leesburg Campus

1.4.9. Recreational, Cultural, and Historic Sites and Assets

The Loudoun County Department of Parks, Recreation, and Community Services (PRCS) develops and maintains a system of parks, recreational facilities, and community services. At the same time, the Department protects environmentally sensitive land and resources and areas of historic significance. The Department manages a Capital Asset Preservation Program (CAPP) that provides a consistent means of planning and financing asset maintenance efforts. The program provides the county with the ability to extend the useful life of mature and aging features, including repair, total demolition and replacement. CAPP is designed to address and fund replacement and maintenance of park facilities. Features

[15] U.S. News and World Report, n.d., https://www.usnews.com/education/k12/virginia/districts/loudoun-co-pblc-schs-105672

addressed through CAPP can be structural (i.e., structural assessments and replacement of buildings, pavilions, roofs, storage sheds, office building, equipment storage building/maintenance shops, bridges), site-related (i.e., asphalt/concrete, stormwater facilities, channel restoration, playing fields, fences, backstops), mechanical (i.e., outside of buildings), and electrical or plumbing (i.e., boilers, water heaters). CAPP also addresses environmental issues, such as asbestos and lead paint removal and disposal, and the structural integrity of existing and historical buildings which may result in recommendations for removal, replacement, or repair.[16]

- **Arcola Park Pavilion:** Roof Replacement
- **Ashburn Park:** Pavilion Repair
- **Bles Park:** Replace the irrigation line and upgrade the power to the electrical panel
- **Claude Moore Park Fence Replacement:** Fields 1, 2 and 3
- **Conklin Park:** Develop conceptual plans for features and trails within the park. This development must go through the legislative process for a Special Exception with a Site Plan Amendment. The park is in major and minor floodplain.
- **Douglass Community Center:** Trails and Sidewalk Repair/Replacement
- **Franklin Park Tennis Courts:** Repair/Replacement including fence replacement
- **Trailside Park Bridges:** Repair one and replace two of the three bridges in collaboration with the Dept. of General Services, including channel restoration and floodplain study. Includes the need for a retaining wall and guardrails.

Loudoun County is also a member of NOVA Parks (formerly **Northern Virginia Regional Park Authority**), an inter-jurisdictional organization that owns and operates over 10,000 acres of woodlands, streams, parks, trails, nature reserves, countryside, and historic sites in Northern Virginia. The group is governed by a 12-member policy board, with representation from three counties—Loudoun, Arlington, and Fairfax—and three cities—Alexandria, Falls Church, and Fairfax.[17]

1.4.9.1. Historic and Cultural Conservation Districts

The Historic District Program enables Loudoun County to be a Certified Local Government. This gives the county standing with the State Preservation Office to comment on nominations of property to the national and state registers and allows the county to apply for grant money specifically allocated for local preservation efforts. Loudoun County Historic Districts include Aldie, Beaverdam Creek Historic Roads, Bluemont, Goose Creek, Oatlands, Taylorstown, and Watersford. The Towns of Leesburg, Middleburg, and Purcellville also have locally designated historic districts administered by the town governments.[18]

[16] Loudoun County Department of Parks, Recreation, and Community Services (PRCS)
[17] https://www.novaparks.com/about-nova-parks/about-nova-parks
[18] Loudoun County Planning and Zoning, Historic & Heritage Resources, County Historic Districts, https://www.loudoun.gov/2370/County-Historic-Districts

Loudoun County Historic Districts

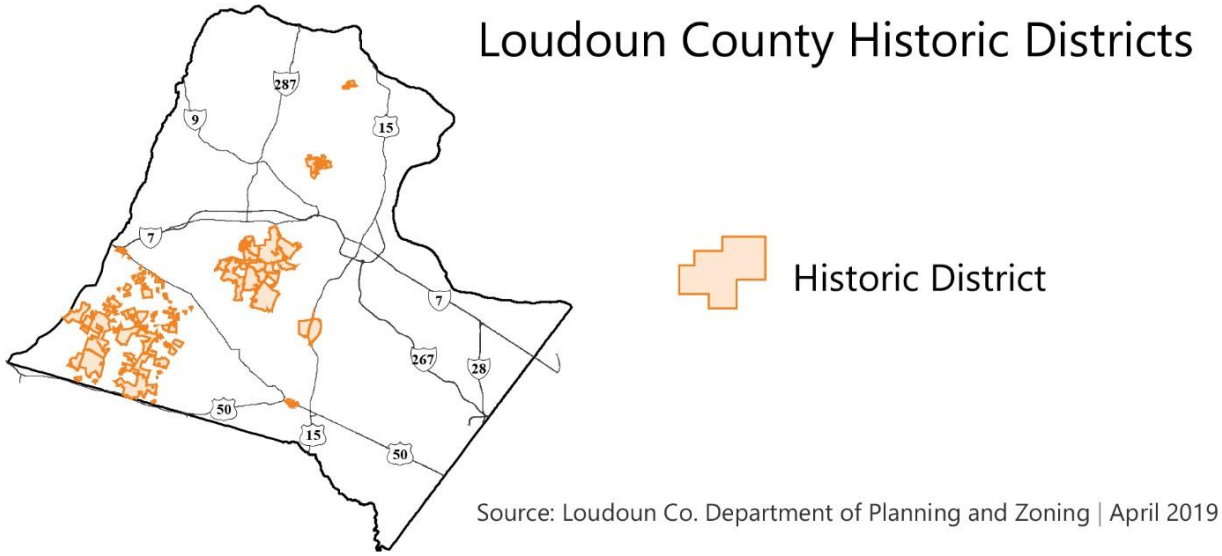


Figure 6: Loudoun County Historic Districts

The Loudoun County Resident Curator Program (RCP) helps preserve the county's historic buildings by rehabilitating and maintaining underutilized historic properties and making them accessible to the public. The county will provide long-term leases to qualified tenants who agree to rehabilitate and maintain these historic resources in accordance with established preservation standards. A curator can be a private citizen, a nonprofit entity, or a for-profit entity. The RCP is part of the county's implementation of its Heritage Preservation Plan, allowing the county to protect and preserve resources through acquisition, maintenance, and public engagement and education related to county-owned properties.

The RCP was designed to reduce the public costs associated with the care and preservation of the properties by enabling groups or individuals to take over the responsibility. In addition to caring for the day-to-day management of the property, the curators are responsible for the rehabilitation and continued maintenance of the property. Properties that are included in the RCP have been deemed historically significant and either meet the county's established criteria of eligibility for curation and/or also may meet the National Historic Register criteria.

Three RCP initiatives support Loudoun County's vision of recognizing its historical past while looking ahead to improving life of and services for its residents.

1. **Maintained a Master List of archeology sites**

   For most types of development applications, an archaeological survey is required to determine if the proposed development will negatively impact significant historic and archaeological sites.

   Loudoun County has over 1,500 recorded archaeological sites that include both prehistoric Native American sites and early European domestic and industrial sites. The majority of archaeological investigation that occurs in Loudoun County is directly linked to both county and federal requirements related to land development projects.

2. **Developed the African American Survey**

   In 2002 and 2003, the Loudoun County Board of Supervisors contracted with History Matters, a program of the City of New York (CUNY) and George Mason University, to survey historic resources related to the history of African Americans in Loudoun County, Virginia. As a result of the survey, the Virginia Department of Historic Resources determined that seven of the African-American communities are eligible for listing on the National Register of Historic Places:

Bowmantown, Brownsville, Howardsville, Murphy's Corner, St. Louis, Watson, and Willisville. The county continues its efforts to capture all resources available to understanding the contribution of African Americans to the development of the state and our nation.

3. **Created a Heritage Preservation Plan**

   The Heritage Preservation Plan includes strategies for identifying, preserving and promoting Loudoun County's heritage resources on three fronts: community education, heritage tourism, and resource protection. The plan recommends implementation steps, such as the creation of a Heritage Commission and a Heritage Register.

1.5. Growth and Development Trends

The county's population grew slowly through the 1970s. Until around 1990, the population was under 100,000, but since that time the growth rate has moved from a relatively flat horizontal line to growth spurts between each year from 2000 to the present, when the line becomes vertical.

In recent decades, Loudoun County has transitioned from a residential suburb of Washington, D.C. to a vital commercial, residential, office, and research hub. This substantial change has been reflected in the jurisdiction's land-use pattern, with the vast expansion of nonresidential land uses and, to a lesser extent, growth in residential land use, by acres. Since 1990, the rate of multi-family townhouses and apartments has exceeded single-family detached housing construction at a rate of two to one. As of December 2020, there was a planned 2.7 million square feet of office space under construction in the county.[19]

This rate of growth has had a significant impact on public facilities and infrastructure, particularly on transportation capacity and the reduction in the supply of vacant land. The increased demand for future development and infrastructure may result in pressure to build in areas susceptible to impacts from natural hazards such as floods. Land use controls through the county's ordinances and regulations provide some protection against this pressure but should be continuously monitored for new demands that could increase hazard risks in the future.

Despite the overall slowing growth rate, the 2050 forecast for population, housing units, and households indicates slight growth. Much of the population growth is related to continuing development of multi-family housing, including owned and rental properties. For this reason, stakeholders developed the Loudoun County 2019 Comprehensive Plan (Comprehensive Plan). This plan is the culmination of a collaborative multiyear effort and an unprecedented public outreach campaign that brought together Loudoun's citizens, elected and appointed officials, stakeholders, and county staff to create a new comprehensive plan for the county. This planning process, known as Envision Loudoun/Loudoun 2040, encapsulates what residents want to see in the way of future development of Loudoun County while considering growth management; land use; place types; transportation; natural, environmental, and heritage resources; and community facilities. This led to the development of the 2019 Comprehensive Plan, which describes the community's vision.[20]

[19] *Real Estate Report,* Loudoun County Economic Development Authority, Year-End 2020, December 31, 2020. (https://www.Loudouncountyeda.org/wp-content/uploads/2021/07/Yearend2020RealEstateReport.pdf)
[20] Loudoun County, New Comprehensive Plan: The History of the Envision Loudoun Process, https://www.loudoun.gov/3298/Envision-Loudoun-Process

Figure 7: Loudoun County Comprehensive Plan

Among the datasets included in the Comprehensive Plan is an estimate of population growth for each five-year period between the years 2021 and 2045.

Table 11: Loudoun County Population Estimates through 2045 by Subregions[21]

Subregion	2025	2030	2035	2040	2045
Ashburn	5,205	5,804	1,952	1,975	1,627
Dulles	4,521	3,086	1,242	529	358
Leesburg	2,021	2,339	1,023	132	15
Northwest	312	365	488	507	507
Potomac	167	120	243	284	196
Route 15 North	210	210	227	226	226
Route 15 South	145	200	150	111	111
Route 7 West	515	420	238	250	80
Southwest	105	125	135	156	156
Sterling	1,282	1,658	1,360	990	409
County	14,483	14,327	7,058	5,160	3,685

The Comprehensive Plan highlights the intent for appropriate residential development of land in relation to flood hazards, as stated in Objective 7, Policy a: “Prohibit new residential structures within flood impact hazard areas.” This objective, in combination with the land-use ordinances and Floodplain Management Plan, provide some controls that limit the increase of flood hazard risk caused by future development. Land development in Loudoun County is monitored and controlled at the county level. Loudoun County will continue to be a planning partner with local jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk. Projected growth trends should be monitored in the next planning cycle with the intent to provide a more detailed statistical analysis of vulnerable populations and how this could potentially impact hazard consequences and mitigation opportunities.

[21] Source: Loudoun County Department of Budget and Finance

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, Loudoun County followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the NOVA HMP Planning Team, the county supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction. Participants in the local planning activities are listed in Table 11.

Table 12: Local Planning Participants

Kelly Myers	Assistant Coordinator- Planning	Loudoun County Office of Emergency Management
Joe Dame	Emergency Management Coordinator	Town of Leesburg
Danny Davis	Town Manager	Town of Middleburg
Melissa Hynes	Town Administrator	Town of Round Hill
Harriet West	Town Clerk	Town of Round Hill
Cynthia McAlister	Chief of Police	Town of Purcellville
Ernie Brown	Director	Loudoun County- Department of General Services
Alan Brewer	Director	Loudoun County- Department of Building and Development
Alana Ray	Director	Loudoun County- Department of Planning and Zoning
Monica Spells	Assistant County Administrator- Human Services	Loudoun County Office of the County Administrator
Sam Finz	Town Manager	Town of Lovettsville
John Merrithew	Planning Director	Town of Lovettsville
Joe Betts	Project Manager	Town of Lovettsville
Buddy Rizer	Director	Loudoun County Economic Development

Colleen Kardasz	Assistant Director	Loudoun County Economic Development
Joe Kroboth	Assistant County Administrator-Community Development	Loudoun County Office of the County Administrator
Aj Panebianco	Chief of Police	Town of Middleburg
Alton Echols	Deputy General Manager of Operations & Maintenance and Engineering	Loudoun Water
Maggie Auer	Floodplain Manager	Loudoun County- Department of Building and Development
David Ma	Senior Engineer	Town of Leesburg
Betsey Arnett	Public Information Officer	Town of Leesburg
Gwen Kennedy	Program Manager	Loudoun County- Department of Building and Development
Richard Williams	Director of Parks and Recreation	Town of Leesburg
Russell Chambers	Plant Manager- Water Treatment Facility	Town of Leesburg
Philip Jones	Assistant Director for Capital Projects	Town of Leesburg
Matt Schulz	Assistant Coordinator - Operations	Loudoun County Office of Emergency Management
Andrew Irvine	Emergency Preparedness Specialist	Loudoun County Office of Emergency Management
Glen Barbour	Public Information Officer	Loudoun County Office of Public Affairs
Elizabeth Moore	Emergency Preparedness Specialist	Loudoun County Office of Emergency Management

The list of project meetings in which representatives of Loudoun County and/or its jurisdictions participated show the degree to which the county and its jurisdictions are committed to the hazard mitigation planning process. Shown here are meetings at which the county and towns discussed their specific hazards of concern, though many of the county and town representatives also attended meetings of the full NOVA HMP Planning Team.

Table 13: Schedule of Jurisdiction Meetings

Date	Jurisdiction(s)	Purpose
May 25, 2021	Loudoun County, Town of Leesburg, Town of Purcellville, Town of Middleburg, and Town of Round Hill	Jurisdiction Planning Needs Assessment
June 25, 2021	Loudoun County and Town of Leesburg	Technical Assistance
July 22, 2021	Loudoun County	Capability Assessment
August 2, 2021	Loudoun County, Town of Leesburg, Town of Purcellville, and Town of Middleburg	Action Item review and creation
August 23, 2021	Loudoun County, Town of Leesburg, Town of Purcellville, and Town of Middleburg	Action Item review and creation
August 27, 2021	Town of Lovettsville	Hazard Identification, Community Asset Identification, Jurisdiction Information Collection, Jurisdiction Needs Assessment, and Action Items and Action Plan Completion
September 30, 2021	Town of Lovettsville	Capability Assessment, Hazard Risk Ranking, and Critical Facilities and Historical Information Review
October 29, 2021	Town of Middleburg	Capability Assessment and Critical Facilities and Historical Information Review

The jurisdiction identified its chief hazard mitigation planning responsibility as providing oversight in the planning process through the Emergency Manager's Group and representation in the Emergency Manager's Planning Group. The county also identified the following tasks as part of its mitigation planning responsibilities:

- Jurisdictional Planning Team
- Management support for the planning effort
- Planning Team resource/subject matter expert
- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review plan drafts and provide input
- Public outreach activities
- Implementing the plan
- Maintaining the plan

Loudoun County planning participants coordinated primarily by means of virtual meetings during the planning process and as needed to carry out independent planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Team meetings is included in the **Base Plan, Appendix A**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a Public Hazard Survey https://www.loudoun.gov/752/Hazards and access to the draft plan for review and input.

In reviewing both documents, the public was offered the opportunity to provide input to the community hazards of concern and the Draft 2022 Plan update that recommends mitigation strategies to minimize the impact of any and all hazards. Notification of the Draft Plan release was made through the same county web link used to enable residents to participate in the community survey. Documentation of the public survey and draft plan review is included in **Attachment 3** of this annex.

3. Jurisdiction-Specific Hazard Event History

Loudoun County's comprehensive hazard history is described in **Section 5, Base Plan**. The diversity of the landscape increases the vulnerability to a variety of hazards, most notably flooding and severe storms. In addition to snow melt and rain-related river flooding episodes, low-lying areas of the county along the Potomac River are also subject to tidal and storm surge flooding. As sea levels rise, permanent inundation of low-lying areas along and near the river shoreline is also a threat. Additionally, winter storms pose significant threats, as evidenced during the 2015–2016 winter season, which resulted in a Federal Disaster Declaration.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,036 recorded natural weather events that took place in the county between January 1, 1950, and May 2021. The county has been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 14: Federal Disaster and Emergency Declarations (2017–2021), Loudoun County[22]

Declaration	Date	Hazard	Assistance Type
DR-4512-VA	4/2/2020 (continuing)	COVD-19 Pandemic	Individual Assistance, Public Assistance
EM-3448-VA	3/13/2020 (continuing)	COVID-19 Pandemic	Public Assistance (Category B)
EM-3403-VA	9/11/2018	Hurricane Florence	Public Assistance (Category B)

Table 15: Significant Hazard Events Identified by Loudoun County, 2017–2021

Date	Hazard	Event and Description
February 2020	EF0 Tornado	An area of low pressure formed over the area in response to an impressive longwave trough approaching from the west. A line of low-topped showers and thunderstorms formed along the system's cold front, leading to instances of damaging winds and a tornado in Leesburg. Many trees were downed and fell on homes and cars. Property damage totaled $5,780,000, the largest amount for a hazard event in Loudoun County in the last five years.
February 2019	Winter Weather	Surface high pressure was located over the region, giving way to several waves of low pressure. Intermittent precipitation led to snow accumulations up to around one inch and ice accumulations generally between 0.10 and 0.20 inches, although these figures were as high as 0.50 to 1.0 inch across the higher elevations. The only direct fatality reported by NCEI since 2017 occurred when a 52-year-old woman in northeastern Loudoun County was killed from a falling branch outside of her home due to weight from ice on

[22] FEMA
Several significant events were identified by NCEI as taking place in recent years.

Date	Hazard	Event and Description
		the tree limbs. The elevation of the incident was approximately 680 feet.
March 2018	High Wind	A low-pressure system moved in from the central United States and intensified rapidly as it moved eastward. Winds up to 58 mph were recorded in several locations, including a report from Dulles International Airport, which clocked the wind at 57 mph. Numerous trees were downed, and the wind blew roofing, siding, and doors from residential structures, although no official report of damages is recorded.

4. Hazard Risk Ranking

After developing hazard profiles, the Loudoun County Mitigation Planning Team conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan**. The Hazard Risk Ranking scores by individual categories for Loudoun County are provided in **Attachment 2** of this annex.

The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard subsections in **Section 5, Base Plan**, and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II of the Base Plan**.

Table 16: Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.3	3.5	6.8	**High**
High Wind/Severe Storm	2.7	3.4	6.1	**High**
Flood	1.7	4.1	5.8	**High**
Tornado	1.7	4.1	5.8	**High**
Dam Failure	1.0	4.4	5.4	**Medium**
Drought	2.0	3.2	5.2	**Medium**
Extreme Temperatures	2.3	2.7	5.0	**Medium**
Earthquake	1.7	3.2	4.9	**Medium**
Landslide	1.3	2.5	3.9	**Low**
Wildfire	1.0	2.8	3.8	**Low**
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	**Low**

Table 17: Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	2.0	5.3	7.3	**High**
Terrorism	1.0	6.1	7.1	**High**
Cyberattack	1.7	4.7	6.4	**High**
Civil Unrest	1.0	4.9	5.9	**Medium**
Communication Disruption	1.3	3.7	5.0	**Medium**
Hazardous Materials	1.0	3.9	4.9	**Low**
Active Violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, Loudoun County evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter Weather, Flood (riverine/flash flood), and High Wind/Severe Storm
- **Medium:** Dam Failure, Drought, Earthquake, Extreme Temperatures, Tornado

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, Cyberattack
- **Medium:** Civil Unrest, Communication Disruption

All other hazards are ranked as “low,” signifying a minimal risk to Loudoun County.

4.1. Additional Hazard Risk Considerations

4.1.1. National Risk Index

The National Risk Index (NRI) is a dataset and online tool developed by the Federal Emergency Management Agency (FEMA) and other partners to help illustrate communities in the United States at risk for 18 natural hazards. Hazard risk is calculated on data for a single hazard type and reflects the relative risk for that hazard type; it should be considered only as a baseline relative risk measurement for comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently from those in this plan, so a direct hazard-to-hazard risk comparison is not possible.

Based on the NRI findings, the highest hazards by risk rating for Loudoun County are Winter Weather, Strong Wind, Tornado, and Cold Wave (included in this plan as Extreme Cold). Loudoun County was rated as having “very low” risk ratings overall, and those labeled as presenting the most risk are only marginally more threatening than those considered to be of lower risk. Of the 15 hazards for which risk ratings are given, they were all determined to be “very low,” with one hazard (Heat Wave) determined as “relatively low” when compared to the rest of the state and the national average.

Hazard Types	Risk Index Rating	Risk Index Score	
Avalanche	Not Applicable	--	
Coastal Flooding	Not Applicable	--	
Cold Wave	Very Low	0.01	0 — 100
Drought	Very Low	0.00	0 — 100
Earthquake	Very Low	0.00	0 — 100
Hail	Very Low	0.01	0 — 100
Heat Wave	Very Low	0.00	0 — 100
Hurricane	Very Low	0.00	0 — 100
Ice Storm	Very Low	0.00	0 — 100
Landslide	Very Low	0.00	0 — 100
Lightning	Very Low	0.00	0 — 100
Riverine Flooding	Very Low	0.00	0 — 100
Strong Wind	Very Low	0.01	0 — 100
Tornado	Very Low	0.01	0 — 100
Tsunami	Not Applicable	--	
Volcanic Activity	Not Applicable	--	
Wildfire	Very Low	0.00	0 — 100
Winter Weather	Very Low	0.01	0 — 100

Figure 8: Hazard Type Risk Index, National Risk Index[23]

The NRI calculation does not follow the same criteria and formulas used in the hazard risk ranking methodology for this plan but is provided as a comparative measurement tool.

4.1.2. Dam Failure

The USACE National Inventory of Dams lists 99 dams as being in Loudoun County[24]: 14 are classified as **High Hazard** and 9 are classified as being a **Significant Hazard** due to the consequences of a failure of the structure. USACE data includes dam locations, ownership, pool volume, impoundment capacity, and use.

The 23 high and significant hazard dams in Loudoun County are both publicly and privately owned and used for a variety of purposes, including flood control, stormwater management, and recreation.

[23] National Risk Index, FEMA.
[24] Dam Inventory–2021, US Army Corps of Engineers,

Table 18: State-Regulated High Hazard Dams in Loudoun County, as of May 2021[25]

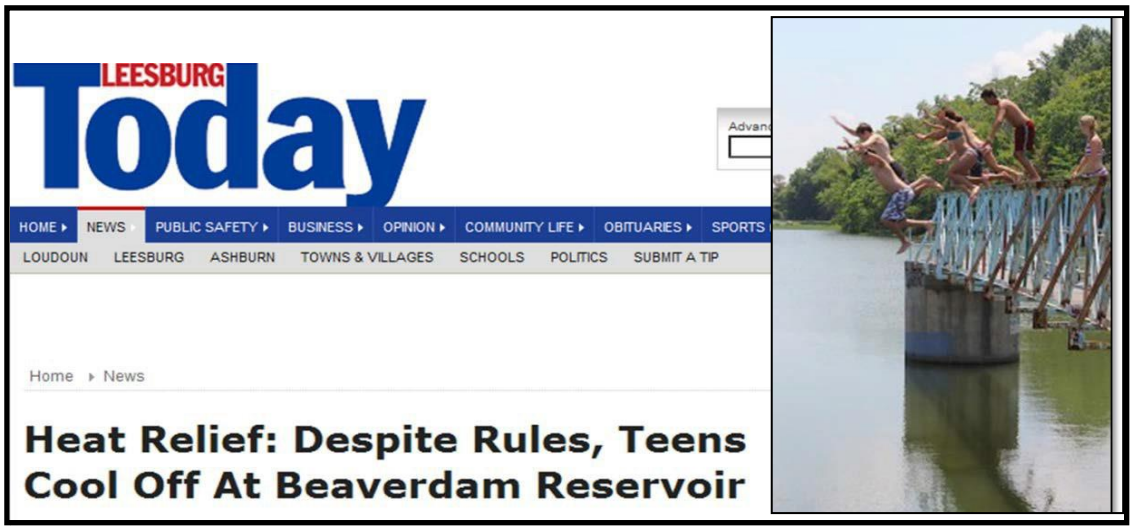
Dam Name	Classification	Dam Owner/Operator
Arcola Center Dam	Significant	Arcola Limited Liability Company
Creighton Hills Dam	Significant	Creighton Hills, LLC
J.T. Hirst Dam	Significant	Town of Purcellville
Dulles Airport Dam	Significant	Metro-Washington Airport Authority
Red Cedar Lake Two Dam	Significant	Ian S. & Debra J. Foster
Oliver Dam	Significant	Woodmar Farm Conservancy
Daley Dam	Significant	Brian Meyerriecks, Timothy Biddle
Haynes Dam	Significant	Martin Lawrence Family Trust
Precision Dynamics Lake Dam	Significant	Round Hill Owners Association
Richmond Square Dam	High	Exeter Homeowners Association
Moorefield Station East SWM Pond Dam	High	Loudoun County Board of Supervisors
Kalnasy Dam	High	Johnson, Cedric & Cynthia Holgate, Marc Weiner.
Beaverdam Creek Dam	High	Loudoun Water
Goose Creek Dam	High	Loudoun Water
Horsepen Dam	High	Metro-Washington Airport Authority
Ashburn Village Lake #2	High	Ashburn Village Community Association
Brambleton Land Bay 3 Pond 6 Dam	High	Brambleton Group LLC
Ashburn Village Lake #1	High	Ashburn Village Community Association
Gore Dam	High	Jo Ann D. Athey
The Lakes At Red Rock Dam	High	The Lakes at Red Rocks Homeowners Association
Moorefield Station West SWM Pond Dam	High	Claude Moore Charitable Foundation
Sleeter Lake Dam	High	Round Hill Owners Association
Hope Parkway Dam	High	East Stratford Residential Community Association, Inc.

In the year 2017, after the previous mitigation plan was developed, a report titled *A Heightened Focus on Public Safety at Dams Does Not Happen by Accident* was produced by engineering firm Gannett Fleming, Inc., to discuss Loudoun Water's recently developed Public Safety Plan (PSP). It was decided such a plan was needed in the wake of several fatalities and near fatalities occurring at Goose Creek Dam and Beaverdam Creek Dam. Both of these assets are used for water supply, but the county's increased growth makes these and other dams attractive for recreational purposes.[26]

The report led to Loudoun Water developing guidelines for protecting the public, including methods used to ensure conformity with the public safety plan, public safety education, training and outreach programs implemented by Loudoun Water, and additional public safety improvements planned for Beaverdam Creek. The report also cited publicly available resources about specific incidents that prompted development of the safety plan.[27]

[25] Source: U.S. Army Corps of Engineers, National Inventory of Dams
[26] Insert Footnote info
[27] Ibid

- *Leesburg Today* article about teens ignoring the signs and rules about entry and showing them jumping from the handrail on the access bridge into the reservoir.



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Heat Relief: Despite Rules, Teens Cool Off At Beaverdam Reservoir

- The Associated Press piece describing how a mother and her two children drowned at Beaverdam Reservoir.

Mother, 2 children drown in reservoir

By The Associated Press

LEESBURG—A mother and her two children drowned at Beaverdam Reservoir, and investigators are trying to determine why the three were in the water.

The Loudoun County Sheriff's Office identified the victims as Lorena Lima, 28; Ashley Hernandez, 8; and Oscar Lima, 6, all of Manassas.

The three were last seen about 3 p.m. Saturday on the bank of the reservoir in an area where swimming is not allowed, said sheriff's spokesman Ed Pifer.

"We don't know if they were swimming or fell in," he said.

Interviews with witnesses indicated that people nearby became aware of the incident when they heard screams.

'We don't know if they were swimming or fell in.'

— Ed Pifer
Loudoun County sheriff's spokesman

while awaiting rescue personnel.

Lorena Lima was pronounced dead at Loudoun Hospital Center in Leesburg. The children were transferred by helicopter to Children's Hospital in the District of Columbia, where they were pronounced dead on arrival.

A soccer game was going on nearby, and the woman's husband

- *Loudoun Times-Mirror* article about drowning in Beaverdam Creek Reservoir.

UPDATE: Man's body found in water day after boat capsizes on Beaverdam Creek Reservoir

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Sunday, Nov. 27, 2011 by John Geddie and Matt Vecchio| 33 comments | Email this story

- *Station WVTR-TV* (Richmond, VA) article about family of five being rescued from their boat perched on the crest of Goose Creek Dam.

4.1.3. Flood/Flash Flood

The Loudoun County Planning Team noted that the frequency of flash flood incidents has increased in recent years, attributable to more frequent excessive rainfall events combined with aging drainage and stormwater infrastructure designed to lower capabilities. The county is addressing this issue through increased maintenance of drainage systems and capacity upgrades funded through capital improvement projects, but it highlights the need for additional studies to identify potential locations and the extent of future events.

Table 19: Flood/Flash Flood Events in Loudoun County, 1950–May 31, 2021[28]

Jurisdiction	Flood/Flash Flood Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
Loudoun County Including: Town of Leesburg Town of Lovettsville Town of Middleburg Town of Purcellville Town of Round Hill	162	0	0	$2,018,000	$170,000	$2,188,000

4.1.4. High Wind/Severe Storm

Table 23 presents the number of severe storm events documented in the NCEI Storm Events Database, including high wind, hail, and lightning, and the impacts of hazard events on people, property, and crops.

Table 20: High Wind/Severe Storm Events in Loudoun County, 1950–June 30, 2021[29]

Jurisdiction	High Wind/ Severe Storm Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
Loudoun County Including: Town of Leesburg Town of Lovettsville Town of Middleburg Town of Purcellville Town of Round Hill	696	1	9	$10,248,650	$224,600	$10,473,250

[28] NCEI Storm Events Database
[29] NCEI Storm Events Database

4.1.5. Winter Weather

Table 24 presents the number of severe winter storm events documented in the NCEI Storm Events Database, including blizzard, heavy snow, winter storm, and winter weather. Noteworthy is the fact that NCEI does not include in its records any events that took place before December 2014.

Table 21: Severe Winter Storm Events in Loudoun County, 1950–June 30, 2021[30]

Jurisdiction	Severe Winter Storm Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
Loudoun County Including: Town of Leesburg Town of Lovettsville Town of Middleburg Town of Purcellville Town of Round Hill	101	1	0	$0	$0	$0

Other hazard information for Loudoun County is presented in the **Base Plan**.

[30] NCEI Storm Events Database

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

Loudoun County and the five towns participating in the 2022 plan update process all participate in the National Flood Insurance Program (NFIP). In addition, the county participates in NFIP's voluntary Community Rating System (CRS) program under the NFIP with a CRS Class of 10 rating. At this class rating, property owners are not able to take advantage of lower flood insurance premium deductions available to those lower classes. As such, Loudoun County is considering ways it could increase its class status and save money for those who choose to purchase flood insurance.

The Flood Risk Report (FRR) for Loudoun County, released on October 15, 2016, included discussion about waterways in unincorporated Loudoun County—the five municipalities participating in the 2022 Northern Virginia HMP update (Leesburg, Lovettsville, Middleburg, Purcellville, and Round Hill), as well as the Town of Hillsboro and the Town of Hamilton. The report provides non-regulatory information to help local or tribal officials, floodplain managers, planners, emergency managers, and others better understand their flood risk, take steps to mitigate those risks, and communicate those risks to their citizens and local businesses. Because flood risk often extends beyond community limits, the FRR provides flood risk data for all of Loudoun County, as well as for each individual community. This approach also includes a focus on flood risk reduction activities that may impact areas beyond jurisdictional boundaries. The report also discusses the types of mitigation actions a community can pursue, including planning and regulatory, structural, natural system protection, and public outreach and education.

Table 22: National Flood Insurance Program Status, Loudoun County[31]

Initial FHBM Identified	Initial FIRM Identified	Current Eff Map Date	Reg-Emer Date	CRS Entry Date	Current Eff Date	CRS Class	% Disc SFHA	% Disc Non SFHA
04/25/1975	01/05/1978	02/17/2017	01/05/1978	10/1/1992	05/01/2003	10	0%	0%

Table 23: NFIP Status, Insurance Summary, as of September 14, 2021[32]

NFIP Topic	Source of Information	Comments

[31] FEMA NFIP Community Status Report, September 9, 2021
[32] Loudoun County Office of Emergency Management

How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist Community Information System Database	**6,615 policies** countywide based on information through July 2021. Total premium is $3,601,181. Approximately 73% of the insured structures are located outside FEMA's designated Special Flood Hazard Areas (SFHAs).
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist Community Information System Database	**1,260 claims** paid through July 2021; **total amount $13,844,072**. Information on how many of the paid claims were for substantial damage is not available.
How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA) Estimate from FEMA	**Approximately 2,000 structures are estimated to be in SFHAs.**
Describe any areas of flood risk with limited NFIP policy coverage.	Community FPA and FEMA Insurance Specialist	**An estimated 10% of the structures in SFHAs do not have NFIP coverage**, presumably because their owners do not hold federally backed mortgages.

Table 24: NFIP Status, Staff Resources, as of September 14, 2021[33]

NFIP Topic	Source of Information	Comments
Is the Community FPA or NFIP Coordinator certified?	Community FPA	Community FPA/NFIP Coordinator holds Professional Engineer (PE) and Certified Floodplain Manager (CFM) certifications.
Is floodplain management an auxiliary function?	Community FPA	No. Floodplain management is a primary function of the two primary agencies responsible–the Department of Land Development Services (LDS) and the Department of Public Works and Environmental Services (DPWES).
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability).	Community FPA	The full range of NFIP administrative services (permitting, inspections, outreach, GIS, and engineering analysis) is provided by LDS and DPWES.
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	Currently no barriers.

Table 255: NFIP Status, Compliance History, as of September 14, 2021[34]

[33] Loudoun County Office of Emergency Management
[34] Loudoun County Office of Emergency Management

NFIP Topic	Source of Information	Comments
Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Are there any outstanding compliance issues (i.e., current violations)?		No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		October 6, 2014

5.2. Population

Loudoun County is somewhat less densely populated than other counties near Washington, D.C., given that a large portion of its land is used for agricultural purposes, while there are denser population clusters elsewhere in the county. U.S. Census Bureau figures show that, of the 366,827 persons over the age of five, 31.6% speak a language other than English, and 9.8% speak English “less than very well.” This situation highlights the challenge of communicating emergency information and educating residents about hazard risks and vulnerabilities and the benefits of hazard mitigation.

The Census Bureau also reports that approximately 5.8% of the population, or 24,455 residents, is identified as non-institutionalized disabled persons due to access or functional needs.

Estimates of the number of residents in Loudoun County vulnerable to each hazard are presented in the various hazard sections in the **Base Plan.**

The Centers for Disease Control and Prevention’s (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations. The CDC SVI categorizes the vulnerability of communities at the census tract level, by county, into fifteen census-derived factors grouped into four themes—socioeconomic status, household composition/disability, race/ethnicity/language, and housing type/transportation. Social vulnerability refers to a community’s capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills.

The Overall CDC SVI illustrated in Figure 10 indicates the locations of highest overall vulnerability are in more urbanized areas, such as the Jefferson, Loudoun, Mt. Vernon, and Upper Potomac Planning Districts, and along major transportation routes.

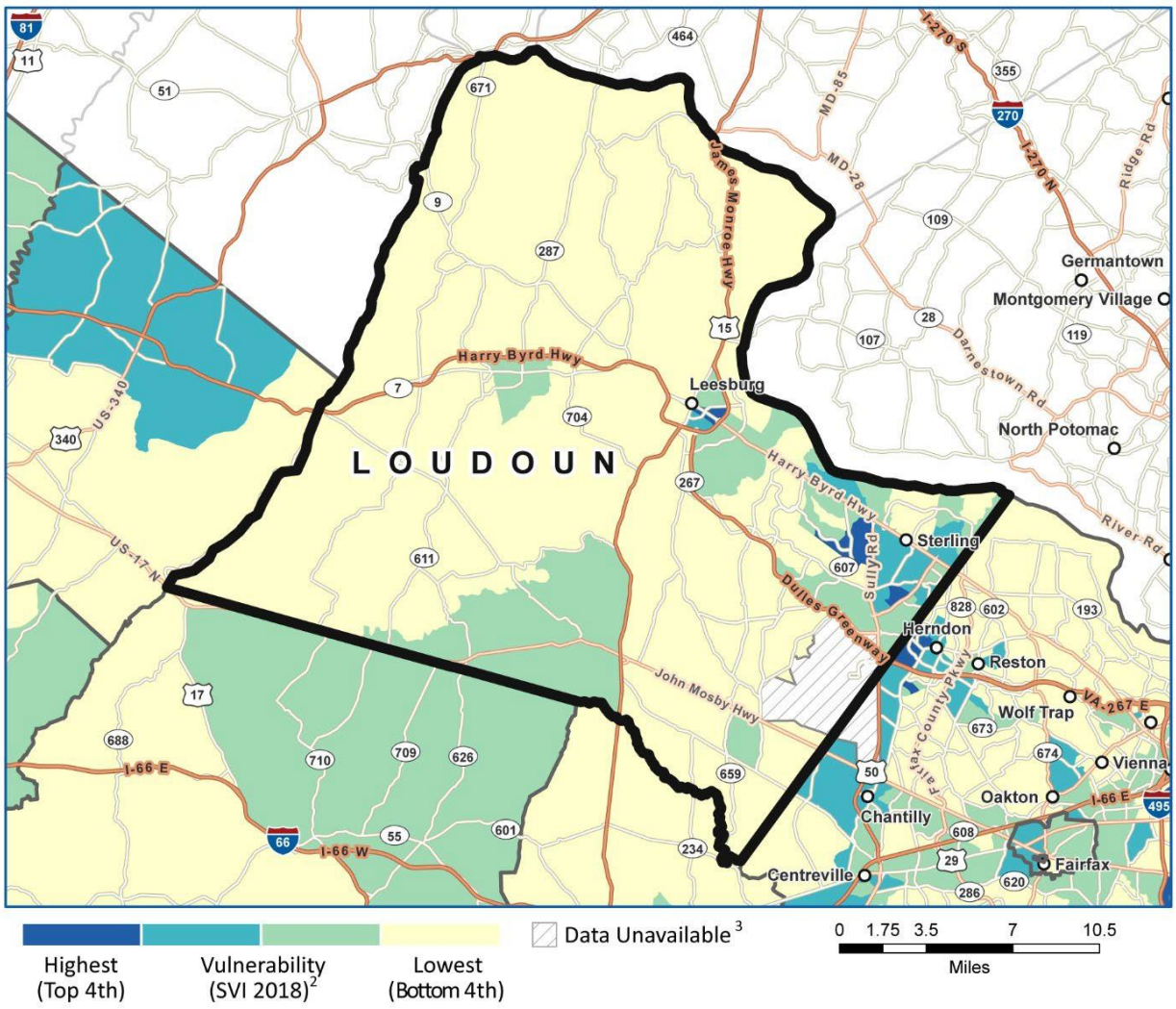


Figure 9: Overall Social Vulnerability (2018), Loudoun County[35]

When examined by vulnerability theme, one can see that the planning districts with highest vulnerabilities vary widely across the county.

- **Socioeconomic Status:** Countryside Cascades, Sterling, Middleburg, Purcellville
- **Household Composition/Disability:** Loudoun Heights, Dulles Town Center, Leesburg
- **Race/Ethnicity/Language:** Belmont, Dulles Town Center, South Riding, Conklin, Arcola
- **Housing Type/Transportation:** Leesburg, Potomac Falls, Broadlands, Moorefield Station

35 Centers for Disease Control and Prevention (https://svi.cdc.gov/map.html)

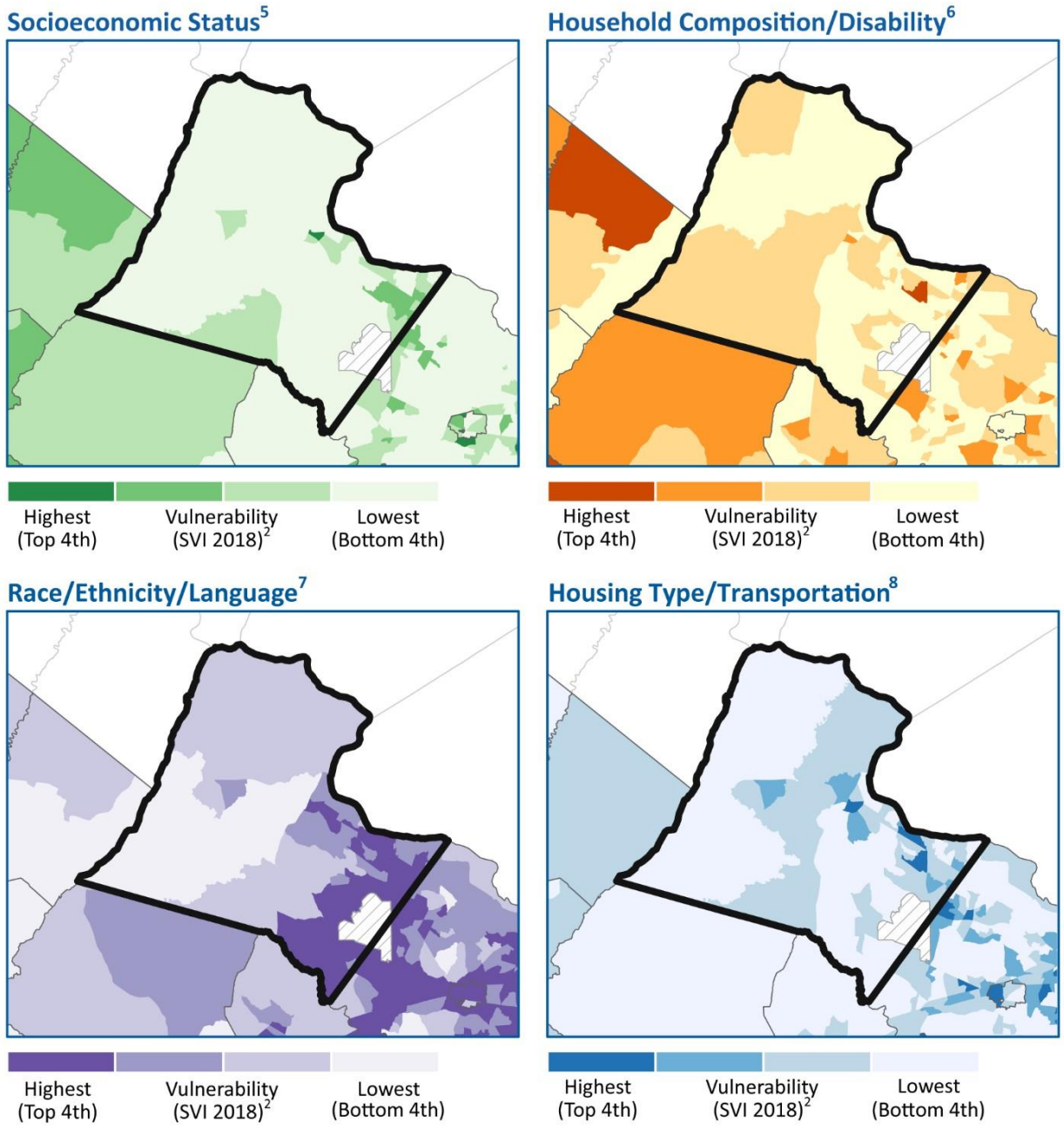


Figure 10: Social Vulnerability, by Theme, Loudoun County[36]

The themed maps illustrate the county's higher level of vulnerability within the race/ethnicity/language theme, demonstrating the importance of communicating essential hazard mitigation, preparedness, response, and recovery information to the public in alternate formats and multiple languages.

[36] Centers for Disease Control and Prevention (https://svi.cdc.gov/map.html)

5.3. Built Environment

Based on data currently available through Hazus, the tables presented in this section provide a total number of exposed facilities and properties in relation to earthquake, flood, and hurricane wind.

Table 26: Building Stock Exposure by General Occupancy[37]

Type	Amount
Residential	$144,188,703,000
Commercial	$20,116,524,000
Industrial	$2,464,611,000
Agricultural	$272,032,000
Religion	$1,827,947,000
Government	$579,222,000
Education	$1,378,119,000
TOTAL	**$170,827,158,000**

Loudoun County has more than $170.8 million in exposure to buildings within the 100-year floodplain. Using the 100-year flood scenario, Hazus identified a total of 357 structures that would be damaged, with 44 being at least 50% damaged and 88 sustaining substantial damage.

5.4. Community Lifelines and Assets

Loudoun County reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events.[38] The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA.

Table 27: Vulnerable Community Lifeline Assets (in Thousands of Dollars)[39]

Sector	Dollar Exposure (in thousands)
Safety and Security	Undetermined
Food, Water, Shelter	$1,487,248
Health and Medical	Undetermined
Energy	$837,534
Communications	$744
Transportation	$2,411,988
Hazardous Materials	Undetermined

[37] Hazus-MH
[38] Although Loudoun County maintains a separate critical facilities inventory, information used in this analysis is extracted from the Hazus-MH critical facilities database to maintain consistency with other jurisdictions.
[39] Hazus-MH

Table 28: Critical Facilities Exposed to FEMA Floodplains, Loudoun County[40]

Type of Critical Facility	Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
Wastewater Treatment Plants	20	6	0
Ferries	1	1	0
Fire Stations	20	1	0
Highway Bridges	364	127	9
Highway Segments	32	15	0
Natural Gas Pipelines	10	9	0

A map on page 23 of the Loudoun County *2016 Flood Risk Report* illustrates the many rivers and streams that course through the region. Almost all segments of both unincorporated Loudoun County and within its towns are located relatively near a water body.

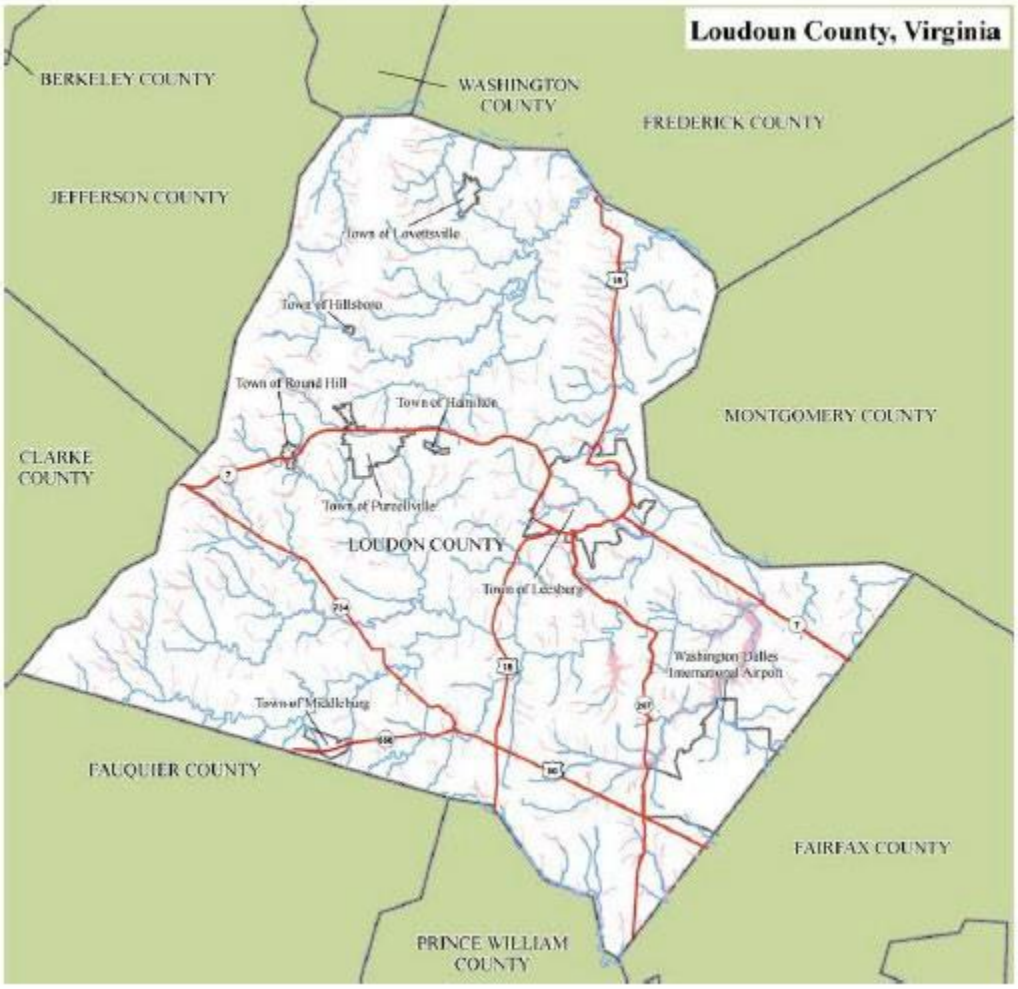


Figure 11: Location of Loudoun County Rivers and Streams

[40] Ibid.

5.5. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

Additional environmental concerns for Loudoun County are related to the Potomac Watershed Waterways and potential for flooding. The county also has a high number of public parks, outdoor sporting facilities, and National Park Service trails and parks. The county identified Huntley Meadows as a critical habitat due to its forests, meadows, and wetlands.

5.6. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2,500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets.

Table 29: Direct Economic Losses Related to Earthquake, Flood, and Hurricane Wind[41]

Hazard	Buildings (Capital Stock and Income)	Transportation	Utilities
Earthquake	$441,720	$4,977	$30,872
Flood	$434,725	$0	$96,696.45
Hurricane Wind	$30,325	$0	$0

Additional economic concerns for Loudoun County are related to the area's economic base which relies on government, information technology, and finance. Major employers include Fortune 500 companies, the federal government, and the military.

5.7. Cultural/Historical

Information related to vulnerability of cultural and historical assets is presented in the hazard-specific sections of the **Base Plan**.

Loudoun County holds significant historical and cultural landmarks linked to the founding of our nation, many of which are National Trust Historic Sites or locally designated landmarks.

Table 30: Significant Historical and Cultural Landmarks

Historic/Cultural Site	Location
Amos-Goodin House	Loudoun County
Arcola Elementary School	Arcola
Arcola Quarters for the Enslaved	Arcola
Edward Nichols House (Seacrest)	Leesburg
General George C. Marshall House, Dodona Manor	Leesburg
Hamilton Masonic Lodge	Hamilton
Home Farm	Loudoun County

[41] Hazus-MH (2,500-year, 6.5 magnitude Earthquake scenario, 100-year Flood scenario, 2,500-year Hurricane event)

Historic/Cultural Site	Location
Leeland and Lawrence Lee House (Ellwood)	Loudoun County
Locust Grove House	Purcellville
Lucketts School	Lucketts
Morrison House and Janney Hill (Janney House)	Hamilton
Mount Zion Old School Baptist Church	Loudoun County
Mt. Olive Methodist Episcopal Church	Leesburg
Much Haddam House	Middleburg
Purcellville Train Station	Purcellville
Red Fox Inn	Middleburg
Rock Spring Farm	Leesburg
Spring Hill Farm	Hamilton
Waverly Mansion	Leesburg
William Virst House (Uriah Beans House)	Loudoun County
Woodgrove	Round Hill

Historic structures and sites and other types of facilities are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites while following historic preservation standards and guidelines.

Table 31: Cultural and Historic Properties Exposed to FEMA Identified Floodplains[42]

Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
99	28	1

Table 32: Loudoun County Critical Assets Located in FEMA Identified Floodplains[43]

Critical Facilities	Total Facilities	In 100-year Floodplain	In 500-year Floodplain
Wastewater Treatment Plants	20	6	0
Ferries	1	1	0
Fire Stations	20	1	0
Highway Bridges	364	127	9
Highway Segments	32	15	0
Natural Gas Pipelines	1	9	0

The location of these and other assets are shown in the map and legend that follow.

[42] Loudoun County, Hazus
[43] Loudoun County, Hazus

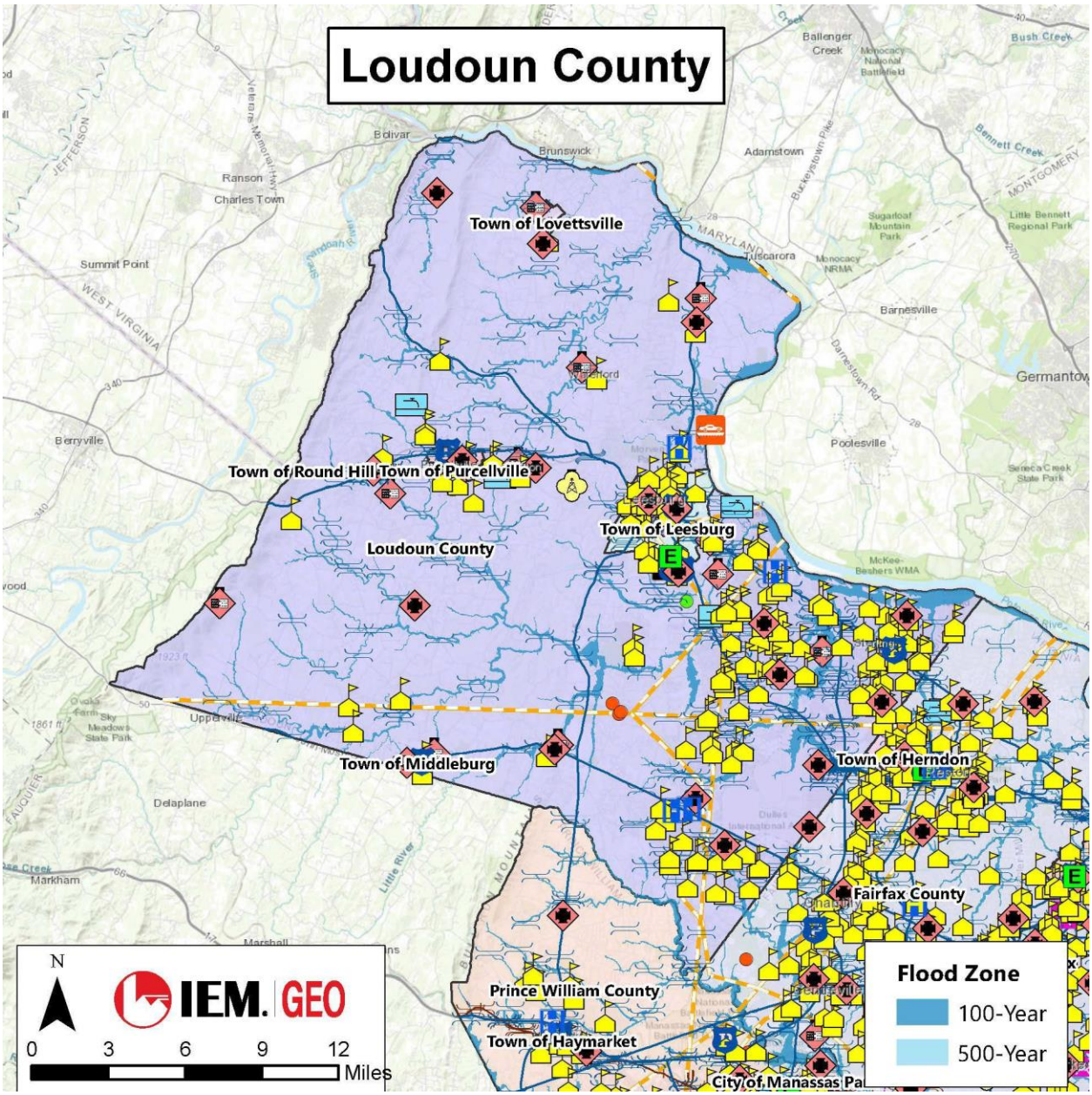


Figure 12: Loudoun County Critical Assets Located in the Flood Zone

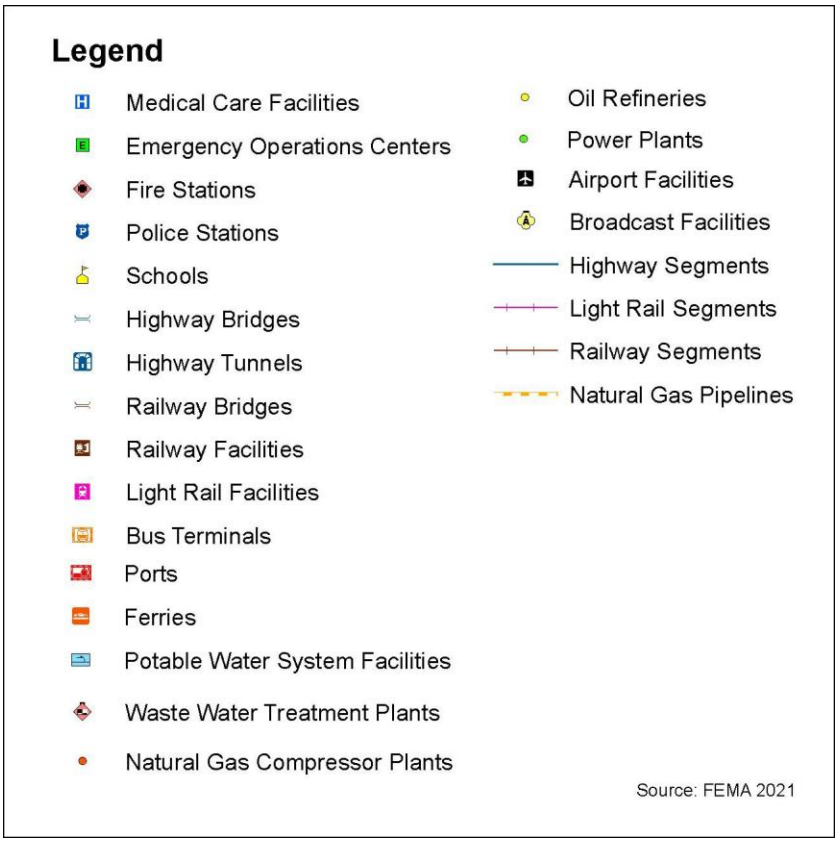


Figure 13: Legend to Figure 12 - Loudoun County Critical Assets Located in the Flood Zone

6. Capability Assessment

Loudoun County reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, Loudoun County completed a Jurisdiction Needs Identification Questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction has limited capabilities within this category and is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities within this category and can implement few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities within this category, but improvement is needed in order to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities within this category as demonstrated by its authorities, programs, plans and/or resources and can implement most mitigation actions.

Assessment of Loudoun County Community Assets and Potential Hazard Impacts[44]Loudoun County evaluated different assets in the community to determine which are potentially at risk to hazards.

Natural Environment: What assets may be impacted by which hazard(s)?

- Water resources: In the Loudoun Plain, six rivers and creeks course through the county: Broad Run River, Bull Run River, Catoctin Creek, Goose Creek, Little River Creek, and Piney Run River. Beaverdam Reservoir, the Potomac River, wetlands, groundwater, drainage systems, and karst terrain are important natural assets.
- Recreation Areas: Forty-seven parks, plus three adult day centers; seven community centers; seven historical sites located within parklands; twenty-five neighborhood parks; and parks with significant ponds/lakes (including three managed dam systems). Any of the structures or outdoor assets could be damaged during a hazard event and the impact may be worsened if staff and residents are using facilities, trails, or waterways.
- Critical Habitat: Forest cover along Blue Bridge, Short Hill, and Catoctin Mountain ranges have zoning ordinances that require reservation.
- **Hazards:** All Hazards

Economy: What assets may be impacted by which hazard(s)?

- Major Employers include Loudoun County Public Schools, Loudoun County Government, Verizon, Northrop Grumman, United Airlines, Raytheon, Inova Loudoun, Walmart, US Postal Service, Dynaletric, Harris Teeter, Bowers
- Primary economic sectors include data centers, information, and communications Technology, Federal Government Contracting, Aerospace and Defense, Aviation and Transportation, Health Innovation and Technology, Agriculture and Related Business.
- **Hazards:** All Hazards

Population: What assets may be impacted by which hazard(s)?

- Loudoun County has a population of 421,636, an increase of approximately 35% since 2010. The population density is 810 persons per square mile, significantly lower than other Northern Virginia counties.
- **Hazards:** All hazards

Built Environment: What assets may be impacted by which hazard(s)?

- The Loudoun County Government Center And other public facilities provide services to residents.
- Critical Facilities include public safety facilities such as Fire-Rescue Stations, Emergency Operations Center, Sheriff's Office Substations, hospitals (Leesburg, Landsdowne, Ashburn, and Stone Springs), Loudoun Water facilities, data centers, government facilities, schools, and long-term care facilities.
- Loudoun County contains numerous historic properties; natural preservation sites; artifacts and archeology assets. These are discussed in greater detail in 1.4.9.1.

  Loudoun County addresses future development in the Loudoun County 2019 Comprehensive Plan.

  Hazards: Natural disasters; fire; vandalism; pandemic impacts to staffing, economic loss of funding

[44] Loudoun County, Community Assets Worksheet 3

Climate Change: Which assets are at risk of future conditions related to climate change?

- The built environment, natural environment, infrastructure, economy and those who live and work in Loudoun County all face risks related to climate change.

Table 33: Capability Assessment Summary Ranking for Loudoun County

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	High
Financial	Moderate
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary

The Loudoun County Office of Planning and Zoning takes an all-hazards approach when developing any jurisdictional plans—including emergency operations—and continuity of operations, as well as the hazard mitigation plan.

The following plans have been newly developed or updated since the 2017 HMP:

- Loudoun County 2019 Comprehensive Plan
- 2019 Transportation Plan (part of the 2019 Comprehensive Plan)
- Fiscal Years 2021-2026 Capital Improvement Plan
- Loudoun Water 2021-2030 Capital Improvement Plan
- 2017 Economic Growth and Diversification Plan
- July 2019 Emergency Operations Plan
- Loudoun County Small Municipal Separate Storm Sewer System (MS4) Stormwater Management Program Plan, July 2018-June 2023
- Loudoun Health District, Pandemic Response Plan, March 2020
- FEMA Flood Insurance Rate Maps, 2019

Capability Analysis: High

Loudoun County is mindful of the need to develop plans, codes, and regulations that minimize the likelihood that hazard events will negatively affect people, property, crops, and farm animals. These include natural hazard-specific ordinances (stormwater, steep slope, wildfire), and the Mountainside Development Overlay District and Steep Slope Standards of the County Zoning Ordinance.

6.1.2. Administrative and Technical Capabilities Summary

Loudoun County identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and implementation of the plan:

- Planning/Engineer: Planning Department, Zoning, Building and Development
- Building and Public Works engineers trained in construction practices related to buildings and infrastructure
- Planners/engineers with an understanding of natural and/or man-made hazards
- GIS and Fire and Rescue Departments with personnel skilled in GIS and Hazus
- Scientists familiar with community hazards
- Emergency Management personnel
- Grant writers in all departments

Capability Analysis: High

The Loudoun County staff across the board is trained in how to maintain current systems for managing all business, societal, and economic sectors and improves staffing needs as is necessary.

6.1.3. Safe Growth Capabilities Summary

Loudoun County departments cover safe growth on many levels. The 2019 Loudoun County Comprehensive Plan includes policies and guidance to cover or reinforce best practices in the following areas:

- Land Use
- Transportation
- Environmental Management
- Public Safety
- Zoning
- Subdivision Development
- Historic Preservation

Capability Analysis: High

The Safe Growth Capabilities in the Plan show that Loudoun County is proud of its illustrious past and tries to maintain a balance between honoring historic assets while taking advantage of future opportunities available to a community located near the nation's capital.

6.1.4. Financial Capabilities Summary

Loudoun County is able to take advantage of financial mechanisms in place to generate funding for current and future opportunities.

- Capital Improvements Project funding
- Authority to levy taxes for specific purposes
- Community Development Block Grants
- Public/Private Partnerships
- State Funding

Capability Analysis: Moderate

While Loudoun County takes full advantage of current financial capabilities, it looks forward to addressing new funding opportunities, including the use of federal grants from FEMA and other agencies.

6.1.5. Education and Outreach Capabilities Summary

Several departments and agencies conduct education and outreach to make citizens aware of resources available to them.

- Sheriff's Office: Adult Crime Prevention Unit offers classes to the public on crime prevention topics
- Loudoun County Public Schools Outreach Services includes a Parent Liaisons program, Language Assistance Service, and a Community Schools Initiative to provide mental health resources and afterschool opportunities to socialize or receive academic assistance.
- The Loudoun Education Foundation provides multicultural educational information and conducts direct outreach to promote interchange between diverse groups.

6.1.5.1. Capability Analysis: Moderate

Loudoun County is well positioned to build on its current education and outreach programs to promote hazard awareness and mitigation efforts that can be practiced by businesses, community groups, individuals, households, and other stakeholders. Its ten public libraries and array of facilities under the Department of Parks, Recreation, and Community Services (PRCS) all provide locations where staff and volunteers regularly interact with the public. These physical structures and the array of print, web-based, and broadcast media show that "the sky's the limit" for the number of ways to create community awareness about hazards and their impact on the community.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, Loudoun County identified activities related to each natural hazard that support risk reduction. They are listed in Table 32.

Table 34: Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Dam Failure (including Levees)	• All but three dams classified as being high or significant hazard dams in Loudoun County have Emergency Action Plans for potential incidents. Per National Dam Inventory, USACE
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and international building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	• Public education and operational plans address preparedness and response to reduce risk.

Hazard	Activity
Flood/Flash Flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. • Stormwater management program and projects address flood prevention and risk reduction.
High Wind/Severe Storm	• State and international building codes provide for wind and seismic design regulations.
Karst/Sinkhole/Land Subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Winter Weather	• Public education and operational plans address preparedness and response to reduce risk.
Non-Natural Hazards	• Public education and operational plans address preparedness and response to reduce risk. • Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate Change	A chapter of the Loudoun County 2019 Comprehensive Plan addresses Land Use and how to develop a resilient built environment. The chapter on Natural, Environmental and Heritage Resources discusses the need to consider how best to maintain a fragile ecosystem and historic resources in the face of current and future climate change.

7. Resilience to Hazards

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of “low risk” is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

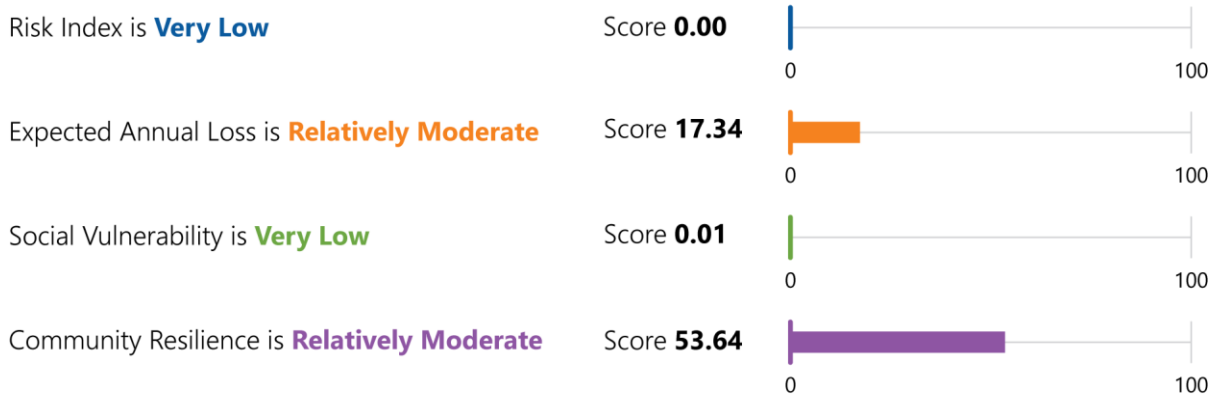


Figure 14: Summary of National Risk Index Findings, Loudoun County[45]

Table 35: Comparison of Loudoun County Scores with Virginia and National Average[46]

Index	Loudoun County	Virginia Average	National Average
Risk	3.26	6.62	10.70
Expected Annual Loss	17.34	9.35	13.47
Social Vulnerability	0.01	35.32	38.35
Community Resilience	53.64	54.92	54.59

Table 36: Loudoun County Risk Ranking[47]

Index	Rank
Risk	Very Low
Expected Annual Loss	Relatively Moderate
Social Vulnerability	Very Low
Community Resilience	Relatively Moderate

[45] National Risk Index
[46] Ibid.
[47] Ibid.

Loudoun County's NRI Community Resilience score of 53.64 represents a relatively low ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the United States.

7.1. Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household-level risk factors.

The index produces aggregate-level (census tract, county, and state) small-area estimates that provide a tool for understanding how much risk a specific neighborhood might face as a result of characteristics that may render certain segments of the population more vulnerable to the impacts and consequences of disasters. These risk factors[48] include the following:

1. Income-to-poverty ratio
2. Single or zero caregiver household
3. Unit-level crowding
4. Communication barrier
5. Aged 65 years or older
6. Lack of full-time or year-round employment (household)
7. Disability
8. No health insurance coverage
9. No vehicle access (household)
10. No broadband internet access (household)

In 2021, the U.S. Census Bureau released data estimates showing the counties and states with the highest percentage of residents who are considered vulnerable to a disaster or other emergency. The percentages were mapped by *U.S. News and World Report.*[49]

[48] The Community Resilience Estimates are developed by the U.S. Census Bureau (initial release date August 10, 2021). Methodology is described at the U.S. Census Bureau Community Resilience Methodology page (https://www.census.gov/programs-surveys/community-resilience-estimates/technical-documentation/methodology.html).

[49] Alex Leeds Matthews, U.S. News and World Report, 10-13-2021. Where Americans Are Most Vulnerable to Disaster, https://www.usnews.com/news/health-news/articles/2021-10-13/counties-where-americans-are-most-vulnerable-to-disaster

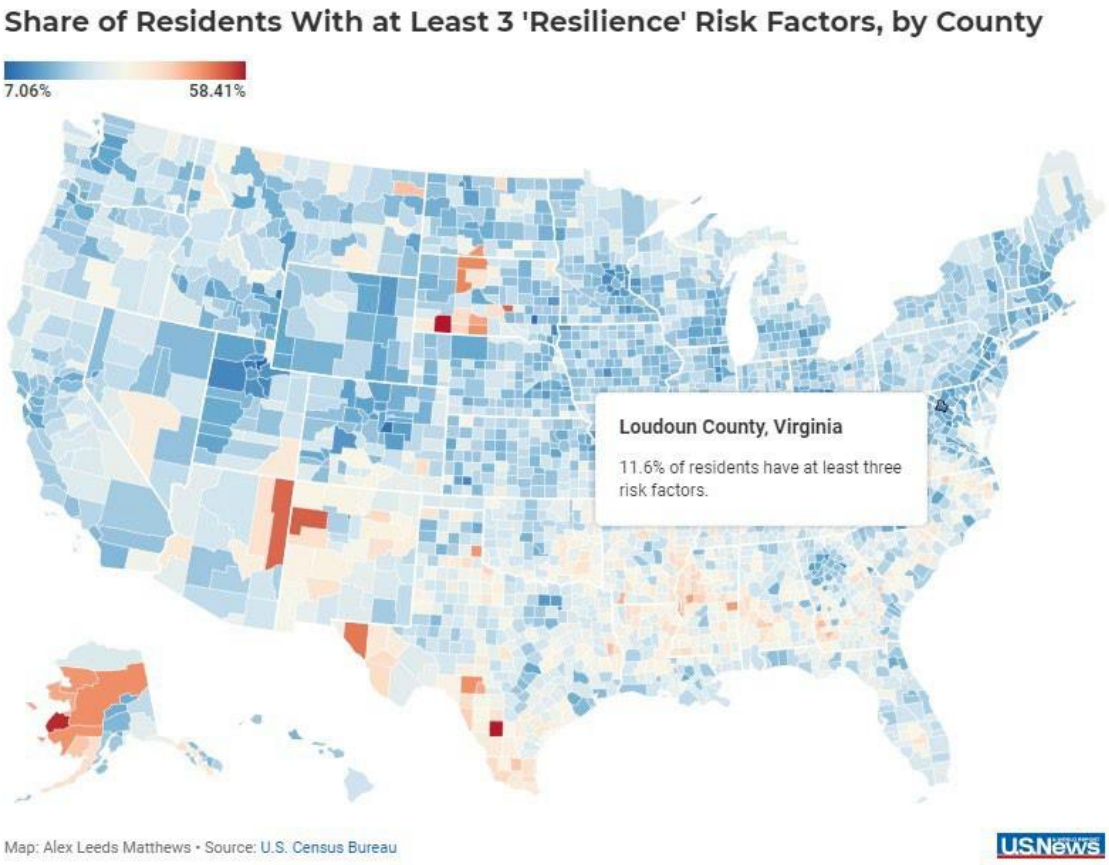


Figure 15: Community Resilience Estimate for Loudoun County[50]

The combination of data and analysis described in this section provides a comprehensive representation of Loudoun County's risk, vulnerability, and resilience to all hazards.

7.2. New Hazard Risk Challenges or Obstacles

The Loudoun County Planning Team identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- The risk of cyber-related incidents on Critical Infrastructure and Key Resource sites
- Climate change
- Increases in the number of excessive rainfall events that impact areas currently identified as flood zones, as well as new areas of flooding that emerge as stormwater management events.

[50] Community Resilience Estimates, U.S. Census Bureau

8. Mitigation Actions

8.1. Goals and Objectives

The Loudoun County Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**. In addition, the *Loudoun County Emergency Operations Plan (EOP),* dated June 2019, outlines the need to conduct Threat and Hazard Identification and Risk Assessment (THIRA), a strategic analysis of hazards that pose a significant threat to the community. The THIRA evaluates and analyzes past experience, historical information, probability, projected impacts, and resource availability—all elements of the hazard mitigation planning process. The EOP states, "By recognizing and understanding the risks that the community faces, Loudoun County places itself in a position to make better resource management decisions" (*Loudoun County EOP,* p. 1-12, Base Plan). The link between the goals of the *NOVA HMP* and the *EOP* increases the likelihood of success in implementing mitigation actions.

8.2. Status of Previous Actions

Loudoun County monitors actions and tracks progress through the periodic review, evaluation, revision, and update of the NOVA HMP. Some projects that contribute to risk reduction have been completed or are currently in progress but have not been included in this plan for one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and resulting risk reduction.

The Loudoun County Mitigation Actions list includes previously identified actions from the 2006, 2010, and 2017 plans. Four actions from the 2006 plan were carried forward for the 2022 NOVA HMP update. Twelve actions from the 2010 plan were carried forward, and one was noted as completed and removed from the list. Nine actions from the 2017 plan were carried forward and three were noted as complete. The comprehensive list of previous mitigation actions, including descriptions of progress made and current status, is presented in **Attachment 4** of this annex.

8.3. New Mitigation Actions

In addition to the actions carried forward from previous plans, the Loudoun County Planning Team identified two new mitigation actions to be included in this plan. These actions address the expansion and strengthening of the Office of Emergency Management continuity program by increasing the resilience of county operations; they also facilitate coordination with FEMA to re-evaluate flood zones and update Flood Insurance Rate Maps (FIRMs) as a basis for future National Flood Insurance Program Activities. **Attachment 4** of this annex includes a table that summarizes each new and continued action, describing the proposed activity, priority level, estimated cost, and lead agency.

8.4. Action Plan for Implementation and Integration

The Loudoun County Office of Emergency Management (OEM) is responsible for coordinating county departments and agencies participating in hazard mitigation activities. The OEM-designated mitigation coordinator (Assistant Coordinator- Planning) is responsible for implementing the mitigation plan on two levels: the jurisdictional level and the multi-jurisdictional regional level. Tasks to ensure the implementation of the jurisdiction's actions are integrated into the *Action Plan for Implementation and*

Integration (which includes the prioritized list of Mitigation Actions), and plan maintenance procedures are described in the next section.

The *Loudoun County Emergency Operations Plan (EOP),* dated June 2019 (p. 82), defines criteria for project eligibility under the Hazard Mitigation Grant Program (HMGP); it states that a project must meet the following requirements:

- Conform to the State Hazard Mitigation Plan.
- Conform to environmental, historical, and economic justice issues.
- Provide a long-term solution.
- Demonstrate cost effectiveness.
- Comply with program regulations.
- Be consistent with overall mitigation strategies.

The Action Plan for Implementation and Integration describes how the county's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 37: Action Plan for Implementation and Integration, Loudoun County

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plan.	Continue to coordinate with departments to incorporate current and emerging risks and actions into planning efforts.
Review/update land development regulations for consistency with mitigation goals.	Continue coordinating with Planning and Zoning and Building Development on future land use projects.
Review/update building/zoning codes for consistency with mitigation goals.	Work with Planning and Zoning and Building and Development to ensure county zoning ordinances are consistent with mitigation goals.
Maintain regulatory requirements of floodplain management program (NFIP).	Support the Department of Building and Development sectors of Natural Resources and Water and Hydrology to ensure compliance with NFIP floodplain management regulations.
Enhance floodplain management through Community Rating System (CRS).	Work with applicable departments on floodplain management and mapping.
Review/update economic development plan and policies for consistency with mitigation goals.	Work with Loudoun County Department of Economic Development to ensure consistency and integration between the mitigation plan and plans for future development.
Continue public engagement in mitigation planning.	Continue to promote awareness of hazards and incorporate public feedback into planning processes for resident feedback.
Identify opportunities for mitigation education and outreach.	Identify opportunities to conduct community outreach to promote the importance of mitigation projects.

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Review/update stormwater plans and procedures for consistency with mitigation goals.	Work with Department of General Services Stormwater Division to discuss plans and procedures on a more frequent basis.
Review/update emergency plans to address evacuation and sheltering.	Continue to work with partner agencies list in the EOP and the Shelter Operations Plan.
Maintain ongoing enforcement of existing policies.	Support Department of Planning and Zoning with any applicable enforcement policies.
Monitor funding opportunities.	Continue to monitor funding sources and coordinate with departments on projects that support mitigation actions.
Incorporate goals and objectives into day-to-day government functions.	Incorporate the concept of mitigation into day-to-day government functions, including continual monitoring of the action items identified in the 2022 update.
Incorporate goals into day-to-day development policies, reviews, and priorities.	Continue work with Department of Planning and Zoning and Building and Development to incorporate mitigation into day-to-day activities.

9. Annex Maintenance Procedures

The point of contact for the NOVA HMP Planning Team is the facilitator for the process of monitoring, evaluating, and updating the **NOVA HMP, Base Plan** and is responsible for initiating the annual activities, convening the Planning Team, and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 38: Loudoun County Plan Maintenance Responsibilities for the *Northern Virginia Hazard Mitigation Plan,* 2022 NOVA HMP Base Plan

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA HMP Planning Team • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA HMP Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the NOVA HMP Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.1. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP, Base Plan**, the Loudoun County mitigation planning coordinator (Assistant Coordinator- Planning) will facilitate the method and schedule for maintaining the **Jurisdiction Annex**.

9.1.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in fifth year

Table 39: Loudoun County Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with jurisdiction planning team. 2. Review the status of all mitigation actions, using the *Mitigation Action Implementation Worksheet* (**Section 3, Attachment A, NOVA HMP Base Plan**).	Produce an annual report that includes the following: • Status update of all mitigation actions • Summary of any changes in hazard risk or vulnerabilities and capabilities • Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	1. Schedule the annual plan evaluation with jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities and hazard mitigation capabilities, using the *Planning Considerations Worksheet* (**Section 3, Attachment C, NOVA HMP Base Plan**).	Submit the annual report to the NOVA HMP Planning Team Point of Contact.
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

Mitigation actions presented in the Loudoun County Jurisdiction Annex may be reviewed, revised, and updated at any time. In addition, the *Loudoun County EOP*, p. 83, stipulates that "OEM will contact all agencies for post-disaster mitigation activities and notify them of their role in these operations." This will ensure that mitigation actions remain current and positioned for potential funding as it becomes available.

Loudoun County will continue to be a planning partner with multiple jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk of the hazards identified in this plan.

10. Annex Adoption

The Loudoun County Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation Plan (2022 NOVA HMP)*.

11. Loudoun County Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of the Planning Process
- Attachment 3: Documentation of Public Participation
- Attachment 4: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Planning Worksheets and Documentation

Capability Assessment

Jurisdiction: Loudoun County

Date: 9/22/21

Participants:

Name	Position/Title	Department/Agency
Kelly Myers	Assistant Coordinator-Planning	Loudoun County
Joe Dame	Emergency Management Coordinator	Town of Leesburg
Elizabeth Moore	Emergency Preparedness Specialist	Loudoun County
Nancy Freeman	Senior Mitigation Planner	IEM
Jessica Mason	Hazard Mitigation Planner	IEM

Planning and Regulatory

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. Please indicate which of the following your jurisdiction has in place.

Plans	Yes or No? Year	Does the plan address natural and/or non-natural hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan: Loudoun County 2019 Comprehensive Plan https://www.loudoun.gov/4957/Loudoun-County-2019-Comprehensive-Plan	Yes, 2019	• Describes land-use trends and population growth, expected growth, and development patterns (Chapter 2, p. 7) • Land-use planning framework policy areas: urban, suburban, transition, rural and towns, and Joint Land Management Areas • Use plan to implement mitigation actions?
Capital Improvement Plan FGOEDC Item 05 Quarterly Report Capital Improvement Projects Q3 FY21 (3).pdf	Yes, 2021-2030	
Economic Development Plan: Economic Growth and Diversification Plan, August 24, 2017, GO Northern Virginia Regional Council https://www.dhcd.virginia.gov/sites/default/files/Docx/gova/region-seven/region-7-growth-diversification-plan.pdf	Yes–regional plan	• Does not address natural or non-natural hazards
Impact fees for new development: Regulatory authority https://law.lis.virginia.gov/vacode/title15.2/chapter22/section15.2-2329/ Land-Development-Application-Fees (loudoun.gov)	Yes–2016	• Allowed under Code of Virginia, §15.2-2329, Imposition of Impact Fees • Economic Development Support Fund: one-time seed money for projects that provide economic benefits to the county for capital development projects, purchasing real estate, programming support for activities identified in the Economic Success Plan
Local Emergency Operations Plan: Loudoun County Emergency Operations Plan, July 2019 https://www.loudoun.gov/DocumentCenter/View/115801/Emergency-Operations-Plan?bidId=	Yes	• “All-hazards” (p. 1-9) • 25 natural, technological and human-caused hazards listed on p. 1-12 • Operational plan, does not include projects

Plans	Yes or No? Year	Does the plan address natural and/or non-natural hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Continuity of Operations Plan	Yes	Currently updating
Transportation Plan: Countywide Transportation Plan (2019 Comprehensive Plan) https://www.loudoun.gov/DocumentCenter/View/152287/CTP---Combined-with-small-maps-bookmarked	Yes	• Projects are not hazard-oriented • Chapter 8 describes multiple funding sources • Chapter 9 describes implementation strategies
Stormwater Management Plan: Loudoun County Code, Chapter 1096, Stormwater Management Ordinance, adopted in 2003 https://codelibrary.amlegal.com/codes/loudouncounty/latest/loudounco_va/0-0-0-9717 Loudoun County Small Municipal Separate Storm Sewer System (MS4) Stormwater Management Program Plan, July 2018-June 2023	Yes	• Purpose includes “control of flooding and standing water” • Program Plan references erosion and sediment control (p. 4) • Public education and outreach program and public involvement requirements described
Community Wildfire Protection Plan	No	
Other special plans (e.g., brownfields redevelopment, disaster recovery, Local Waterfront Redevelopment Plan, climate change adaptation, etc.): *Loudoun Health District, Pandemic Response Plan*, March 2020 https://www.loudoun.gov/DocumentCenter/View/179/Loudoun-Pandemic-Response-Plan?bidId=	Yes	• Pandemic Response Plan, Attachment H: Educational Outreach Activities

Building Code, Permitting, and Inspection	Yes or No?	Are codes adequately enforced?
Building Code: https://www.loudoun.gov/5012/Building-Codes-Regulations	Yes–2015	Virginia Uniform Statewide Building Code
Building Code Effectiveness Grading Schedule (BCEGS) Score	Yes	We received a score of 4 in 2020. That was a regression from 2013 when we were scored a 3. This past June, I requested an appeal, and we were granted a score of 3 based on the new code going in effect July 1. I have not received the final score in writing yet. However, I do have an

Building Code, Permitting, and Inspection	Yes or No?	Are codes adequately enforced?
		email stating the adjustment will be made. I will follow up with ISO to get the final report and score.
Fire Department ISO rating: Public Protection Class (PPC) Ratings Changes | Loudoun County, VA: Official Website	Yes	5–Rural 2–Suburban 10–No Fire Station Within 5 Mile Drive
Site Plan review requirements https://www.loudoun.gov/1315/Site-Plans	Yes	Website describes review requirements and process

Land Use Planning and Ordinances	Yes or No?	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Zoning ordinance https://www.loudoun.gov/zoningordinance	Yes–1993	• Goals include adequate safety from crime, disaster evaluation, civil defense, transportation, water, sewage, flood protection, etc., and protect against loss of life, health, or property from fire, flood, panic and other dangers
Subdivision ordinance: Land Subdivision and Development Ordinance, Chapter 1241 https://www.loudoun.gov/DocumentCenter/View/18047/Land-Subdivision-and-Development-Ordinance?bidId=	Yes–2006	• Does not address hazards or include mitigation actions related to the HMP hazards
Floodplain ordinance: Floodplain Management https://www.loudoun.gov/1505/Floodplains and Revised 1993 Loudoun County Zoning Ordinance, Section 4-1500, Floodplain Overlay District https://www.loudoun.gov/DocumentCenter/Home/Index/1524	Yes	• Major Floodplain (SFHA), and Minor Floodplain, which continues upstream from the Major Floodplain • Publishes the phone number for the County Department of Building and Development Floodplain Help Line
Natural hazard specific ordinance (stormwater, steep slope, wildfire): Mountainside Development Overlay District and Steep Slope Standards of the County Zoning Ordinance https://www.loudoun.gov/1378/Steep-Slopes-Mountainsides	Yes	• Delineates safety hazards on this topography • Reference to erosion and downstream flooding
Flood insurance rate maps	Yes, 2017	Yes

Land Use Planning and Ordinances	Yes or No?	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Acquisition of land for open space and public recreation uses	Yes	Plans in the County Comprehensive Plan
Other • Home Improvement Programs | Loudoun County, VA: Official Website • FY 2022 Adopted Budget: Volume Two (loudoun.gov)	Yes	• Loans and grants to help homeowners who meet certain criteria to make home repairs focusing on code violations and health and safety issues • Additional projects (Capital Improvement Projects listed FY 2022 Budget Vol. 2 Capital Improvement Program)
How can these capabilities be expanded and improved to reduce risk?		

Administrative and Technical

Identify whether your community has the following administrative and technical capabilities. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. If your jurisdiction does not have local staff resources, please indicate if these are available through agreement with other entities or at the county level to provide the services or technical assistance.

Staff/Personnel Resources	Have Capability Y/N	Department/ Agency and Position	Effective Coordination?	Adequate Staffing?	Integrated into Mitigation Planning?
A. Planner(s) or engineer(s) with knowledge of land development and land management practices	Yes	Building and Development	Yes	Yes	Yes
B. Engineer/professionals trained in construction practices related to buildings and/or infrastructure	Yes	Building and Development General Services	Yes	Yes	Yes
C. Planners/Engineer(s) with an understanding of natural and/or manmade hazards	Yes	Building and Development	Yes	Yes	Yes
D. Floodplain manager	Yes	Building and Development	Yes	Yes	Yes
E. Surveyor(s)	No				
F. Staff with education or expertise to assess the community's vulnerability to hazards	Yes	Office of Emergency Management and the Department of Building and Development	Yes	Yes	Yes
G. Personnel skilled in GIS and/or Hazus	Yes	Fire and Rescue, Mapping Office, Office of Emergency Management	Yes	Yes	Yes
H. Scientist familiar with hazards of the community	No				
I. Emergency manager	Yes	Office of Emergency Management	Yes	Yes	Yes
J. Grant writer(s)	Yes	County Administration	Yes	Yes	Yes
K. Warning systems or services (automated callout, sirens, etc.)	Yes	DIT, Office of Emergency Management,	Yes	Yes	Yes

Staff/Personnel Resources	Have Capability Y/N	Department/ Agency and Position	Effective Coordination?	Adequate Staffing?	Integrated into Mitigation Planning?
		Department of Fire and Rescue, Sheriff Office			
How can these capabilities be expanded and improved to reduce risk?					

Safe Growth

This worksheet identifies potential gaps in your community's growth guidance instruments and improvements that could be made to reduce vulnerability to future development.

Comprehensive Plan	Yes	No
Land Use		
1. Does the future land-use map clearly identify natural hazard areas?	X	
2. Do the land-use policies discourage development or redevelopment within natural hazard areas?	X	
3. Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?	X	
Transportation		
1. Does the transportation plan limit access to hazard areas?	X	
2. Is transportation policy used to guide growth to safe locations?	X	
3. Are movement systems designed to function under disaster conditions (e.g., evacuation)?	X	
Environmental Management		
1. Are environmental systems that protect development from hazards identified and mapped?	X	
2. Do environmental policies maintain and restore protective ecosystems?	X	
3. Do environmental policies provide incentives to development that is located outside protective ecosystems?	X	
Public Safety		
1. Are the goals and policies of the comprehensive plan related to those of the FEMA-approved Local Hazard Mitigation Plan?	X	
2. Is safety explicitly included in the plan's growth and development policies?	X	
3. Does the monitoring and implementation section of the plan cover safe growth objectives?	X	

Comprehensive Plan	Yes	No
Zoning Ordinance		
1. Does the zoning ordinance conform to the comprehensive plan in terms of discouraging development or redevelopment within natural hazard areas?	X	
2. Does the ordinance contain natural hazard overlay zones that set conditions for land use within such zones?	X	
3. Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?	X	
4. Does the ordinance prohibit development within wetlands, floodways, and floodplains or enable fines for such development?	X	
Subdivision Regulations	**Yes**	**No**
1. Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?		X
2. Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources?	X	
3. Do the regulations allow density transfer where hazard areas exist?		X
Capital Improvement Program and Infrastructure Policies	**Yes**	**No**
1. Does the capital improvement program limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?	X	
2. Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?	X	
3. Does the capital improvement program provide funding for hazard mitigation projects identified in the FEMA-approved Local Hazard Mitigation Plan?	X	
Other	**Yes**	**No**
1. Do small area or corridor plans recognize the need to avoid or mitigate natural hazards?	X	
2. Does the building code contain provisions to strengthen or elevate construction to withstand hazard forces?	X	
3. Do economic development or redevelopment strategies include provisions for mitigation of natural hazards?	X	

Comprehensive Plan	Yes	No
4. Is there an adopted evacuation and shelter plan to deal with emergencies from natural hazards?	X	

Financial

Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in the past and for what type of activities?	Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Yes, for general projects	Yes
Authority to levy taxes for specific purposes	Yes, as allowed by law	Yes, for special assessments and special tax districts that fund a specific community need, usually water/sewer	Yes, but must meet certain requirements
Fees for water, sewer, gas or electric services	No		
Impact fees for new development	Y	Yes	Yes
Storm water utility fee	Yes	Yes, one-time fee for potential failure of alternative septic systems that do not get repaired by the landowner	Yes
Incur debt through general obligation bonds and/or special tax bonds	Yes	Yes, for general projects	Yes, must meet certain requirements, such as having been through referendum, fall within debt limits, approved by board
Incur debt through private activities	No		
Community Development Block Grant	Yes	Yes	Yes
Other federal funding programs	Yes	Yes, FEMA Public Assistance (PA). Flood mitigation is an area where FEMA offers assistance; we recently applied but were not selected for funding. Other funding based on law, i.e., ARPA, CARES Act	Yes, when a federal emergency is declared for FEMA PA, others may be competitive or enacted by law
State funding programs	Yes	Yes	Yes, if available. Could be competitive
Public/private partnership funding sources	Yes	Yes, to build soccer stadium and garage	Yes
How can these capabilities be expanded and improved to reduce risk?			

Education and Outreach

Identify education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Program/Organization	Yes/No	Describe program/organization and how it relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizens groups or nonprofit organizations focused on environmental protection, emergency preparedness, access, and functional needs populations, etc.	Yes	Blue Ridge Center for Environmental Stewardship - ©2021 Loudoun Environmental Education Alliance (loudounnature.org) Loudoun Senior Interest Network | Resources for the Elder Care Community in Loudoun County (loudounseniors.org) Awareness, Connections, Education, Solutions | Accessible Community
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education, household recycling, etc.)	Yes	Fire and Life Safety Programs | Loudoun County, VA - Official Website
Natural disaster or safety-related school programs	Yes	School Programs | Loudoun County, VA - Official Website
StormReady certification	Yes	The county has the certification. INOVA Health System and Leesburg Corner Premium Outlets are supporters. StormReady® and TsunamiReady® in Virginia (weather.gov)
Firewise Communities certification	No	
Public-private partnership initiatives addressing disaster-related issues		Loudoun Cares Salvation Army Loudoun Watershed Watch - Overseeing the Water Resources of Loudoun County, VA
Other		
How can these capabilities be expanded and improved to reduce risk?		

National Flood Insurance Program (NFIP) Survey Form

Jurisdiction: Loudoun County
Floodplain/NFIP Administrator: Maggie Auer
Phone: 703-777-0222
Date: 9/22/2021
Email: Maggie.Auer@loudoun.gov
Jurisdiction Participants: Towns of Hamilton, Leesburg, Middleburg, Lovettsville, Purcellville, Round Hill, Unincorporated Areas of Loudoun County

Please provide the information below to document your community's participation in and continued compliance with the NFIP, as well as to identify areas for improvement that could be potential mitigation actions. Indicate the source of information if different from the one included.

NFIP Topic	Source of Information	Comments
Insurance Summary		
How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist	664, $402,839 (as of 05/2020)
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist	93, $1,839,126, N/A (as of 05/2020)
How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA)	550 building footprints, 150 w/addresses in SFHA
Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	Unknown
Staff Resources		
Is the Community FPA or NFIP Coordinator certified?	Community FPA	Yes, Certified Floodplain Administrator (CFM)
Is floodplain management an auxiliary function?	Community FPA	No, full-time position
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	Permit & Plan Review, Zoning Enforcement, Review Engineering Analysis
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	None
Compliance History		
Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes

NFIP Topic	Source of Information	Comments
Are there any outstanding compliance issues (i.e., current violations)?		Yes
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		2014–2015

11.3. Attachment 3: Documentation of Public Participation

Loudoun County residents were invited to participate in a survey asking for their experience with local hazards. *Loudoun Now*, a community news source, published an article requesting community input.

A Loudoun County Fire-Rescue technical rescue crew trains at the Panda Stonewall Energy Center in the fog Thursday, Oct. 22. [Renss Greene/Loudoun Now]

Loudoun Residents Asked to Take Hazard Survey

2021-08-20 Loudoun Now

County officials are encouraging Loudoun residents and business owners to help build community resilience to disasters by participating in the Northern Virginia Hazard Mitigation Survey.

Loudoun County and its towns are part of a regionwide effort to update the Northern Virginia Hazard Mitigation Plan. The plan identifies strategies for reducing or eliminating loss of life, injury, and property damage caused by disasters as well as the long-term risks that result from hazards such as floods, severe storms, tornadoes, wildfires, and winter weather.

In addition to preventing loss of life, injury and damage to buildings and infrastructure, hazard mitigation can prevent damage to a community's economic, social, and environmental well-being.

The survey asks questions about natural hazards they are concerned about or have directly experienced in the past five years, as well as for opinions on proposed mitigation strategies...

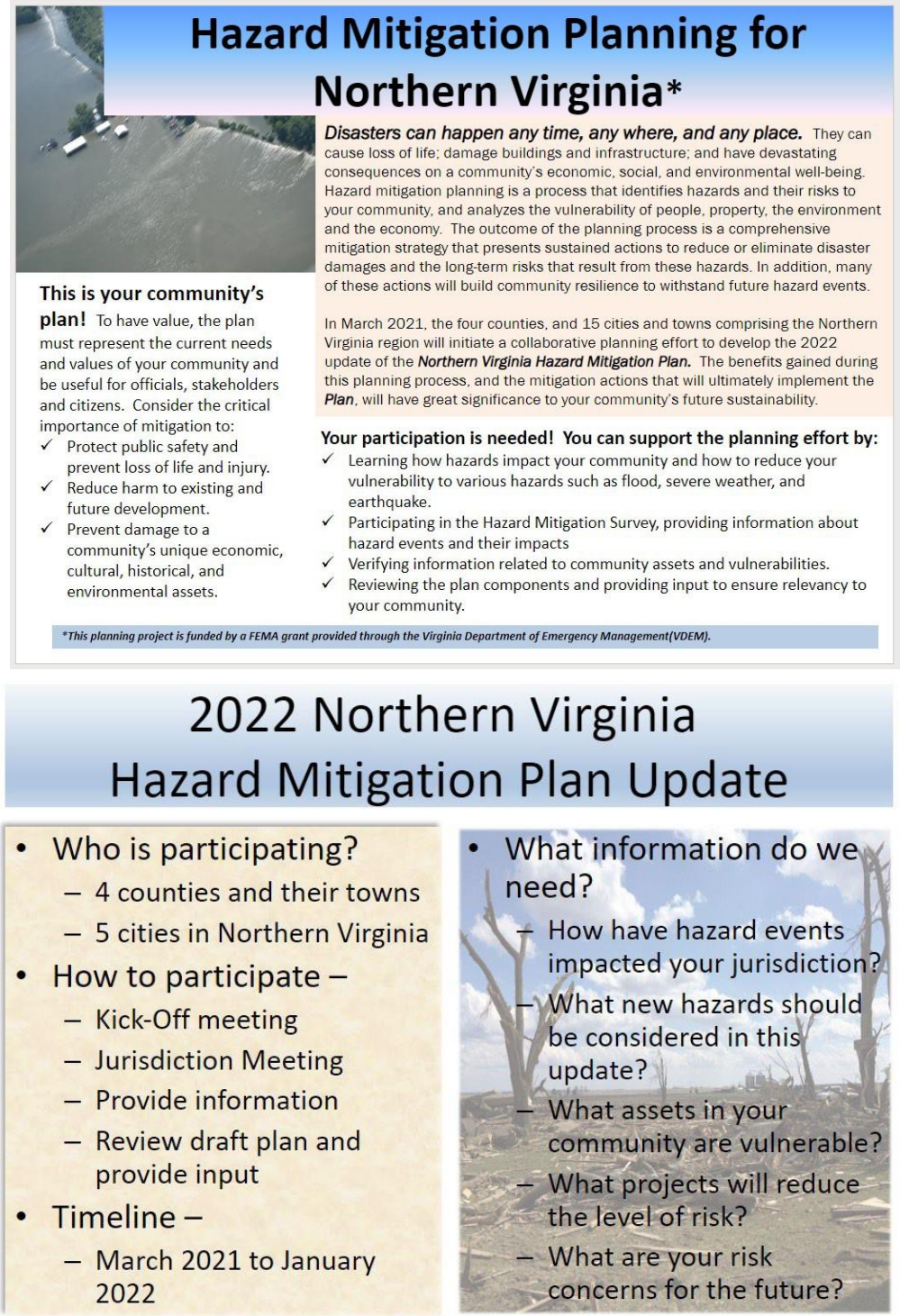


Figure 16: Promotional Flyer Distributed throughout the Planning Area

Below is a copy of the news release that Loudoun County sent out. It was shared with all the Towns was disseminated through other channels.

For Immediate Release
September 12, 2022

Media Contact: Glen Barbour, Public Affairs and Communications Officer
703-771-5086, Glen.Barbour@loudoun.gov

Loudoun Community Encouraged to Comment on Regional Hazard Mitigation Plan

The Loudoun County Office of Emergency Management encourages residents and business owners in Loudoun County to help build community resilience to disasters by providing comments on the proposed Northern Virginia Hazard Mitigation Plan.

The plan is a multi-jurisdictional plan that includes Loudoun County and its incorporated towns as well as other Northern Virginia jurisdictions, including Arlington, Fairfax and Prince William counties.

The plan identifies strategies for reducing or eliminating loss of life, injury and property damage caused by disasters as well as the long-term risks that result from hazards such as floods, severe storms, tornadoes, wildfires and winter weather.

In addition to preventing loss of life and injury and damage to buildings and infrastructure, hazard mitigation can prevent damage to a community's economic, social and environmental well-being.

Members of the community can participate in the mitigation planning process by submitting their comments on the plan by 5:00 p.m., October 8, 2022, by email at NOVA2022PublicComment@iem.com.

11.4. Attachment 4: Mitigation Actions

Table 40: Previous Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status	Comments to Justify Current Status	Projected Completion
2006-8	Maintain high quality aerial photography of the County	Office of Mapping/ Office of Emergency Management	All Hazards	Department of Homeland Security grants, UASI funding, County Funding	Ongoing	Continue to work with our local officials in stressing the importance of this initiative and identify funding to maintain the current capabilities	Low (Currently being done, but need to ensure it continues to be funded)	Complete-- but still a priority to maintain	Complete but still a priority to maintain	Need to Maintain	Continuation
2010-1	Meet with VDOT and develop a plan for adding flooding signage and gates for known trouble spots	Office of Emergency Management/ Loudoun County Sheriff's Office	Flood/High Wind/Severe Storm	Internal county funding, Federal Highway Administration grants, Tiger Grants	Ongoing	Within ninety days of endorsement of the plan have our kick-off meeting- within six months of our kick-off meeting have identified and vetted locations for action. Remaining period of time to identify funding sources and complete installation	High	Since 2010, we have met with VDOT and increased signage capability available for deployment notifying the public of road closed due to "high water". We have initiated conversation with VDOT regarding the installation of gates, but those conversations are in the infancy stage.	Complete but still need to maintain	Need to Maintain	Continuation

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status	Comments to Justify Current Status	Projected Completion
2010-2	Evaluate Repetitive Loss and Severe Repetitive Loss properties within the County. Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate	Office of Emergency Management	Flood/High Wind/Severe Storm	FEMA Unified Hazard Mitigation Assistance Grants, Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Ongoing	Property owner interest and application to participate in FEMA Grant Program	High	Since 2010 Loudoun County has participated in the Risk Map program and have preliminary discussed these options in a variety of settings. Given the results of the Risk Map project, we will need to develop and implement strategies that continue the discussions and look at ways to minimize risk.		Need to Maintain	Continuation
2010-3	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filling form FEMA AW-501	Office of Emergency Management	Flood/High Wind/Severe Storm	FEMA Unified Hazard Mitigation Assistance Grants, Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Ongoing	Property owner interest and application to participate in FEMA grant program	High	This is part of the Risk Map project, which will yield additional requirements associated with this mitigation action.		Need to Maintain	Continuation

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status	Comments to Justify Current Status	Projected Completion
2010-4	Collaboration with VDOT, transportation officials and law enforcement to develop a strategy for installation of permanent variable message boards for public messaging and traffic cameras for maintaining situational awareness	Office of Emergency Management/ Loudoun County Sheriff's Office	Flood/High Wind/Severe Storm/Tornado/Winter Storm	Internal county funding, Federal Highway Administration grants, Tiger Grants	Ongoing	Within ninety days of endorsement of the plan have our kick-off meeting- within six months of our kick-off meeting have identified and vetted locations for action. Remaining period of time to identify funding sources and complete installation	Medium	Through a partnership with VDOT, we have deployed mobile variable message boards to several strategic locations to enhance the ability of public messaging VDOT has increased the number of traffic cameras throughout the eastern portion of the County, which allows for collecting situational awareness. We are presently working through the County Attorney's Office regarding an agreement with VDOT through the Secure Partner's initiative	Internal county funding, Federal Highway Administration grants, Tiger Grants	Ongoing	Continuation
2010-5	Research possible vulnerable population registration systems to better identify and serve at risk citizens	Office of Emergency Management	All Hazards	Department of Homeland Security grants, UASI funding, County Funding	Ongoing	Continue ongoing work in this area. Within one year of endorsement of the plan be able to identify possible solutions and spend the remaining period of time working to identify funding sources to complete the project	Medium	Loudoun County implemented the County of Loudoun Evacuation Assistance Registry, which allows for the identification of those individuals at risk and needing assistance during an evacuation.	Complete but still need to maintain	Department of Homeland Security grants, UASI funding, County Funding	Continuation
2010-6	Determine feasibility of developing a drought preparedness and response plan	Office of Emergency Management	Drought	Department of Homeland Security grants, UASI funding, Internal County Funding	Ongoing	Research and identify applicable funding mechanisms to develop the plan	Medium	This initiative has not commenced as of yet and will be continued in the next planning cycle	Ongoing	Need to Maintain	Continuation

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status	Comments to Justify Current Status	Projected Completion
2017-1	Continue working with VDOT regarding the development and implementation of gates to prevent drivers from crossing known flood prone roadways	Office of Emergency Management	Flood/High Wind/Severe Storm	Department of Homeland Security grants, TIGER grants, Transportation Grants, Commonwealth of Virginia	Ongoing	Upon approval of the plan we will convene representatives to discuss current progress and to further develop the project concept	High		Department of Homeland Security grants, TIGER grants, Transportation Grants, Commonwealth of Virginia	Need to Maintain	Continuation
2017-2	Evaluate Repetitive Loss and Severe Repetitive Loss properties within the County. Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate	Office of Emergency Management	Flood/High Wind/Severe Storm	FEMA Unified Hazard Mitigation Assistance Grants, Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Ongoing	Further timeframe will be identified as Loudoun County continues our participation in the Risk Map Process	High		FEMA Unified Hazard Mitigation Assistance Grants, Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Need to Maintain	Continuation
2017-3	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filling form FEMA AW-501	Office of Emergency Management	Flood/High Wind/Severe Storm	FEMA Unified Hazard Mitigation Assistance Grants, Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Ongoing	Further timeframe will be identified as Loudoun County continues our participation in the Risk Map Process	High		Ongoing	Further timeframe will be identified as Loudoun County continues our participation in the Risk Map Process	Continuation

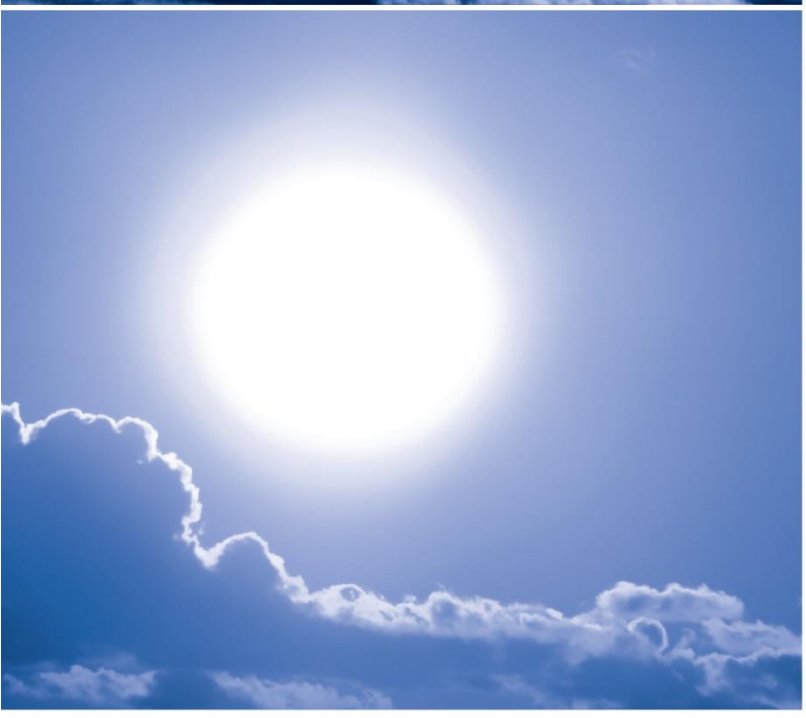
Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status	Comments to Justify Current Status	Projected Completion
2017-4	Collaboration with VDOT and transportation officials to continue expanding the traffic cameras to maintain the ability for situational awareness	Office of Emergency Management	Flood/High Wind/Severe Storm/Tornado/Winter Storm	Internal county funding, Federal Highway Administration grants, Tiger Grants	Ongoing	Upon approval of the plan convene a meeting of stakeholders to determine status and to develop the project scope	Medium		Need to Maintain	Continuation	Continuation
2017-5	Determine feasibility of developing a drought preparedness and response plan	Office of Emergency Management	Drought	Department of Homeland Security grants, UASI funding, Internal County Funding	Ongoing	Research and identify applicable funding mechanisms to develop the plan	Medium		Need to Maintain	Continuation	Continuation

Table 41: Non-Natural Hazard Mitigation Actions for County and Participants

#	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Active Violence	Civil Unrest	Communications Disruption	Cyberattack	Hazardous Materials	Pandemic/Public Health	Terrorism	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
LC-1	Cybersecurity Assessment: Improvements	Loudoun Water				x				Loudoun Water Capital Improvement Plan	Ongoing	Cybersecurity assessment program has recently matured. Assessments will be conducted every 3 years to maintain optimal cybersecurity.	Medium	Continued assessment/implementation of a multi-faceted cybersecurity program, including a cybersecurity master plan, cybersecurity awareness training, continuity of operations planning and exercises, cybersecurity policies and procedures, intrusion detection and prevention technology, data loss prevention technology, and advanced persistent threat detection.
LC-2	Community Systems Risk Assessment	Loudoun Water				x			x	Loudoun Water Capital Improvement Plan	2025	2–3 Community Risk Assessments will be completed every year for 4 years. Ongoing, on target.	Medium	Risk assessment for the community systems like the water risk and resiliency assessment that was completed in 2020. This will include scoring and analyzing likelihood and consequences of failure of critical wastewater assets and providing a risk score. Threats analyzed will include both natural hazards and malevolent acts. Ideas for mitigation of risk will also be included.
LC-3	Wastewater Risk Assessment	Loudoun Water					x	x	x	Loudoun Water Capital Improvement Plan	2023	Design is being completed. Not started- on target.	High	Risk assessment for the central wastewater system like the water risk and resiliency assessment that was completed in 2020. This will include scoring and analyzing likelihood and consequences of failure of critical wastewater assets and providing a risk score. Threats analyzed will include both natural hazards and malevolent acts. Ideas for mitigation of risk will also be included.
LC-4	Public Safety Radio Town Coverage Sites	Department of Fire and Rescue, Sheriff's Office, Department of Information Technology	x	x	x	x	x	x	x	Loudoun Water Capital Improvement Plan	Ongoing	Phase I included a study to identify where and how many additional towers are needed to provide optimal coverage and has been completed. Quotes are being requested to begin Phase II (construction of new towers). Construction of new towers is expected continue every two years.	High	This project consists of two phases. Phase I will conduct a study which will identify how many and where additional towers may be needed, and if existing tower locations should be relocated for optimal coverage. Phase II will construct new towers or relocate existing towers.

#	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Active Violence	Civil Unrest	Communications Disruption	Cyberattack	Hazardous Materials	Pandemic/Public Health	Terrorism	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
LC-5	Public Safety School Emergency Radio Coverage	Public Schools, Sheriff's Office, Department of Information Technology	x	x	x	x	x	x	x	Capital Improvement Projects	FY 2026	Phase I (Coverage Study) has been completed. Phase II will install and replace the Bi-Directional Amplifiers (BDA) identified in the study.	Medium	This project consists of two phases. Phase I will conduct a coverage study to determine needs and identify schools that need additional equipment to meet coverage requirements. Phase II will install and replace the BDAs identified in the study. This project provides funding to purchase and install BDAs in public school buildings to provide Public Safety radio coverage for the school resource officers. Funding is based on a coverage study that was administered by the Department of Information and Technology which identified the location of schools that needed boosters and determined the proper replacement schedule of existing BDAs. The project budget was revised during the FY 2022 CIP budget development process to include planned funding for the remaining phases of project implementation for FY 2022, FY 2023, FY 2024, FY 2025, and FY 2026.
LC-6	Backup Emergency Communications Center	Department of Fire and Rescue, Sheriff's Office, Building and Development	x	x	x	x	x	x	x	Capital Improvement Projects	FY 2025	Schedule a kickoff meeting.	Medium	This project provides funding for relocation of the Backup Emergency Communications Center (ECC) to a modern, technically redundant, secure facility. This migration could be a step whereby the technology and operations are moved to a data center. The existing ECC facility is aging and has been identified on the county's Technology Roadmap as a key backup facility that must be migrated to a modern data center due to the critical nature of the work performed in the facility.
LC-7	Data Center and Fiber Plant Relocation	Department of Information Technology (DIT)	x	x	x	x	x	x	x	Capital Improvement Projects	FY 2023	Continue migration of data center. Once complete, ensure the stability of the new center before collapsing existing facilities	High	This project provides funding to continue the migration of the county's data center facilities to a private, fit-for-purpose data center within Loudoun County. Once complete, DIT will collapse the existing, aging data center facilities which present a significant risk to continuity of operations.

#	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Active Violence	Civil Unrest	Communications Disruption	Cyberattack	Hazardous Materials	Pandemic/Public Health	Terrorism	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
LC-8	Public Safety: 911 Phone Switch Replacement	Department of Fire and Rescue, Sheriff's Office, Department of Information Technology (DIT)	x	x	x	x	x	x	x	Capital Improvement Projects	FY 2024	Develop scope of the plan and schedule kickoff meeting.	High	This project provides funding to replace the county's current E-911 phone switch. All emergency communications in the county transmit through the E-911 phone switch, which makes it an essential piece of equipment for the health and safety of Loudoun's citizens. The current E-911 phone switch was installed in the ECC and became fully operational in July 2015. The estimated lifespan for this mission-critical system is seven years.
LC-9	Public Safety: Radio Tower Expansion Program	Department of and Rescue, Sheriff's Office, Department of Information Technology (DIT)	x	x	x	x	x	x	x	Capital Improvement Projects	Ongoing	The first phase, identifying locations for additional towers, has been completed. Installation of new towers will be ongoing every two years.	High	This project provides funding for the installation of additional Public Safety Radio Towers to provide required radio coverage for First Responders, based on the findings of a coverage study that was managed by the DIT. The first phase of this project identified the need for nine additional towers in various locations throughout the county. The second phase includes the installation of the new towers as identified in the coverage study which will begin in FY 2021 and continue every two years. Due to population growth within the county, it is expected that additional Public Safety Radio Towers are needed to provide the required radio coverage for First Responders. Future funding for this program will be re-evaluated based on updated requirements.
LC-10	Broad Run Farms Waterline Extension	Department of General Services					x					Currently in design and bidding phase	High	EPA is using Federal Funds to extend water service to 142 parcels in the Broad Run Farms community in Sterling. Capital Improvement Funds are extending water mains to the remaining 311 parcels. The Hidden Lane Landfill is an Environmental Protection Agency (EPA) Superfund Site in Broad Run Farms. The Board of Supervisors has authorized an extension of public waterlines throughout the subdivision in response to groundwater contamination from the Hidden Lane Landfill.



Northern Virginia Hazard Mitigation Plan

Annex 8-A: Town of Leesburg

November 2022

Town of Leesburg Overview

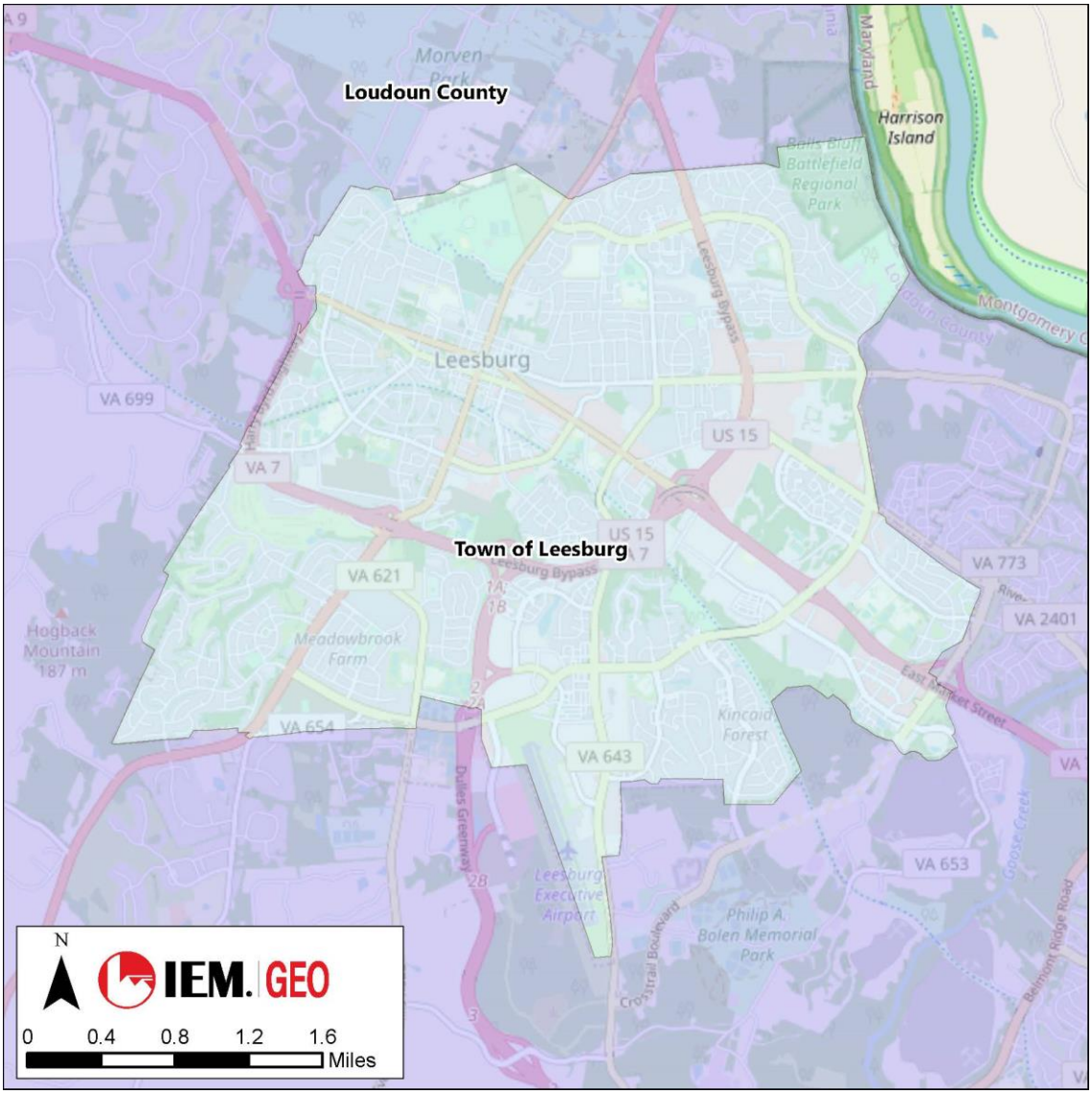


Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
Founded in 1758 Incorporated in 1813	12.27 sq. mi.	48,250	25 West Market St., Leesburg, VA 20176	17,900	Flood/Flash Flood

Town of Leesburg's Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI), 1950–June 2021

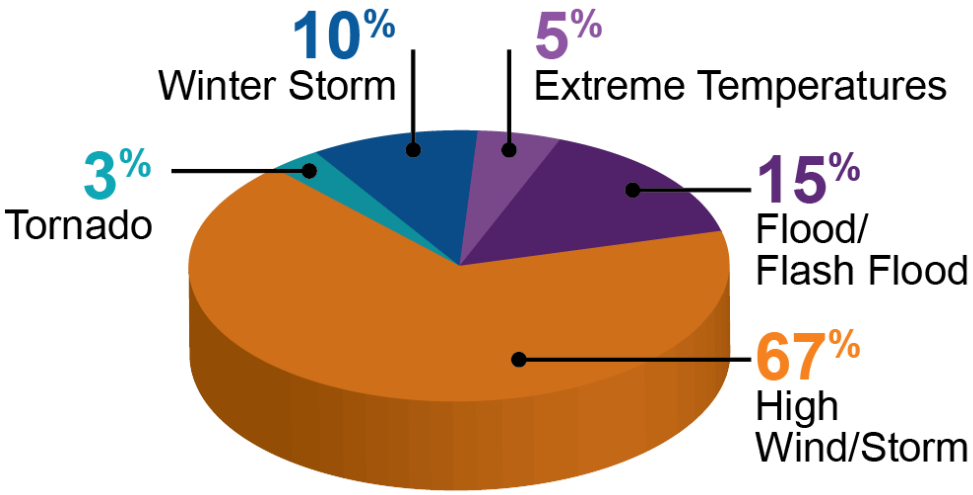


Figure 1: Percentage of Hazards

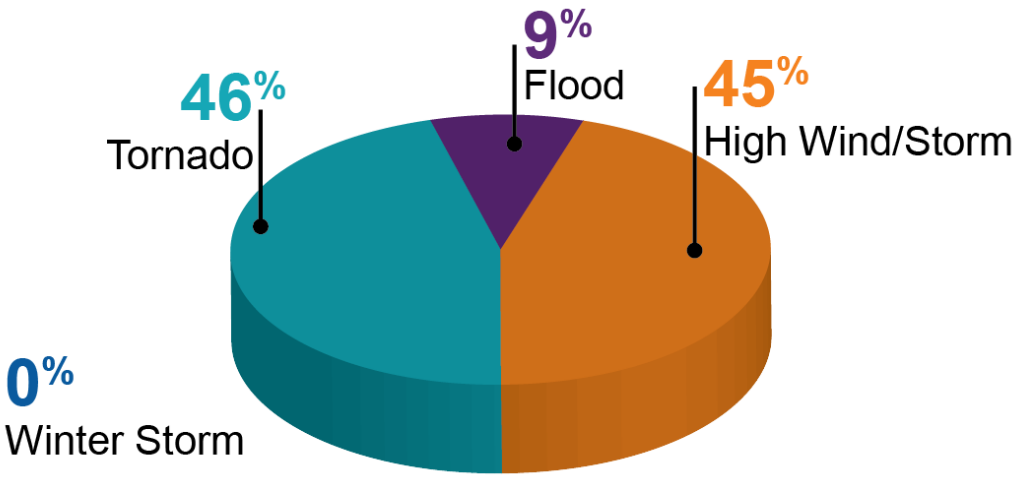


Figure 2: Property Damage from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Natural Hazard Risk Ranking Summary

Hazard	Hazard Ranking
Winter Weather	**High**
High Wind/Severe Storm	**High**
Flood	**High**
Tornado	**High**
Dam Failure	**Medium**
Drought	**Medium**
Extreme Temperatures	**Medium**
Earthquake	**Medium**
Wildfire	**Low**
Karst/Sinkhole/Land Subsidence	**Low**
Landslide	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	23
Food, Water, Shelter	22
Health and Medical	5
Energy	14
Communications	10
Transportation	39
Hazardous Materials	14
Education	15
Cultural/Historical	6
High Hazard Dams	2

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking, Town of Leesburg

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	Low
Financial	Moderate
Education and Outreach	Low

Hazard Mitigation Plan Point of Contact

Table 5: Point of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Emergency Management Coordinator Town of Leesburg Office of Emergency Management 703-771-2700 25 West Market Street Leesburg, VA 20176

Town of Leesburg

This annex presents the following jurisdiction-specific information to update the *2022 Northern Virginia Hazard Mitigation Plan (NOVA HMP)*. Information was provided by the Town of Leesburg and, where municipal-level data was unavailable, by Loudoun County and other resources.

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1. Jurisdiction Profile

Established	1758
Total Land Area	12.27 square miles
Geographic Region	Piedmont
Persons Per Household	3.47
Persons Per Square Mile	4,327
Median Age	24.7
Elevations	36 feet

1.1. Location

The Town of Leesburg is the county seat of Loudoun County, VA. Part of the town is located on the Potomac River, but it spreads westward to Catoctin Mountain. It is situated to the south of the river and 28 miles northwest of Washington, D.C. There are many historic sites and museums that attract thousands of tourists each year.

1.2. History

In 1757 the Assembly of Virginia selected this settlement for the location of the Loudoun County courthouse. The land was then owned by Nicholas Minor, who hired John Hough to survey and plat his 60 acres into 70 lots to form a town, which he called George Town. The name was changed to Leesburg the following year, in honor of the Lee family. In September 1758, an Act of the Assembly established the Town of Leesburg, although the town was not incorporated until 1813.

The farm area outside of Leesburg attracted a group of Quakers, whose habit it was to farm large landholdings. In 1803, the Treatise on Practical Farming was published by agriculturist John Binns, who stressed the importance of crop rotation and deep plowing, clover, grazing, and gypsum to increase farm yields. He noted the Quakers had been using such practices for decades, techniques that are now considered facets of today's widespread use of organic farming.[2]

Leesburg took center stage during the Civil War as the location of the Battle of Ball's Bluff, the first engagement to take place in Loudoun County. The town is part of the Journey Through Hallowed Grounds Heritage area, a 180-mile-long region between Gettysburg, PA, to Charlottesville, VA, the site of Monticello, Thomas Jefferson's home.[3]

Located within the ring of communities that encircle the nation's capital, Leesburg has seen tremendous growth and development along with other Virginia and Maryland communities within commuting distance of Washington, D.C., and is finding new business and social opportunities on every front since the end of the twentieth century.

1.3. Demographics, Economy, and Governance

The Town of Leesburg is included as part of the Loudoun County profile and the regional Northern Virginia profile as presented in **Section 1 of the Base Plan** as context to the entire plan. The 2020 U.S. census population estimate for the town is 48,250, an increase of 12% since 2010.

Table 6: Population and Growth Rate, Loudoun County[1]

Year	Population	Decennial Percent Increase
1970	4,800	
1980	8,400	75%
1990	16,200	93%
2000	28,300	75%
2010	42,616	51%
2020	48,250	13%

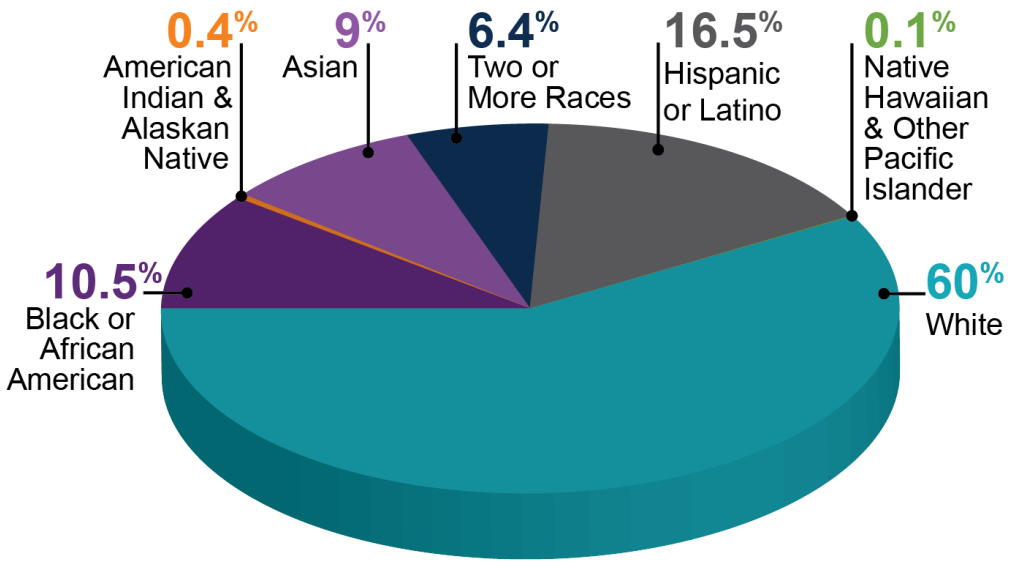


Figure 4: Race and Ethnicity Demographics from 2020 Census

[1] U.S. Census (1970–2020), City-Data (www.city-data.com), U.S. Census Bureau (www.census.gov), and Loudoun County (www.Loudouncounty.gov)

Table 7: Economic Data

Economy	Data
Median Household Income (2021)	$114,444
Unemployment Rate (November 2021, September 2021)	2.1%, 2.5%
Per Capital Income (2019)	$55,744
Median House or Condo Market Value (2021)	$434,000
Percentage Below Poverty (2019)	5.01%
Number of Businesses (2019)	11,028
Most Common Businesses and Services	Professional, Scientific, Professional Education, Management and Administrative, Waste Management

Despite having a high median income, approximately 5.01% of the town's residents, or 2,600 people, live in poverty, the highest group being females between the ages of 1 and 24, or 17% of those impoverished. Rates for all older female age groups are all higher than those of the male population. It is likely that many of these women are heads of households with dependents under the age of 18.[2]

The town's location in the Washington metropolitan area, its ease of access by car and public transportation, and its highly skilled labor force have attracted an increasingly varied residential and commercial mix economically.

The town also participates, through Loudoun County, in the Commercial Property Assessed Clean Energy (C-PACE) Program. C- PACE is a financing tool that enables commercial and industrial property owners to obtain low-cost, long- term financing for energy efficiency, renewable energy, and water efficiency improvement projects in new and existing buildings and real property.

C-PACE in Loudoun County was recently adopted under Chapter 825 of the Codified Ordinances and is administered by Virginia PACE Authority. The Loudoun County C-PACE program is available to commercial borrowers throughout Loudoun County, including those businesses located within Leesburg and other Loudoun towns, as long as the borrower, the property, and the improvements all qualify for the program.

The location of Dulles International Airport in Loudoun County has provided a boost to small businesses for which product shipping is essential to their operations.

The Town of Leesburg owns and operates the Leesburg Executive Airport (JYO). Its convenient location to Washington, D.C. and the number of businesses in the surrounding area have made JYO the second busiest general aviation airport in Virginia. An economic impact study conducted by the Virginia Department of Aviation in 2018 found JYO brings in over a $100 million in economic activity and is responsible for nearly 600 jobs.

1.4. Built Environment and Community Lifelines

The information related to Community Lifelines and critical assets for the Town of Leesburg was pulled out of the Loudoun County data presented in this section and has been collected from multiple sources, including town Office of Emergency Management and Security, Hazus (Version 4.2), and county and

[2] Data USA: Loudoun County, https://datausa.io/profile/geo/loudoun-county-va#housing

town government websites. Data extracted from the Hazus Level 1 assessment indicates that Loudoun County has an estimated total of 808 Community Lifelines and critical assets. Due to the time lag in collecting and verifying data and the method of documenting location and jurisdiction used in Hazus, this may not reflect the current inventory maintained by Loudoun County. Additional information about the assets that were identified is included in the **Base Plan**.

Table 8 provides a summary of the number of critical assets, by type. The Town of Leesburg maintains a detailed list of Community Lifeline facilities, sites, and critical assets that are important and critical for the town.

Table 8: Number of Assets per Community Lifeline/Sector, Loudoun County[3,4]

Lifeline/Sector	Number of Assets
Safety and Security	22
Food, Water, Shelter	22
Health and Medical	5
Energy	14
Communications	10
Transportation	39
Hazardous Materials	14
Education	15
Cultural/ Historical	6
High Hazard Dams	2

1.4.1. Safety and Security

Hazus data citing Loudoun County assets to address community Safety and Security included mention of 1 Emergency Operations Center, 20 fire stations, and 8 police stations. Hazus medical data was combined with that found at www.countyoffice.org, a centralized database of government services provided in all 50 states. The Town of Leesburg contains 1 police station, on Sheriff's Office, and 3 fire/rescue station.

1.4.2. Food, Water, Shelter

Food commodities are available throughout Loudoun County from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

Four service providers in Loudoun County provide potable water services: Goose Creek Water Treatment Plant, Hamilton Acres Water Treatment Plant, Kenneth B. Rollins Memorial Water Filtration, and the Town of Purcellville Water Treatment Plant. The Town of Leesburg operates the Kenneth B. Rollins Water Filtration Plant, which is the only water provider in Leesburg.

[3] Loudoun County, Hazus

[4] CountyOffice.gov, Hospitals - Loudoun County, VA (Emergency & Medical Care, https://www.countyoffice.org › Hospitals – Virginia

The town owns and operates a wastewater treatment plant. The town Department of Utilities is a self-supported entity whose budget is completely based on user fees charged for services. This enterprise fund requires no taxes for the operation, maintenance, or construction of any water or sewer infrastructure.

1.4.3. Health and Medical

The Hazus program identified four hospitals as being located in Loudoun County: The Town of Leesburg is served by the INOVA Cornwall campus.

- Inova Loudoun Hospital – Cornwall
- Inova Loudoun – Lansdowne
- Inova Loudoun – Ashburn HealthPlex
- StoneSprings Hospital

Additional healthcare resources identified as being located in the town include the following:

- Three emergency services centers
- Three health department offices
- Three mental health services facilities (in addition to the North Spring Behavioral Healthcare)
- Eight nursing homes
- Five assisted living centers

1.4.4. Energy

Fourteen energy assets are identified in the Hazus database as being located in Loudoun County. Natural gas pipelines include those maintained by Dominion Transmission Company, Columbia Gas Transmission Company, and Cove Point Pipeline. The county includes three natural gas compressor plants and the Stonewall Power Plant located just outside of Leesburg. There are also three power transmission lines within Leesburg.

1.4.5. Communications

Most communications and information systems and infrastructure in the United States are privately owned; however, the county maintains authority and control over public safety communications for fire, police, and other responding agencies. Loudoun County is served by an array of broadcasters either in the county or the larger surrounding counties, Washington, D.C., and communities directly across the Potomac River in Maryland. On another front, Loudoun County is a national leader on the information technologies (IT) communications front given the region's concentration of businesses providing IT services.

In recent years, the federal government has taken a stronger role in protecting information and communications infrastructure, which may also present a challenge in relation to disaster impacts. Increasing reliance on this infrastructure by individuals, businesses, and government could cause vulnerabilities that emergency managers should take into consideration in pre- and post-incident planning and operations.

The Town of Leesburg operates a secondary PSAP 911 dispatch center, 1 public safety radio system tower site.

1.4.6. Transportation

The Town of Leesburg is served by US Highway 15, VA 7, and Rt 267 (Dulles Greenway). Other major highways that do not traverse through town but provide connection to the surrounding region include Highways 50, 340, and 601.

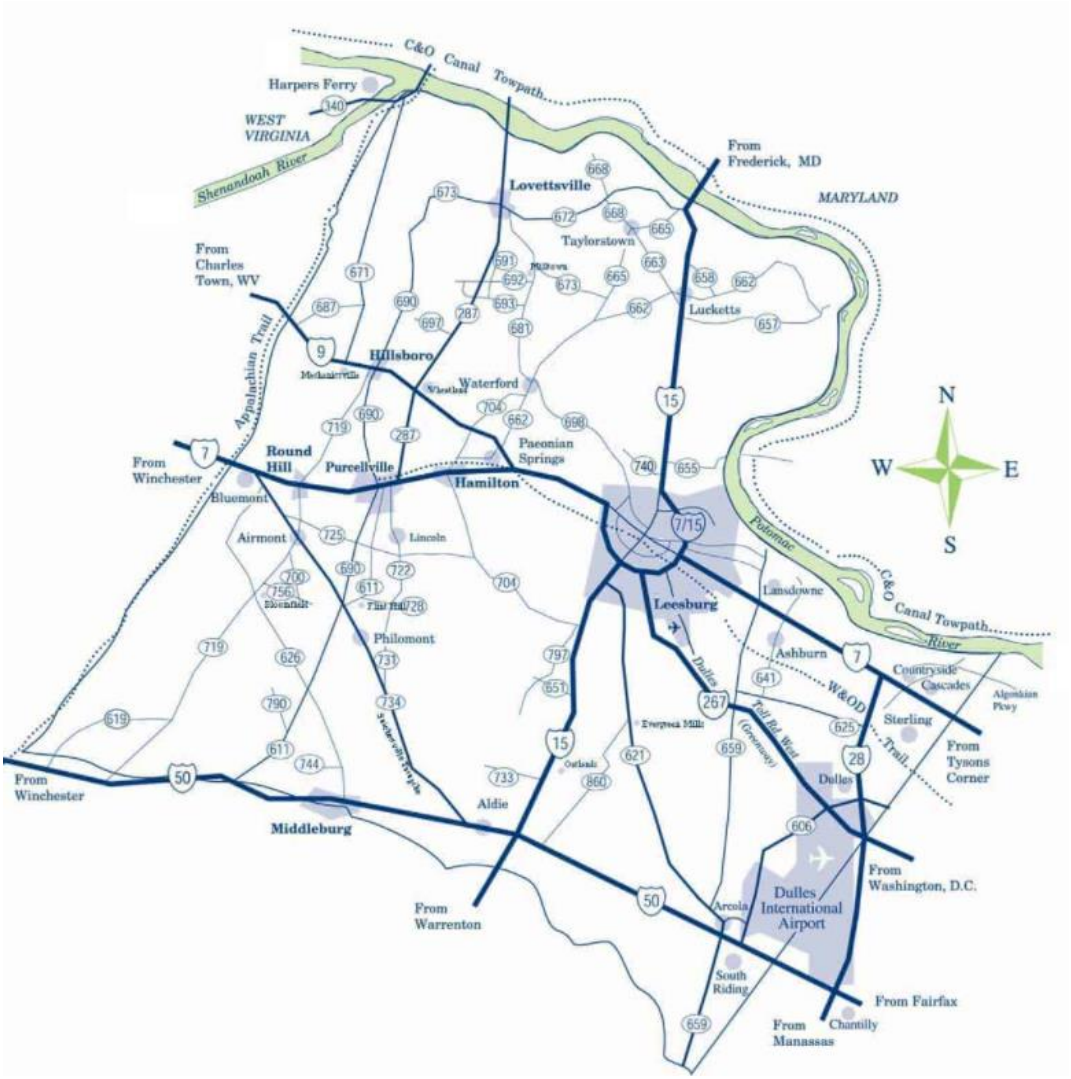


Figure 5: Loudoun County Road and Town Map[5]

[5] The History of Loudoun County, Loudoun County Town and Road Map, https://www.loudounhistory.org/history/history-loudoun/

The maintenance of transportation facilities and systems are the responsibility of the owner or entity with authority, including municipal, county, state, and federal highway departments, and agencies; toll and rail authorities; and the military. The Town of Leesburg owns and maintains approximately 250 lane miles of roadway. Homeowner associations also have responsibilities for roadway maintenance. This link provides snow removal responsibility information.

The Virginia Department of Transportation maintains most primary and secondary roads in Loudoun County, except for the Dulles Toll Road, which is owned by the authority of the Metropolitan Washington Airports Authority, and town-maintained roads. Loudoun County Transit (LCT) manages local fixed-route bus service from Purcellville through Leesburg and eastern Loudoun County. In keeping with the community's interest in outdoor recreation and environmental preservation, all local buses are equipped with bike racks. LCT also provides paratransit service for eligible persons with disabilities, but fixed route busses are equipped with wheelchair lifts and are wheelchair accessible

Metrorail, which is operated by the Washington Metropolitan Area Transit Authority, enables commuters, visitors, and area residents a mechanism for travel throughout the Washington, D.C. area. The system is the second busiest in the United States and is currently piloting an after-hours commuter service.

The Hazus database notes a total of 443 transportation structures, facilities, or segments, including the following:

- Highway Bridges – 402 (16 within the Town of Leesburg)
- Highway Segments – 39
- Airport Facilities – 1

1.4.7. Hazardous Materials

The Hazus database identifies a list of assets including 10 natural gas pipelines, 3 natural gas compressor plants, and 1 power plant located in Loudoun County. In October 2021, the Environmental Protection Agency released its Toxic Release Inventory (TRI) of chemicals released in the year 2020. The report showed that 9,287 pounds of 19 different chemicals—from 1,2,4 trimethylbenzene and ammonia to xylene and n-hexane—were released through onsite or offsite disposal.[6] The Loudoun County Office of Emergency Management works closely with companies that dispose of chemicals to monitor processes and ensure that hazardous materials are handled safely.

1.4.8. Education

Leesburg is part of Loudoun County Public Schools (LCPS), the third-largest school division in the Commonwealth of Virginia. Established in 1870, LCPS is located in the rapidly growing Washington metro area. Loudoun County is the fastest-growing county in the Commonwealth of Virginia. Each year, LCPS opens one to three new school facilities to accommodate its growing student population. There are 15 public K–12 schools in Leesburg.[7]

A report on LCPS published in *U.S. News and World Report* highlighted key facts:

[6] U.S. Environmental Protection Agency, Toxic Release Inventory (TRI), Toxic Release Explorer, Loudoun County Chemical Release Report, https://tinyurl.com/yswvbxct

[7] https://www.lcps.org

Table 9: Quick Stats – The Loudoun County School District[8]

Student-Teacher Ratio	14-1
Number of Schools	94
Number of Students	83,606
Minority Enrollment	50%
Economically Disadvantaged	15.3%

At schools in Loudoun County Public Schools, 15.3% of students are eligible for the federal free and reduced-price meal program and 13.9% of students are English language learners.

Loudoun County has one of the largest public school districts in the United States, with 198 PK–12 schools and centers and a diverse student population of 83,606 students. More than 27% of these students are considered economically disadvantaged, and more than 26% of students learn English as a second language.

In addition to these public and private educational facilities within Loudoun County, there are 35 college and university facilities located in or near the Town of Leesburg, including the following:

- The Art Institute of Washington – Dulles
- Northern Virginia Community College
- George Washington University – Virginia
- George Mason University – Loudoun Campus
- Shenandoah University – Leesburg Campus
- Shenandoah University – Ashburn Campus
- Virginia Polytechnic Institute and State University – Leesburg Campus

1.4.9. Recreational, Cultural, and Historic Sites and Assets

The Town of Leesburg Parks and Recreation (P&R) develops and maintains the system of parks, recreation facilities, and community services. The P&R owns and operates 17 parks, a full-service recreation center, an aquatic center, and a tennis complex. Ida Lee Park is the crown jewel of the parks, featuring the recreation center, with over 3,000 recreation opportunities.[9]

Loudoun County is also a member of NOVA Parks (formerly named Northern Virginia Regional Park Authority), an inter-jurisdictional organization that owns and operates over 10,000 acres of woodlands, streams, parks, trails, nature reserves, countryside, and historic sites in Northern Virginia. The group is governed by a 12-member policy board, with representation from three counties—Loudoun, Arlington, and Fairfax—and three cities: Alexandria, Falls Church, and Fairfax.[10]

[8] *U.S. News and World Report*, n.d., https://www.usnews.com/education/k12/virginia/districts/loudoun-co-pblc-schs-105672

[9] Town of Leesburg Parks & Recreation

[10] https://www.novaparks.com/about-nova-parks/about-nova-parks

1.4.9.1. Assessment of Leesburg P&R and Potential Hazard Impacts[11]

Natural Environment: What assets may be impacted by which hazard(s)?

- Land holdings including large, biodiverse forests along the Potomac River and, in the western region of the county, extensive trails in the Bull Run and Blue Ridge Mountain ranges. In the Loudoun Plain, six rivers and creeks course through the county: Broad Run River, Bull Run River, Catoctin Creek, Goose Creek, Little River Creek, and Piney Run River.
- The Town of Leesburg has two main watersheds – Goose Creek and Potomac River. The Town is traversed by Big Spring Creek, Cattail Branch, Dry Mill Branch, Town Branch, and Tuscarora Creek. The Potomac River serves as the primary drinking water source for the Town.
    - **Hazards:** Natural disasters; flooding; pandemic effects on staffing; economic loss of funding
- Forty-seven parks, plus three adult day centers; seven community centers; seven historical sites located within parklands; twenty-five neighborhood parks; parks with significant ponds/lakes (including three managed dam systems). Any of the structures or outdoor assets could be damaged during a hazard event and the impact may be worsened if staff and residents are using facilities, trails, or waterways. The Town of Leesburg maintains 17 parks and recreation facilities dispersed throughout the community.
    - **Hazards:** Natural disasters; flooding; pandemic effects on staffing; vandalism; economic loss of funding
- Air, water, soil, natural habitat, natural vegetative communities, and the ecosystems they form. Inventory includes protected species of rare or significant resources.
    - **Hazards:** Natural disasters; flooding; pandemic effects on staffing; vandalism; economic loss of funding
- The Town has been recognized by the Arbor Day Foundation as a Tree City USA since 1989. In 2000, the Town initiated a goal of planting 2,000 trees. Over the last 20 years, 2,487 trees have been planted on Town property. As part of a recent stream restoration project, 11,000 live stakes and 3,200 seedlings were planted.
    - **Hazards**: Natural disasters; flooding

Economy: What assets may be impacted by which hazard(s)?

- Private employers with 250-500 employees include Costco, Stryker, Target, and Wegmans. Private employers with 100-250 employees include Altar'd State, Dulles Motor Cars, EIT, Giant Food, Heritage Hall Health Care, Home Depot, Inova Loudoun Hospital, Inova Loudoun Long-term Care, Leesburg Motors, Loudoun Medical Group, Lowe's, Morningside House, Tuscarora Mill,
- Public Employers:
    - Loudoun County (2500-5000)
    - Loudoun County Public Schools (1000-2500)
    - Federal Aviation Administration (500-1000)
    - Town of Leesburg (250-500)
    - Commonwealth of Virginia (250-500)

[11] Loudoun County, Town of Leesburg Worksheet 3 Community Assets

- Other considerations: Recreation and parks; historic and natural preservation; facilities and support
    - **Hazards**: All sectors of the economy could be impacted by any natural hazard, flooding, pandemic.

Population: What assets may be impacted by which hazard(s)?

- Loudoun County has a population of 413,538, most of whom live within one-half mile of parkland and indoor or outdoor recreational facilities. Annually, millions hike the paths and trails in mountainous regions.
- The Town of Leesburg has a population of 48,908 according to U.S. Census estimates and 17,900 households. Population density is 3,439 persons per square mile.
- Access and Functional Needs Populations
    - 5.0% in poverty per US Census
    - 4.3% population under 65 are disabled
    - 10.7% of persons under 65 are without health insurance
    - 28% of persons over 5 live in a home where a language other than English is Spoken
- The National Risk Index reports the following risk levels for Census Tracts in Leesburg.
        - Relatively Moderate Risk (51107610505)
        - Relatively Low Risk (51107610504, 51107610603)
        - Very Low Risk (51107610400, 51107610601, 61107610602, 51107610604,051107610506, 51107610403)
    - **Hazards**: All hazards; Natural disasters; vandalism; economic loss of funding

Built Environment: What assets may be impacted by which hazard(s)?

- The Loudoun County Government Center, managed by the County General Services Department.
- The Town of Leesburg has 17 Town owned facility sites
- Critical Facilities include The FAA Air Traffic Control Center, Leesburg Police Headquarters and Emergency Operations Center, Loudoun County Fire Rescue Stations 1, 13 & 20, Loudoun County 9-1-1 Center, Water Treatment Plant and Water Pollution Control Plant.
- Infrastructure includes the Town of Leesburg Water Intake (Potomac River), Telecommunication structures, and Leesburg Executive Airport
- The Town of Leesburg maintains an interactive floodplain mapping tool that allows users to view the floodplain and impacted parcels. Areas of interest regarding flooding include:
    - Area of Mosby Drive and Morven Park Road
    - Area of Dry Mill Road and Town Branch Terrace
    - Area of South King Street and South Street
    - Area of Catoctin Circle and Harrison Street
    - Area of Harrison Street and Shenandoah Street

  - 0-100 Block of Sycolin Road SE
  - Lawson Road SE
  - Russell Branch Parkway near Golf Club Road
  - Battlefield Parkway NE near Hunton Place NE
- Future development: Remaining properties to be developed at also at risk to hazards. The Town has a formal review process aimed at reducing risk, particularly for floodplain management.
  - **Hazards**: Natural disasters; fire; flooding; snow, thunderstorm, tornadoes, extreme temperature, vandalism; pandemic impacts to staffing; economic loss of funding
- Historic properties (detailed in section 1.4.9.2); natural preservation sites; artifacts and archeology inventory.
  - **Hazards:** Natural disasters; fire; vandalism; pandemic impacts to staffing, economic loss of funding
- Park Planning has several development and renovation projects in the planning stage.

Climate Change: Which assets are at risk of future conditions related to climate change?

- The built environment, natural environment, infrastructure, and those who live and work in Loudoun County
- Increasing extreme weather events driven by climate change have the potential to disrupt the local economy and have both short and long-term consequences. The watersheds and bodies of water located within Town are vulnerable to stream degradation due to increasing extreme rain events. These events are changing the flooding dynamics and impact to residents and visitors. Extreme heat and cold events have the potential to increase impacts to populations with limited access to heating or air conditioning. Extreme snow fall events are also possible, which have had significant impacts in the past.
- All residential, commercial, and Town owned property are at risk due to energy dependency. The Town has begun discussions on the implementation of solar/renewable energy options at Town owned facilities.

1.4.9.2. Historic and Cultural Conservation Districts

The Town of Leesburg has demonstrated commitment to the identification, documentation and preservation of historic resources throughout the Town since the creation of the Old and Historic District in 1963. The Town promotes design principles to enhance the visual experience leading into Leesburg's Historic Downtown, and the Board of Architectural Review evaluates applications for exterior alteration and new construction in the Old and Historic District for appropriate design standards. The Town has engaged in surveys of historic architectural resources and historic battlefields, and survey information and other historical and genealogical records are housed at the Thomas Balch Library. A walking tour mobile phone application and map of Leesburg's Old Historic District is available for visitors to use while exploring local historic properties and museums.[12]

Notable historic sites and museums in Leesburg include[13]:

- Balls Bluff Battlefield & National Cemetery

[12] Town of Leesburg Planning & Zoning, Historic Preservation, https://www.leesburgva.gov/departments/planning-zoning/historic-preservation
[13] https://www.leesburgva.gov/visitos/historic-sites-museums

- Historic Downtown Leesburg
- Dodona Manor
- Loudoun Museum
- Thomas Balch Library
- Douglas High School (408 East Market Street)
- General George Marshall House (217 Edwards Ferry Road)
- Edward Nichols House (330 West Market Street)
- Rock Spring Farm (329 Loudoun Street SW)
- Waverly (212 South King Street)
- Olde Izaak Park
- Carrvale Park

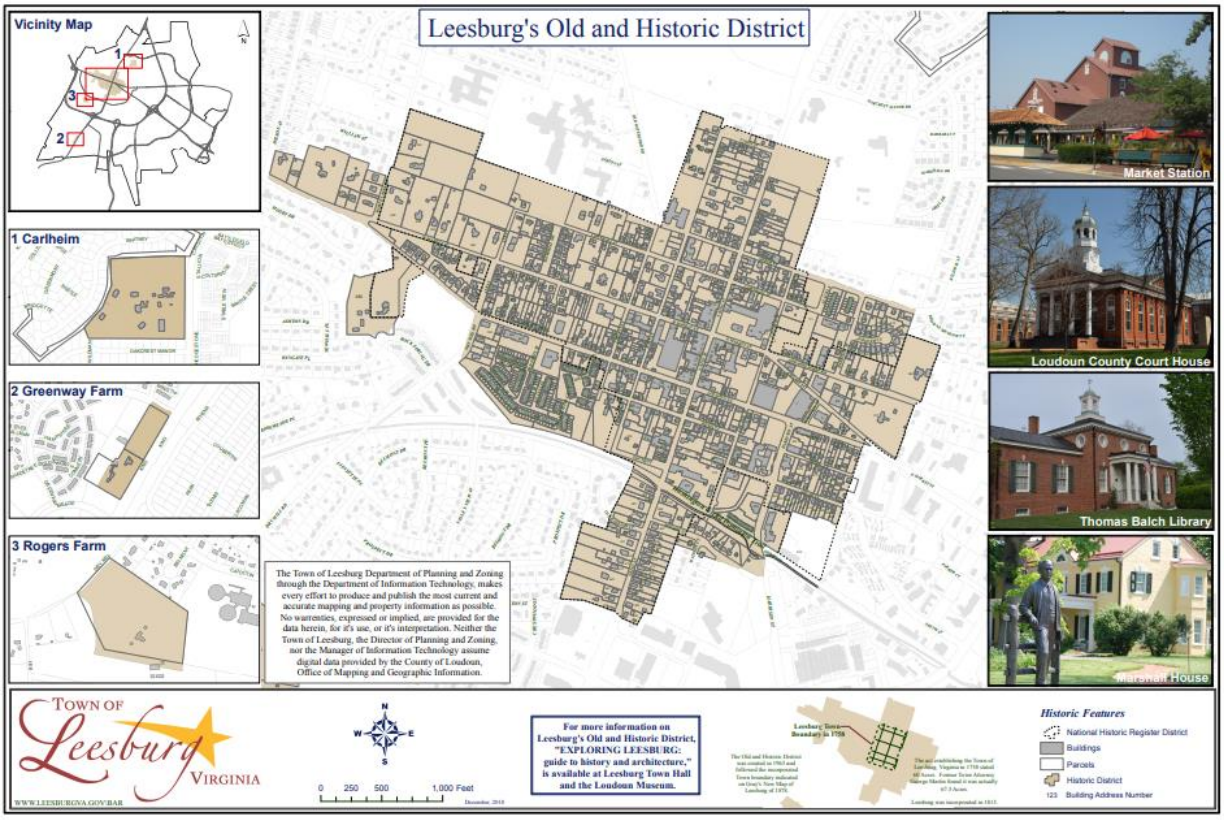


Figure 6: Leesburg's Old and Historic District

The Leesburg Arts & Cultural District helps to position, promote and expand Leesburg's distinction as the cultural center of Loudoun County. It provides a framework for arts and entertainment establishments to expand, synergize and add vitality to the community. It also serves as an economic development vehicle to foster revitalizations of the Historic Downtown and Crescent Districts.[14]

[14] Town of Leesburg Arts & Cultural District https://www.leesburgva.gov/businesses/site-selection/business-incentives/arts-cultural-district

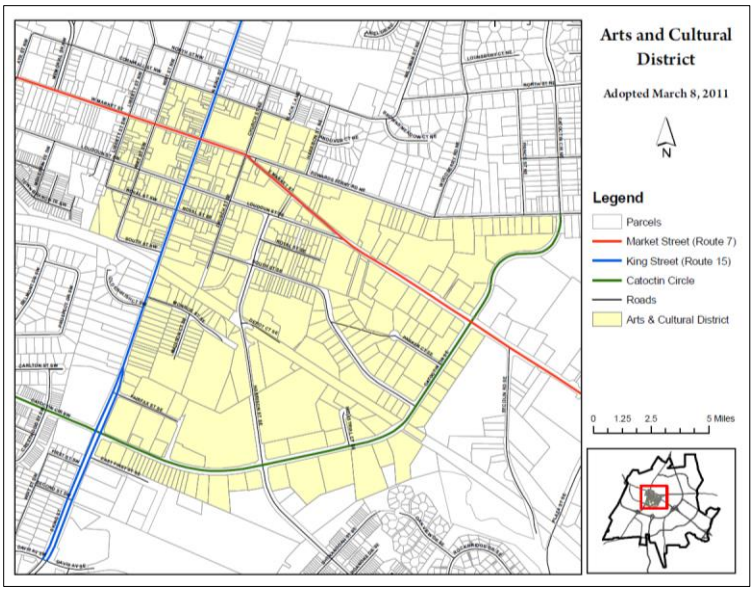


Figure 7: Leesburg Arts and Cultural District

1.5. Growth and Development Trends

The Town's population grew at a slow rate through the 1980s. Significant growth has occurred since 1990.

Table 10: U.S. Census Bureau Milestone Population Counts, Town of Leesburg

Year	Population
1990	16,200
2000	28,300
2020	48,250

In recent decades, both Leesburg and Loudoun County have been transformed from being residential suburbs of Washington, D.C., to a vital commercial, residential, office, and research hub. This substantial change has been reflected in the jurisdiction's land use pattern with the vast expansion of nonresidential land uses, and, to a lesser extent, growth in residential land use, by acres. Since 1990, the rate of multi-family townhouses and apartments has exceeded single-family detached housing construction at a rate of two to one. As of December 2020, there was a planned 2.7 million square feet of office space under construction in the county.[15] In the Town of Leesburg, almost 1.7 million square feet of office, retail, commercial and institutional space, and more than 2,00 new housing units are under development. [16]

[15] *Real Estate Report*, Loudoun County Economic Development Authority, Year-End 2020, December 31, 2020. (https://www.Loudouncountyeda.org/wp-content/uploads/2021/07/Yearend2020RealEstateReport.pdf)
[16] Town of Leesburg Development News https://www.leesburgva.gov/businesses/information-center/development-news#ad-image-2

This rate of growth has had a significant impact on public facilities and infrastructure, particularly on transportation capacity and the reduction in the supply of vacant land. The increased demand for future development and infrastructure may result in pressure to build in areas susceptible to impacts from natural hazards such as floods. Land use controls through the county's ordinances and regulations provide some protection against this pressure but should be continuously monitored for new demands that could increase hazard risks in the future.

Leesburg recently completed and adopted the Legacy Leesburg plan, the culmination of an intensive community-based planning process lasting over one year. The Legacy Leesburg plan recognizes the fundamental opportunities and challenges facing Leesburg today and describes principals to manage growth and change in a way that will preserve and enhance the Town's character and quality of life. The strategies developed in the plan provide cohesive direction for implementing planning and development policies, zoning and related regulations, incentives, capital budget and similar tools. Trends addressed in the plan include a shift toward fewer single-family homes in favor of townhouse and multi-family homes and mixed-use development, an aging population, changes in transportation demands, employment trends for their well-educated population, and availability of land for future development, [17]

Despite the overall slowing growth rate, the 2050 forecast for population, housing units, and households indicate slight growth. For this reason, stakeholders developed *The Loudoun County 2019 Comprehensive Plan (Comprehensive Plan)*. This planning process, known as Envision Loudoun/Loudoun 2040, encapsulates what residents want to see in the way of future development of Loudoun County while considering growth management; land use; place types; transportation; natural, environmental, and heritage resources; and community facilities.[18]

Among the datasets included in the County Comprehensive Plan is an estimate of population growth for each five-year period between the years 2021 and 2045.

Table 11: Loudoun County Population Estimates Through 2045 by Subregions[19]

Area	2025	2030	2035	2040	2045
Ashburn	5,205	5,804	1,952	1,975	1,627
Dulles	4,521	3,086	1,242	529	358
Leesburg	2,021	2,339	1,023	132	15
Northwest	312	365	488	507	507
Potomac	167	120	243	284	196
Route 15 North	210	210	227	226	226
Route 15 South	145	200	150	111	111
Route 7 West	515	420	238	250	80
Southwest	105	125	135	156	156
Sterling	1,282	1,658	1,360	990	409
County	**14,483**	**14,327**	**7,058**	**5,160**	**3,685**

[17] Legacy Leesburg, https://www.leesburgva.gov/home/showpublisheddocument/37700/637838227427570000
[18] Loudoun County, New Comprehensive Plan: The History of the Envision Loudoun Process, https://www.loudoun.gov/3298/Envision-Loudoun-Process
[19] Source: Loudoun County Department of Budget and Finance

The Loudoun County 2019 Comprehensive Plan highlights the intent for appropriate residential development of land in relation to flood hazards, as stated in Objective 7, Policy a: “Prohibit new residential structures within flood impact hazard areas.” This objective, in combination with the land use ordinances and Floodplain Management Plan, provides some controls that restrict the increase of flood hazard risk caused by future development.

Loudoun County will continue to be a planning partner with local jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk. Projected growth trends should be monitored in the next planning cycle with the intent of providing a more detailed statistical analysis of vulnerable populations and how this could potentially impact hazard consequences and mitigation opportunities.

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, Loudoun County followed the planning process described in **Section 2 of the Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Committee, the county supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction. Participants in the local planning activities are listed in Table 12. Representing the Town of Leesburg on the committee is Joe Dame, Emergency Management Coordinator.

Table 12: Local Planning Participants

Name	Position/Title	Department/Agency
Joe Dame	Emergency Management Coordinator	Town of Leesburg
David Ma	Senior Engineer	Leesburg Dept. of Plan Review
Scott Parker	Senior Planner	Leesburg Dept. of Planning and Zoning
Betsy Arnett	Public Information Officer	Town of Leesburg
Lauren Murphy	Preservation Planner	Leesburg Dept. of Planning and Zoning
Phil Jones	Stormwater and Environmental Manager	Leesburg Dept. of Public Works
Russell Chamgers	Water Treatment Plant Manager	Leesburg Dept. of Utilities
Rich Williams	Director of Parks and Recreation	Town of Leesburg

The list of project meetings in which representatives of Loudoun County and/or its jurisdictions participated show the degree to which the county and its jurisdictions are committed to the hazard mitigation planning process. Shown here are meetings at which the County and Towns discussed their specific hazards of concern, though many of the County and Town representatives also attended meetings of the full NOVA HMP Planning Team.

Table 13: Schedule of Jurisdiction Meetings

Date	Jurisdiction(s)	Purpose
May 25, 2021	• Loudoun County • Town of Leesburg • Town of Purcellville • Town of Middleburg • Town of Round Hill	• Jurisdiction planning needs assessment
June 25, 2021	• Loudoun County • Town of Leesburg	• Technical assistance
July 22, 2021	• Loudoun County	• Capability assessment
August 2, 2021	• Loudoun County • Town of Leesburg • Town of Purcellville • Town of Middleburg	• Action item review and creation

Date	Jurisdiction(s)	Purpose
August 23, 2021	• Loudoun County • Town of Leesburg • Town of Purcellville • Town of Middleburg	• Action item review and creation
August 27, 2021	• Town of Lovettsville	• Hazard identification • Community asset identification • Jurisdiction information collection • Jurisdiction needs assessment • Action items and action plan completion
September 30, 2021	• Town of Lovettsville	• Capability assessment • Hazard risk ranking • Critical facilities and historical information review
October 29, 2021	• Town of Middleburg	• Capability assessment • Critical facilities and historical information review

The jurisdiction identified its chief hazard mitigation planning responsibility as providing oversight in the planning process through the Emergency Manager's Group and representation in the Emergency Manager's Planning Group. The county also identified the following tasks as part of its mitigation planning responsibilities:

- Jurisdictional Planning Team
- Management support for the planning effort
- Planning Group resource/subject matter expert
- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Public outreach activities
- Implementation of the Plan
- Maintaining the Plan

Loudoun County planning participants coordinated primarily by means of virtual meetings during the planning process, and as needed, independently to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Team meetings is included in the **Appendix A of the Base Plan**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a public hazard survey (https://www.fairfaxcounty.gov/emergencymanagement/emergency-plans) and access to the draft plan for review and input. Additionally, the Town of Leesburg promoted public feedback on the Town website and social media channels in August 2021.

In reviewing both documents, the public was offered the opportunity to provide input to the community hazards of concern and the draft 2022 NOVA HMP update that recommends mitigation strategies to minimize the impact of any and all hazards. Notification of the draft plan release was made through the same county weblink used to enable residents to participate in the community survey. Documentation of the public survey and draft plan review is included in **Attachment 3** of this annex.

3. Jurisdiction-Specific Hazard Event History

Loudoun County's comprehensive hazard history is described in **Section 5 of the Base Plan**. The diversity of the landscape increases the vulnerability to a variety of hazards, most notably flooding and severe storms. In addition to snowmelt and rain-related river flooding episodes, low-lying areas of the county along the Potomac River are also subject to tidal and storm surge flooding. As sea levels rise, permanent inundation of low-lying areas along and near the river shoreline is also a threat. Additionally, winter storms pose significant threats, as evidenced during the 2015–2016 winter season, which resulted in a Federal Disaster Declaration.

The National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) Storm Events Database includes 1,036 recorded natural weather events that took place in the county between January 1, 1950, and May 2021. The county has been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 14: Federal Disaster and Emergency Declarations (2017–2021), Loudoun County[20]

Declaration	Date	Hazard	Assistance Type
DR-4512-VA	4/2/2020 (continuing)	COVD-19 Pandemic	Individual Assistance, Public Assistance
EM-3448-VA	3/13/2020 (continuing)	COVID-19 Pandemic	Public Assistance (Category B)
EM-3403-VA	9/11/2018	Hurricane Florence	Public Assistance (Category B)

Several significant events were identified by NCEI as taking place in recent years.

Table 15: Significant Hazard Events Identified by Loudoun County, 2017–2021

Date	Hazard	Event and Description
August 2020	Flooding	An intense complex storm cell left over 4 inches of rain on Leesburg in a few hours' time. There were no reports of injuries or fatalities, thought a number of people were rescued. The Leesburg bypass was closed for a number of hours and a several cars were damaged. There were no reports of property damage.
June 2020	Severe Weather	An unseasonably strong upper-level trough interacted with a modestly unstable environment over the Middle Atlantic to produce several supercell thunderstorms which transitioned into small bowing line segments across far eastern West Virginia, central Maryland and northern Virginia. The storms produce substantial and relatively widespread wind damage and some hail along their path, though the storms themselves were isolated to widely scattered in nature. There were reported winds guests of up to 55mph in Leesburg. There were no reports of injuries or fatalities with some property damaged to be reported around $10,000, including the roof of the Ida Lee Recreation Center.

[20] FEMA

Date	Hazard	Event and Description
April 2020	High Wind	Straight line wind event caused property damage along a 1.25-mile path through Leesburg. There were no major impacts, no reports of injuries or fatalities. There were roof damages to homes and cars were damaged by falling trees and branches. There was limited power outage for the area.
February 2020	EF0 Tornado	An area of low pressure formed over the area in response to an impressive longwave trough approaching from the west. A line of low-topped showers and thunderstorms formed along the system's cold front, leading to instances of damaging winds and a tornado in Leesburg. Many trees were downed and fell on homes and cars. Property damage totaled $5,780,000, the largest amount for a hazard event in Loudoun County in the last five years.
February 2019	Winter Weather	Surface high pressure was located over the region, giving way to several waves of low pressure. Intermittent led to snow accumulations up to around 1 inch and ice accumulations generally between 0.10 and 0.20 inches, although these figures were as high as 0.50 to 1.0 inch across the higher elevations. The only direct fatality reported by NCEI since 2017 occurred when a 52-year old woman in northeastern Loudoun County was killed from a falling branch outside of her home due to weight from ice on the tree limbs. The elevation of the incident was approximately 680 feet.
March 2018	High Wind	A low-pressure system moved eastward from the central United States and intensified rapidly it moved eastward. Winds up to 58 mph were recorded in several locations, including a report from Dulles International Airport, which clocked the wind at 57 mph. Numerous trees were downed, and the wind blew roofing, siding, and doors from residential structures, although no official report of damages is recorded.
January 2018	Winter Weather	A low-pressure system developed across the south-central United States on January 12. The low pressure system then tracked into the southeastern United States and moved northeastward offshore near the Outer Banks of North Carolina throughout the day of January 13. Widespread accumulating snow affected northern and central Virginia, with 11 inches of snow in Leesburg. Schools were closed for the day and roads were temporarily closed until snow was cleared off the roads.

4. Hazard Risk Ranking

After developing hazard profiles, the Loudoun County and Town of Leesburg Mitigation Planning Team conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an overall risk score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4 of the Base Plan**. The hazard risk ranking scores by individual categories for Loudoun County are provided in **Attachment 2** of this annex.

The overall risk score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5 of the Base Plan**, and local detail is provided in the jurisdiction annexes. Non-natural hazard profiles are presented in **Volume II of the Base Plan**.

Table 16: Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.3	3.5	6.8	**High**
High Wind/Severe Storm	2.7	3.4	6.1	**High**
Flood	1.7	4.1	5.8	**High**
Tornado	1.7	4.1	5.8	**High**
Dam Failure	1.0	4.4	5.4	**Medium**
Drought	2.0	3.2	5.2	**Medium**
Extreme Temperatures	2.3	2.7	5.0	**Medium**
Earthquake	1.7	3.2	4.9	**Medium**
Wildfire	1.0	2.8	3.8	**Low**
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	**Low**
Landslide	0.0	0.0	0.0	**Low**

Table 17: Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	2.0	5.3	7.3	**High**
Terrorism	1.0	6.1	7.1	**High**
Cyberattack	1.7	4.7	6.4	**High**
Civil Unrest	1.0	4.9	5.9	**Medium**
Communication Disruption	1.3	3.7	5.0	**Medium**
Hazardous Materials	1.0	3.9	4.9	**Low**
Active Violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, Loudoun County evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter weather, flood (riverine/flash flood), and high wind/severe storm
- **Medium:** Dam failure, drought, earthquake, extreme temperatures, tornado

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious disease/public health, terrorism, cyberattack
- **Medium:** Civil unrest, communication disruption

All other hazards are ranked as “low,” signifying a minimal risk to Loudoun County.

4.1. Additional Hazard Risk Considerations

4.1.1. Dam Failure

The U.S. Army Corps of Engineers (USACE) National Inventory of Dams lists 99 dams as being located in Loudoun County,[21] 14 of which are classified as **High Hazard** and 9 of which are classified as being a **Significant Hazard** due to the consequences related to a potential failure of the structure. USACE data, includes dam locations, ownership, pool volume, impoundment capacity, and use.

The 23 significant and high-hazard dams in Loudoun County are both publicly and privately owned and used for a variety of purposes, including flood control, stormwater management, and recreation.

[21] Dam Inventory – 2021, U.S. Army Corps of Engineers

Table 18: State-Regulated High-Hazard Dams in Loudoun County, as of May 2021

Dam Name	Classification	Dam Owner/Operator
Arcola Center Dam	Significant	Arcola Limited Liability Company
Creighton Hills Dam	Significant	Creighton Hills, LLC
J.T. Hirst Dam	Significant	Town of Purcellville
Dulles Airport Dam	Significant	Metro-Washington Airport Authority
Red Cedar Lake Two Dam	Significant	Ian S. and Debra J. Foster
Oliver Dam	Significant	Woodmar Farm Conservancy
Daley Dam	Significant	Brian Meyerriecks, Timothy Biddle
Haynes Dam	Significant	Martin Lawrence Family Trust
Precision Dynamics Lake Dam	Significant	Round Hill Owners Association
Richmond Square Dam	High	Exeter Homeowners Association
Moorefield Station East SWM Pond Dam	High	Loudoun County Board of Supervisors
Kalnasy Dam	High	Johnson, Cedric and Cynthia Holgate, Marc Weiner
Beaverdam Creek Dam	High	Loudoun Water
Goose Creek Dam	High	Loudoun Water
Horsepen Dam	High	Metro-Washington Airport Authority
Ashburn Village Lake #2	High	Ashburn Village Community Association
Brambleton Land Bay 3 Pond 6 Dam	High	Brambleton Group LLC
Ashburn Village Lake #1	High	Ashburn Village Community Association
Gore Dam	High	Jo Ann D. Athey
The Lakes at Red Rock Dam	High	The Lakes at Red Rocks Homeowners Association
Moorefield Station West SWM Pond Dam	High	Claude Moore Charitable Foundation
Sleeter Lake Dam	High	Round Hill Owners Association
Hope Parkway Dam	High	East Stratford Residential Community Association, Inc.

Table 19: Dams Identified by the Town of Leesburg

Dam Name	Classification	Dam Owner/Operator
Hope Parkway Dam	High	East Stratford Residential Community Association, Inc.
MacAlister Drive Dam		Tavistock Farms Community Homeowner Association

Dam Name	Classification	Dam Owner/Operator
Max Ct Dam		Evergreen Homeowner Association
Richmond Square Dam	High	Exeter homeowner Association
Shadwell Terrace Dam		East Stratford Residential Community Association, Inc.
Old Waterford Knoll Dam		Old Waterford Knoll Homeowner Association
Leesburg South Regional SWM Pond Dam		Arcadia Community Inc.

Leesburg South Regional Stormwater Management Pond Dam is considered to have low hazard potential.

4.1.2. Flood/Flash Flood

The Loudoun County Planning Team noted the frequency of flash flood incidents has increased in recent years, attributable to more frequent excessive rainfall events, combined with aging drainage and stormwater infrastructure designed to lower capabilities. The county is addressing this issue through increased maintenance of drainage systems and capacity upgrades funded through capital improvement projects but highlights the need for additional studies to identify potential locations and the extent of future events.

Figure 8: Loudoun County Swift Water Rescue Team Training

Figure 9: Loudoun County Swift Water Rescue Team Training

Table 20: Flood/Flash Flood Events in Loudoun County (Including the Towns of Leesburg, Lovettsville, Middleburg, Purcellville, and Round Hill), 1950-May 31, 2021

Impact	Data
Flood/Flash Flood Events	162
Direct Deaths	0
Direct Injuries	0
Property Damage	$2,018,000
Crop Damage	$170,000
Total Property and Crop Damage	$2,188,000

4.1.2.1. Leesburg Stormwater Management

The Town has completed the following storm draining projects:

- Browns Meadow/Woodberry Road Drainage Improvements
- Chesapeake Bay TMDL
- North King Street Drainage Improvements
- Turner Harwood Drainage Improvements
- Tuscarora Creek Flood Mitigation & Restoration
- Woodberry Road Drainage and Street Improvements

The following storm drainage projects are currently underway:

- Lawson Road Pedestrian Crossing of Tuscarora Creek
- Liberty Street SW Storm Drainage Improvements
- Royal Street SE Storm Drainage Improvements

The following potential future projects have been identified:

- South Street at South King Street – storm drainage improvements to alleviate flooding of a nearby single-family home. Project dependent on future development nearby.
- Town Branch at Mosby Drive – stabilize the eroding channel to reduce potential flooding

- Town Branch Stream Restoration – stream channel improvements to Town Branch between Catoctin Circle and the W&OD Trail Bridge between South king and Harrison Streets to alleviate flooding and restore the stream channel.
- Tuscarora Creek Stream Restoration – from downstream of the Leesburg Bypass to near Lawson Road – Improvements to the Tuscarora Creek stream channel to mitigate erosion and stream degradation.

4.1.3. Winter Weather

Error! Reference source not found. presents the number of winter weather events documented in the NCEI Storm Events Database, including blizzard, heavy snow, winter storm, and winter weather. Noteworthy is the fact that NCEI does not include in its records event that took place before December 2014.

Table 21: Winter Weather Events in Loudoun County (Including the Towns of Leesburg, Lovettsville, Middleburg, Purcellville, and Round Hill), 1950-May31, 2021[22]

Impact	Data
Winter Weather Events	101
Direct Deaths	1
Direct Injuries	0
Property Damage	$0
Crop Damage	$0
Total Property and Crop Damage	$0

Other hazard information for Loudoun County is presented in the **Base Plan**.

[22] NCEI Storm Events Database

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4 of the Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards. As is the case with some other resources consulted, the information presented here is county-level data.

5.1. National Flood Insurance Program

Loudoun County and the five towns participating in the 2022 NOVA HMP update process all participate in the National Flood Insurance Program (NFIP). In addition, the county participates in NFIP's voluntary Community Rating System (CRS) program under the NFIP with a CRS Class of 10 rating. At this class rating, property owners are not able to take advantage of lower flood insurance premium deductions available to those lower classes. As such, Loudoun County is considering ways it could increase its class status and save money for those who choose to purchase flood insurance.

The Flood Risk Report (FRR) for Loudoun County, released on October 15, 2016, included a discussion about waterways in unincorporated Loudoun County. The report provides non-regulatory information to help local or tribal officials, floodplain managers, planners, emergency managers, and others better understand their flood risks, take steps to mitigate those risks, and communicate those risks to their citizens and local businesses. Because flood risk often extends beyond community limits, the FRR provides flood risk data for all of Loudoun County, as well as for each individual community. This approach also includes a focus on flood risk reduction activities that may impact areas beyond jurisdictional boundaries. The report also discusses the types of mitigation actions a community can pursue, including planning and regulatory, structural, natural system protection, and public outreach and education.

Table 22: National Flood Insurance Program Status, Loudoun County[23]

NFIP Data	Loudoun County	Town of Leesburg
Initial flood hazard boundary map (FHBM) identified	4/25/1975	8/30/1974
Initial flood insurance rate map (FIRM) identified	1/5/1978	9/30/1982
Date of the current effective map	2/17/2017	2/17/2017
Regular-Emergency date	1/5/1978	9/30/1982
CRS entry date	10/1/1992	N/A
Current effective date	5/1/2003	
CRS class	10	
% Disc SFHA	0%	

[23] FEMA NFIP Community Status Report, September 9, 2021

NFIP Data	Loudoun County	Town of Leesburg
% Disc Non SFHA	0%	

Table 23: NFIP Status, September 14, 2021[24]

Category	NFIP Topic	Source of Information	Comments
Insurance	How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist	90 Policies $25,311,800 (total coverage) $77,473 (Total Premium + Federal Policy Fee)
Insurance	How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist	2 Claims $143,340 No substantial damage.
Insurance	How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA)	Approximately 70 buildings (per GIS Data, which does not account for LOMAs), 20+ Stream Crossings (Bridges/Culverts) Structures such as retaining walls were not accounted for.
	Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	Per our updated flood maps, areas should have full NFIP coverage. Based on conversations with DPW, all other flooding areas are just small, localized drainage areas, which are not under the NFIP, as they do not meet specific requirements for flood zone mapping.
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	No. The Floodplain Administrator is a licensed Professional Engineer with 3 Certified Floodplain Managers/Licensed

[24] Loudoun County Emergency Management

Category	NFIP Topic	Source of Information	Comments
			Professional Engineers as personnel.
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	Floodplain management is a routine duty of the Floodplain Administrator in coordination with the Departments of Plan Review, Planning and Zoning, and Public Works and Capital Improvements. Plan Review – Reviews all public and private developments within the Town to ensure that all FEMA and Local floodplain requirements are met. Planning and Zoning – Permits the development and uses within the floodplain limits, which may include coordination with the Department of Plan Review and/or Department of Public Works and Capital Improvements. Public Works and Capital Improvements - Evaluates and implements Capital Project Improvements associated with Flooding. Additionally, Town regulations were updated in 2017 to ensure they meet the minimum NFIP Standards. These include regulating Zoning uses and development within the floodplain limits.
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability).	Community FPA	Permit Review – The Department of Plan Review (DPR - i.e., Floodplain Administrator and Staff) reviews all related floodplain applications which includes but not limited to site plans,

Category	NFIP Topic	Source of Information	Comments
			homeowner projects, etc. with the Department of Planning and Zoning to review and issue permits. GIS - The Floodplain Administrator's Staff (i.e., DPR Staff) handles updating the floodplain limits in the Town's GIS database and coordinating with the Town's GIS Manager to provide floodplain information on the Town's Interactive Floodplain Mapper. Education/Outreach – The Floodplain Administrator and Staff attends yearly Water Conference Events and Webinars (both State and Local such as VA Floodplain Management Association & Virginia Lakes and Watersheds Association) to keep up with updates to NFIP Regulations as well as networking with other jurisdictions on flood related issues. Education/Outreach - The Floodplain Administrator also coordinates with the Town's Public Information Officer to relay flood-related information provided by FEMA and the State Department of Conservation and Recreation (DCR) to the public. Inspections – The Department of Public Works responds to issues related to flooding and coordinates accordingly. The

Category	NFIP Topic	Source of Information	Comments
			Floodplain Administrator, with coordination from the Zoning Administrator/Inspectors, responds to all issues and resident complaints involving flood related concerns which include but not limited to construction in the floodplain, floodplain uses, floodplain debris, etc. The Floodplain Administrator also coordinates with the Zoning Administrator to issue any violations. Engineering Capability – The Floodplain Administrator and DPR Staff review all Town floodplain applications (i.e., floodplain studies, alterations, Letters of Map Change, elevation certificates, flood proofing documentation, etc.) provided by home/property owners/developers and their respective design professionals (i.e. architects, engineers, surveyors, etc.) and has the expertise to review FEMA hydraulic models (i.e. HEC-RAS models).
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	As the Town is a smaller municipality, there are no set positions dealing with the floodplain such as a dedicated floodplain manager only and community rating system coordinator. Currently, the Floodplain Administrator is the Director of Plan Review. Many of the bigger municipalities such as some of the Counties and Cities have dedicated personnel

Category	NFIP Topic	Source of Information	Comments
			which allow for further implementation of policies and programs such as the Community Rating System and additional practices to strengthen and support the aspects of the NFIP.
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Based on a letter received from State Department of Conservation and Recreation dated September 4, 2013, the Town's floodplain management program is in substantial compliance with the NFIP Requirements. This is from a Community Assistance Visit conducted on July 30, 2013. In addition, the Town has since updated all Town floodplain ordinances to meet the minimum NFIP regulations per the model ordinance developed by FEMA and DCR. This update addresses all concerns from the Community Assistance Visit.
Compliance History	Are there any outstanding compliance issues (i.e., current violations)?		Currently, there is 1 violation dealing with storing materials and debris within the floodplain limits. A violation has been sent to the property owner and is currently being rectified.
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		July 30, 2013.

Table 24: High Wind/Severe Storm Events in Loudoun County (Including the Towns of Leesburg, Lovettsville, Middleburg, Purcellville, and Round Hill), 1950–May 31, 2021[25]

Impact	Data
High Wind/Severe Storm Events	696
Direct Deaths	1
Direct Injuries	9
Property Damage	$10,248,650
Crop Damage	$224,600
Total Property and Crop Damage	**$10,473,250**

5.2. Population

Loudoun County and Leesburg are somewhat less densely populated than other counties near the District of Columbia, given that a large portion of its land is used for agricultural purposes, while there are denser population clusters elsewhere in the county. U.S. Census Bureau figures show that, of the 366,827 persons over the age of five, 31.6% speak a language other than English and 9.8% speak English "less than very well." In the Town of Leesburg, 27.1% of the 48,908 residents speak a language other than English at home. This situation highlights the challenge of communicating emergency information and educating residents about hazard risks and vulnerabilities and the benefits of hazard mitigation.

The Census Bureau also reports that approximately 5.8%, or 14, 7490 residents, are identified as non-institutionalized disabled persons due to access or functional needs.

Estimates of the number of residents in Loudoun County vulnerable to each hazard are presented in the various hazard sections in the **Base Plan**.

The Centers for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations. The CDC SVI depicts the vulnerability of communities at census tract level, by county, into 15 census-derived factors grouped into four themes—socioeconomic status, household composition/disability, race/ethnicity/language, and housing type/transportation. Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills.

The Overall CDC SVI for Loudoun County illustrated in Error! Reference source not found. indicates the locations of highest overall vulnerability are in more urbanized areas and along major transportation routes. In the Town of Leesburg, vulnerability appears to be concentrated in the central to southeastern portions of the community.

[25] NCEI Storm Events Database

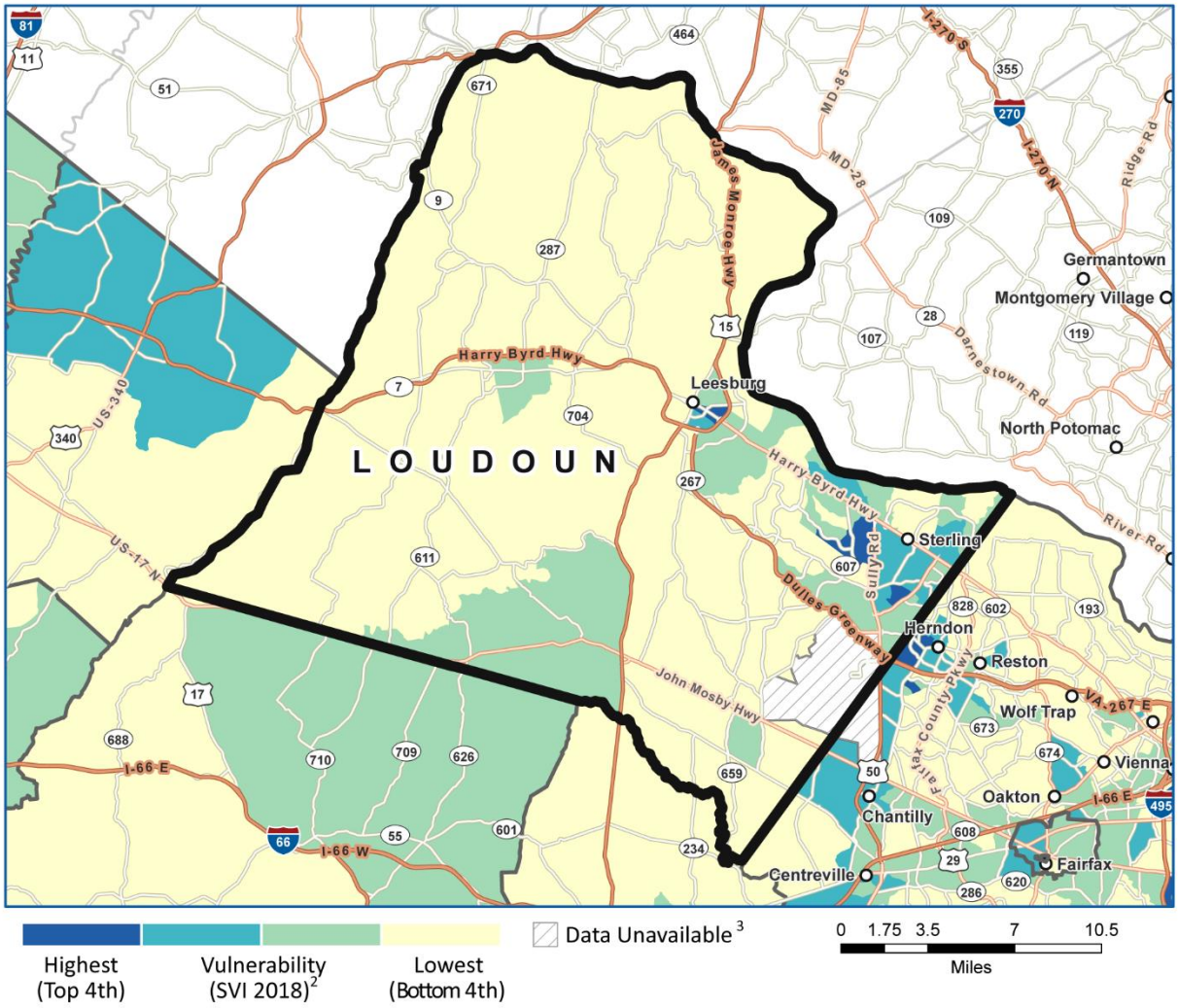


Figure 10: Overall Social Vulnerability (2018), Loudoun County[26]

[26] Centers for Disease Control and Prevention (https://svi.cdc.gov/map.html)

Figure 11: Overall Social Vulnerability (2018), Leesburg[27]

When examined by vulnerability theme, the planning districts with highest vulnerabilities vary widely across the county.

- Socioeconomic Status – Countryside Cascades, Sterling, Middleburg, Purcellville
- Household Composition/Disability – Loudoun Heights, Dulles Town Center, Leesburg
- Race/Ethnicity/Language – Belmont, Dulles Town Center, South Riding, Conklin, Arcola
- Housing Type/Transportation – Housing Type/Transportation – Leesburg, Potomac Falls, Broadlands, Moorefield Station

5.3. Built Environment

Based on data currently available through Hazus, the tables presented in this section provide a total number of exposed facilities and properties in relation to earthquake, flood, and hurricane wind.

Table 25: Building Stock Exposure by General Occupancy[28]

Type	Amount
Residential	$144,188,703
Commercial	$20,116,524
Industrial	$2,464,611
Agricultural	$272,032
Religion	$1,827,947
Government	$579,222
Education	$1,378,119
TOTAL	**$170,827,158**

[27] Zoom of Figure 10, not to scale.
[28] Hazus-MH

Loudoun County has more than $170.8 million in exposure to buildings within the 100-year floodplain. Using the 100-year flood scenario, Hazus identified a total of 357 structures that would be damaged, with 44 being at least 50% damaged, and 88 having substantial damage.

5.4. Community Lifelines and Assets

Loudoun County reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events.[29] The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA.

Table 26: Vulnerable Community Lifeline Assets (in Thousands of Dollars)[30]

Sector	Dollar Exposure
Safety and Security	Undetermined
Food, Water, Shelter	Undetermined
Health and Medical	Undetermined
Energy	$837,534
Communications	$744
Transportation	$2,411,988
Hazardous Materials	Undetermined

Table 27: Critical Facilities Exposed to FEMA Floodplains, Loudoun County[31]

Type of Critical Facility	Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
Wastewater Treatment Plants	20	6	0
Ferries	1	1	0
Fire Stations	15	1	0
Highway Bridges	364	127	9
Highway Segments	32	15	0
Natural Gas Pipelines	10	9	0

The Town of Leesburg interactive floodplain mapper indicates 1 fire station, 1 wastewater plant, and 1 water treatments plant are located within the 100-year floodplain. A map on page 23 of the Loudoun County *2016 Flood Risk Report* illustrates the many rivers and streams that course through the region. Almost all segments of both unincorporated Loudoun County and its towns are located relatively near a water body.

[29] Although Loudoun County maintains a separate critical facilities inventory, information used in this analysis is extracted from the Hazus-MH critical facilities database to maintain consistency with other jurisdictions.
[30] Hazus-MH
[31] Ibid.

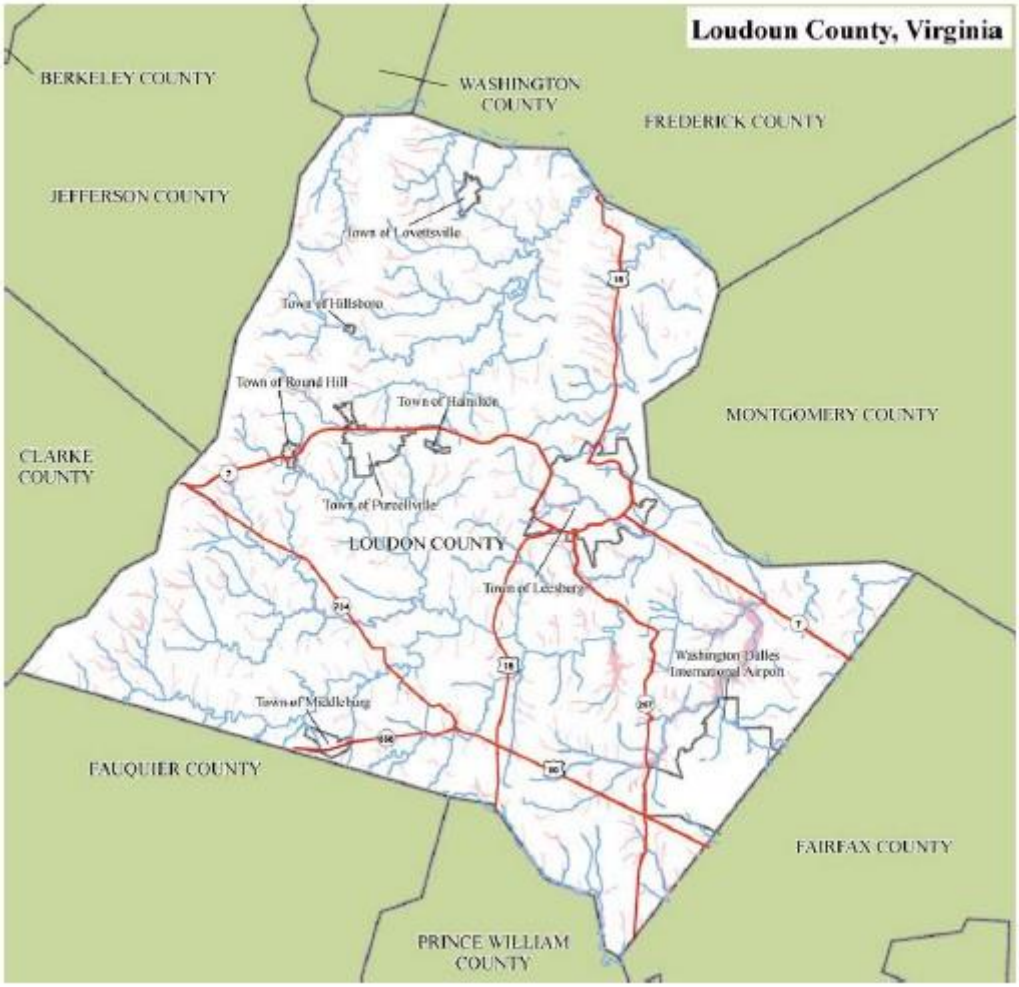


Figure 12: Location of Loudoun County Rivers and Streams

5.5. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

Additional environmental concerns for Loudoun County are related to the Potomac Watershed Waterways and the potential for flooding. The county also has a high number of public parks, outdoor sporting facilities, and National Park Service trails and parks. The county identified Huntley Meadows as a critical habitat due to its forests, meadows, and wetlands.

5.6. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2,500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets.

Table 28: Direct Economic Losses (in Thousands of Dollars) Related to Earthquake, Flood and Hurricane Wind[32]

Hazard	Buildings (Capital Stock and Income)	Transportation	Utilities
Earthquake	$441,720	$4,977	$30,872
Flood	$434,725	$0	$96,696.45
Hurricane Wind	$30,325	$0	$0

Additional economic concerns for Loudoun County are related to the area's economic base which relies on government, information technology, and finance. Major employers include Fortune 500 companies, the federal government, and the military.

5.7. Cultural/Historical

Information related to the vulnerability of cultural and historical assets is presented in the hazard-specific sections of the **Base Plan**.

Loudoun County holds significant historical and cultural landmarks linked to the founding of our nation, many of which are National Trust Historic Sites and others locally designated landmarks. Five of the sites listed are in the Town of Leesburg.

Table 29: Historic Sites

Historic Site	Location
Balls Bluff Battlefield	Leesburg
Douglass High School (408 East Market Street)	Leesburg
Edward Nichols House (Seacrest) 330 West Market Street	Leesburg
General George C. Marshall House, Dodona Manor 217 Edwards Ferry Road	Leesburg
Leesburg Historic District	
Mt. Olive Methodist Episcopal Church	Leesburg
Rock Spring Farm (329 Loudoun Street SW	Leesburg
Waverly Mansion (212 South King Street)	Leesburg

Historic structures and sites and other types of facilities are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to ensuring protection these fragile sites while following historic preservation standards and guidelines.

[32] Hazus-MH (2500-year, 6.5 magnitude Earthquake scenario, 100-year Flood scenario, 2,500-year Hurricane event)

The location of these and other assets are shown in the map and legend that follow.

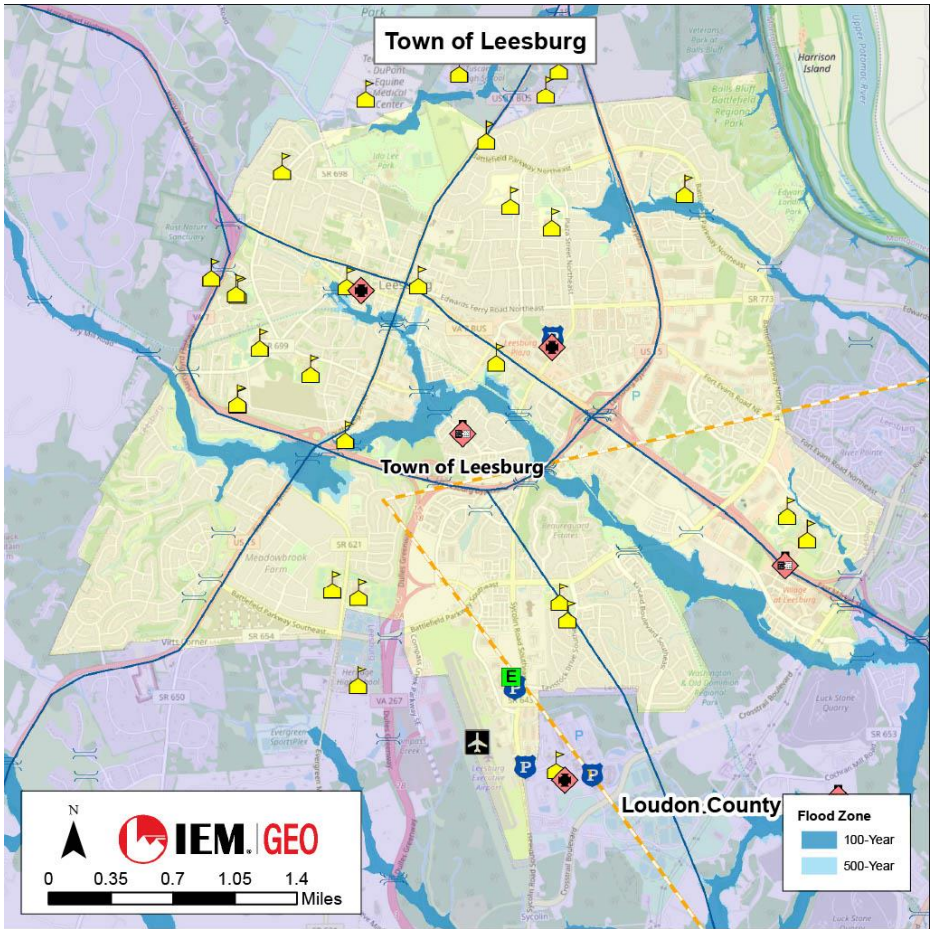


Figure 13: The Town of Leesburg Critical Assets Located in the Town of Leesburg Flood Zone

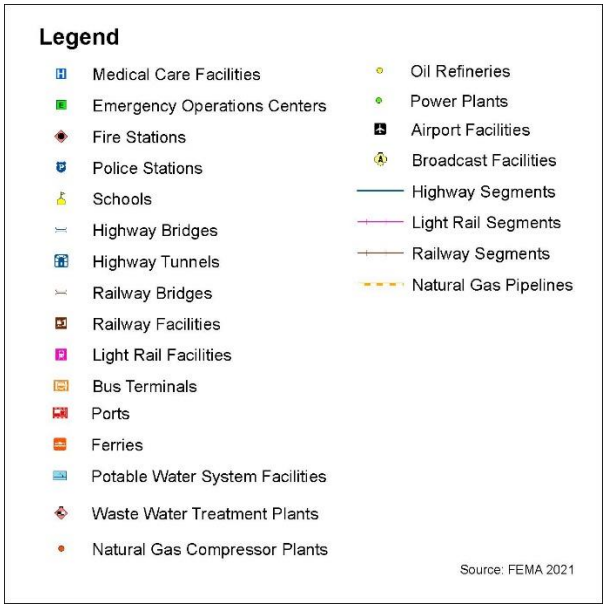


Figure 14: Legend for Figure 13 - Critical Assets Located in the Town of Leesburg Floodplain

6. Capability Assessment

The Town of Leesburg reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a capabilities assessment worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the Town of Leesburg completed a jurisdiction needs identification questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans, and/or resources, and it can implement most mitigation actions.

Table 30: Capability Assessment Ranking Summary, Town of Leesburg

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	Low
Financial	Moderate
Education and Outreach	Low

Recognizing that town resources are often limited, inter-jurisdictional planning can help communities pool their resources and implement initiatives that extend beyond immediate borders.

6.1.1. Planning and Regulatory Capabilities Summary

The Town of Leesburg Office of Planning and Zoning takes an all-hazards approach when developing any jurisdictional plans, including emergency operations, and continuity of operations, as well as the hazard mitigation plan.

The following plans have been newly developed or updated since the 2017 HMP:

- Loudoun County 2019's Comprehensive Plan, including all municipalities
- Town of Leesburg's own comprehensive/master plan, adopted on March 1, 2020
- 2019 Transportation Plan (part of the 2019 Comprehensive Plan)
- Fiscal Years 2021–2026 Capital Improvement Plan
- County-developed 2017 Economic Growth and Diversification Plan

- The Emergency Operations Plan, Economic Development Plan, and other planning documents providing mechanisms through which to carry out mitigation efforts
- Town of Leesburg Municipal Separate Storm Sewer System (MS4) Program Plan, April 2019
- Loudoun Health District, Pandemic Response Plan, March 2020
- FEMA Flood Insurance Rate Maps, developed in 2019

Capability Analysis: High

Loudoun County is mindful of the need to develop plans, codes, and regulations to minimize the risk that hazard events will negatively affect people, property, crops, and farm animals. These include natural hazard-specific ordinances (stormwater, steep slope, wildfire) and the Mountainside Development Overlay District and Steep Slope Standards of the County Zoning Ordinance. Likewise, the Town of Leesburg serves the community well in carrying out programs and guidelines.

6.1.2. Administrative and Technical Capabilities Summary

Loudoun County and the Town of Leesburg identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and implementation of the plan:

- Planning/Engineer – Planning Department; Zoning; Building and Development
- Building and Public Works engineers trained in construction practices related to buildings and infrastructure
- Public Works & Capital Projects and Plan Review
- Planners/engineers with an understanding of natural and/or manmade hazards
- GIS and Fire and Rescue Departments with personnel skilled in GIS and Hazus
- Emergency Management personnel

The Town is in a position to partner with other municipalities and the county to accomplish mitigation efforts.

Capability Analysis: High

The Town of Leesburg staff across the board is trained in how to maintain current systems for managing all business, societal, and economic sectors and improve staffing needs as necessary.

6.1.3. Safe Growth Capabilities Summary

The Town of Leesburg departments cover safe growth on many levels. The Legacy Leesburg Town Plan, 2022 and the 2019 Loudoun County Comprehensive Plan includes policies and guidance to cover or reinforce best practices in the following:

- Land Use
- Transportation
- Environmental Management
- Public Safety

- Zoning
- Subdivision Development
- Historic Preservation

Capability Analysis: Low

The Safe Growth Capabilities in plan and/or on the planning board show that Loudoun County is proud of its illustrious past and endeavors to maintain a balance between honoring historic assets while taking advantage of future opportunities available to a community located near the nation's capital. The Town pays a great deal of attention to the needs of growing communities and may provide more feedback about its efforts in future plan updates.

Three major projects are underway or may be completed in the near future. These show that the Town is trying to protect life and property.

- Project 06306 addresses Tuscarora Creek Flood Mitigation for channel improvements to help reduce flooding of adjoining residential properties by installing storm drainage to handle the 100-year storm event and constructing a 2- to 4-foot high wall.
- Project 24NEW2 addresses providing a backup generator at the Water Pollution Control Facility for emergencies.
- The Town recently deployed 3 flooding sensors acquired through a DHS grant to help inform safe growth and floodplain management.

6.1.4. Financial Capabilities Summary

The Town of Leesburg and Loudoun County are able to take advantage of financial mechanisms in place to generate funding for current and future opportunities.

- Capital improvements project funding
- Authority to levy taxes for specific purposes
- Community development block grants
- Public/private partnerships
- State funding

The Town of Leesburg may be able to share financial responsibilities with the county because their assets are similar or complementary. The Town collects fees for utility services and developed a Capital Improvement Plan and funding, and therefore it is able to incur debt using general obligation specialty tax bonds for infrastructure and program improvements.

Capability Analysis: Moderate

While Loudoun County and the Town of Leesburg make the best use of current finance capabilities, it may look forward to identifying new funding opportunities, including the use of federal grants from FEMA and other agencies.

6.1.5. Education and Outreach Capabilities Summary

Several departments and agencies conduct education and outreach to make citizens aware of resources available to them.

- Sheriff's Department – Adult Crime Prevention Unit teaches classes to the public on crime prevention topics.
- Likewise, the Town of Leesburg Sheriff's Office actively pursues outreach efforts.
- Loudoun County Public Schools Outreach Services includes a Parent Liaisons program, a Language Assistance Service, a Community Schools Initiative to provide mental health resources, and after-school opportunities to socialize or receive academic assistance.
- The Loudoun Education Foundation provides multicultural educational information and conducts direct outreach to promote interchange between diverse groups.

Capability Analysis: Low

The Town of Leesburg and Loudoun County are well-positioned to build on its current education and outreach programs to promote hazard awareness and mitigation efforts that can be practiced by businesses, community groups, individuals, households, and other stakeholders. Its 10 public libraries and array of facilities under the Department of Parks, Recreation, and Community Service all provide locations where staff and volunteers regularly interact with the public. These physical structures and the array of print, web-based, and broadcast media demonstrate the unlimited ways to create community awareness about hazards and their impact on the community. The Town of Leesburg Sheriff's Office cooperates on any and all efforts to communicate the need for public safety.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, the Town of Leesburg identified activities related to each natural hazard that support risk reduction. They are listed in **Error! Reference source not found.**.

Table 31: Capability Summary - Activities that Reduce National Hazard Risk or Impacts

Hazard	Activity
Dam Failure (including Levees)	• The one dam located in the Town of Leesburg is a low-hazard structure.
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and International building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	• Public education and operational plans address preparedness and response to reduce risk.

Hazard	Activity
Flood/Flash Flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. • Stormwater management program and projects address flood prevention and risk reduction.
High Wind/Severe Storm	• State and international building codes provide for wind and seismic design regulations.
Karst/Sinkhole/Land Subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Winter Weather	• Public education and operational plans address preparedness and response to reduce risk.
Non-Natural Hazards	• Public education and operational plans address preparedness and response to reduce risk. • Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate Change	• A chapter of the Loudoun County 2019 Comprehensive Plan addresses Land Use and how to develop a resilient built environment. The chapter “Natural, Environmental, and Heritage Resources” discusses the need to consider how to best maintain a fragile ecosystem and historic resources in the face of current and future climate change.

7. Resilience to Hazards

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of "low risk" is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

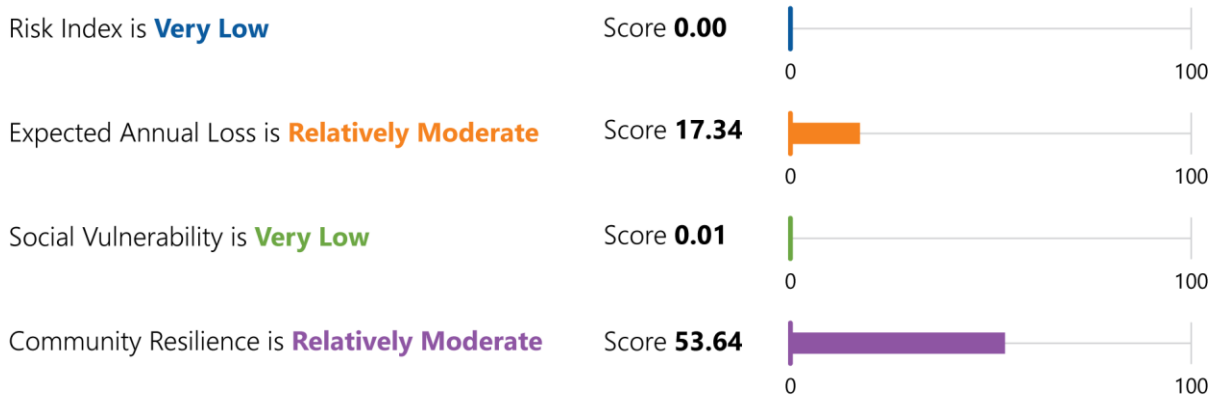


Figure 15: Summary of National Risk Index Findings, Loudoun County[33]

Table 32: Comparison of Loudoun County Scores with Virginia and National Average[34]

Index	Loudoun County	Virginia Average	National Average
Risk	3.26	6.62	10.70
Expected Annual Loss	17.34	9.35	13.47
Social Vulnerability	0.01	35.32	38.35
Community Resilience	53.64	54.92	54.59

Table 33: Loudoun County Risk Ranking[35]

Index	Rank
Risk	Very Low
Expected Annual Loss	Relatively Moderate
Social Vulnerability	Very Low
Community Resilience	Relatively Moderate

Loudoun County's NRI Community Resilience score of 53.64 represents a relatively low ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the United States.

[33] National Risk Index
[34] Ibid.
[35] Ibid.

7.1. Community Resilience Estimates

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household level risk factors.

The index produces aggregate-level (census tract, county, and state) small area estimates, providing a tool for understanding how at-risk specific neighborhoods might be to disasters due to characteristics that may make specific segments of the population more vulnerable to the impacts and consequences of disasters. The 10 risk factors[36] include the following:

1. Income-to-poverty ratio
2. Single or zero caregiver household
3. Unit-level crowding
4. Communication barrier
5. Aged 65 years or older
6. Lack of full-time or year-round employment (household)
7. Disability
8. No health insurance coverage
9. No vehicle access (household)
10. No broadband internet access (household)

In 2021, the U.S. Census Bureau released data estimates showing the counties and states with the highest percentage of residents who are considered vulnerable to a disaster or other emergency. The percentages were mapped by *U.S. News and World Report*.[37]

[36] The Community Resilience Estimates are developed by the U.S. Census Bureau; initial release date, August 10, 2021. Methodology is described at the U.S. Census Bureau Community Resilience Methodology Page (https://www.census.gov/programs-surveys/community-resilience-estimates/technical-documentation/methodology.html).

[37] Alex Leeds Matthews, *U.S. News and World Report*, 10-13-2021. Where Americans Are Most Vulnerable to Disaster, https://www.usnews.com/news/health-news/articles/2021-10-13/counties-where-americans-are-most-vulnerable-to-disaster

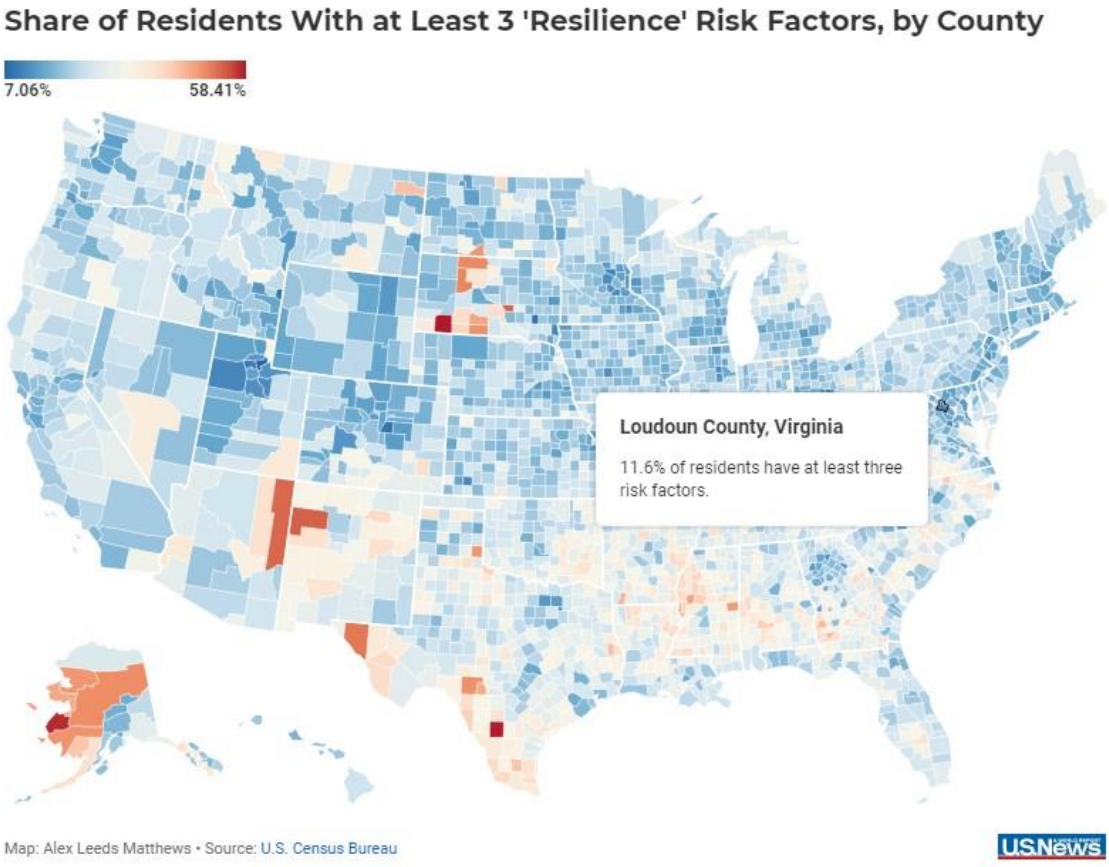


Figure 16: Community resilience Estimate for Loudoun County[38]

The estimate is categorized into three groups: zero risks, one to two risks, and three or more risks. The CRE for Loudoun County is 11.6%, meaning that 47,970 of 47,970 county residents have three or more risk factors.

The combination of data and analysis described in this section provides a comprehensive representation of Loudoun County's risk, vulnerability, and resilience to all hazards.

7.2. New Hazard Risk Challenges or Obstacles

The Loudoun County Planning Team identified the following to be monitored in the next planning cycle:

- **Climate Change:** Increases in the number of excessive rainfall events that impact areas currently identified as flood zones, as well as new areas of flooding that emerge as stormwater management events.

[38] Community Resilience Estimates, U.S. Census Bureau

8. Mitigation Actions

8.1. Goals and Objectives

The Loudoun County Planning Team adopted the regional goal statement presented in **Section 8 of the Base Plan**. In addition, the *Loudoun County Emergency Operations Plan (EOP),* dated June 2019, outlines the need to conduct Threat and Hazard Identification and Risk Assessment (THIRA), a strategic analysis of hazards that pose a significant threat to the community. The THIRA evaluates and analyzes past experience, historical information, probability, projected impacts, and resource availability—all elements of the hazard mitigation planning process. The EOP states, "By recognizing and understanding the risks that the community faces, Loudoun County places itself in a position to make better resource management decisions." (*Loudoun County EOP,* p. 1-12, Base Plan) The link between the goals of the *NOVA HMP* and the *EOP* increases the likelihood of success in implementing mitigation actions.

8.2. Status of Previous Actions

Loudoun County and the Town of Leesburg monitor actions and track progress through the periodic review, evaluation, revision, and update of the NOVA HMP. Some projects that contribute to risk reduction have been completed or are currently in progress but have not been included in this plan for one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and resulting risk reduction.

The Loudoun County Mitigation Actions list includes previously identified actions from the 2006, 2010, and 2017 plans. Four actions from the 2006 plan were carried forward for the 2022 NOVA HMP update. Twelve actions from the 2010 plan were carried forward, and one was noted as completed and removed from the list. Nine actions from the 2017 plan were carried forward, and three were noted as complete.

The comprehensive list of previous mitigation actions, including descriptions of progress made and current status, is presented in **Attachment 4** of this annex.

8.3. New Mitigation Actions

In addition to the 11 actions listed in the 2017 plan, some of which will be carried forward, the Town of Leesburg identified 5 new mitigation actions to include in 2022 NOVA HMP to address natural hazards and 3 new actions to address non-natural hazards. All such initiatives will increase the resiliency of county and municipal assets. The County and Town will also coordinate with FEMA to re-evaluate flood zones and update Flood Insurance Rate Maps (FIRMs) as a basis for future National Flood Insurance Program Activities. **Attachment 4** of this annex includes a table that summarizes each new and continued action, describing the proposed activity, priority level, estimated cost, and lead agency.

8.4. Action Plan for Implementation and Integration

The Loudoun County Office of Emergency Management and Security (OEM) is responsible for coordinating County departments and agencies participating in hazard mitigation activities. The OEM-designated Mitigation Coordinator is responsible for implementing the mitigation plan on two levels: implementation of the jurisdiction's actions and facilitating implementation of the multi-jurisdictional regional plan. Tasks to ensure that the jurisdiction's actions are implemented are integrated into the *Action Plan for Implementation and Integration* (which includes the prioritized list of Mitigation Actions), and plan maintenance procedures described in the next section.

While the County is technically responsible for overseeing implementation, integration, and maintenance after the plan has been approved by FEMA, Town of Leesburg staff who helped develop the plan would be jointly helpful in carrying out mitigation activities listed in the Town's jurisdiction annex. Likewise, the Town was a solid participant in the planning process and its support in helping carry out the overall plan directives during the five-year cycle that begins after approval would be both welcome and insightful.

The *Loudoun County Emergency Operations Plan (EOP),* dated June 2019, (p. 82) defines criteria for project eligibility under the Hazard Mitigation Grant Program (HMGP), stating that a project must meet the following requirements:

- Conform to the State Hazard Mitigation Plan.
- Conform to environmental, historical, and economic justice issues.
- Provide a long-term solution.
- Demonstrate cost effectiveness.
- Comply with program regulations.
- Be consistent with overall mitigation strategies.

The *Action Plan for Implementation and Integration* describes how the County's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 34: Actional Plan for Implementation and Integration, Loudoun County

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plan.	Continue to coordinate with Planning and Zoning and other applicable departments to incorporate current and emerging risks and actions into planning efforts.
Review/update land development regulations for consistency with mitigation goals.	Continue coordinating with Planning and Zoning and Building Development on future land use projects.
Review/update building/zoning codes for consistency with mitigation goals.	Work with Planning and Zoning and Building and Development Services to ensure county zoning ordinances are consistent with mitigation goals.
Maintain regulatory requirements of the National Flood Insurance Program (NFIP).	Support the Department of Building and Development sectors of Natural Resources and Water and Hydrology to ensure compliance with responsible for NFIP floodplain management regulations.

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Enhance floodplain management through Community Rating System (CRS).	Work with Planning and Zoning Land Development Services and the Office of Public Works on reviews of floodplain management and mapping.
Review/update economic development plan and policies for consistency with mitigation goals.	Work with Loudoun County Department of Economic Development Authority to ensure consistency and integration between the mitigation plan and plans for future development.
Continue public engagement in mitigation planning.	Continue to promote awareness of hazards and incorporate public feedback into planning processes for resident feedback.
Identify opportunities for mitigation education and outreach.	Identify opportunities to conduct community outreach to promote the importance of mitigation projects.
Review/update stormwater plans and procedures for consistency with mitigation goals.	Work with the Department of Public Works and Environmental Services Stormwater Division to discuss plans and procedures on a more frequent basis.
Review/update emergency plans to address evacuation and sheltering.	Continue to work with partner agencies listed in the EOP annexes, including the Shelter Annex.
Maintain ongoing enforcement of existing policies.	Support the Department of Planning and Zoning with any applicable enforcement policies.
Monitor funding opportunities.	Continue to monitor funding sources and coordinate with departments on projects that support mitigation actions.
Incorporate goals and objectives into day-to-day government functions.	Incorporate the concept of mitigation into day-to-day government functions, including continual monitoring of the action items identified in the 2022 update.
Incorporate goals into day-to-day development policies, reviews, and priorities.	Continue work with the Department of Planning and Zoning and Building and Development to incorporate mitigation into day-to-day activities.

9. Annex Maintenance Procedures

The point of contact for the NOVA HMP Planning Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP Base Plan** and is responsible for initiating the annual activities, convening the Planning Team, and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3 of the Base Plan**.

Table 35: Loudoun County Plan Maintenance Responsibilities for the NOVA Hazard Mitigation Plan (Base Plan)

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA HMP Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Help disseminate reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA HMP Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Help disseminate information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and updating. • Collect and report data to the NOVA HMP Planning Team. • Maintain records and documentation of all reviews and revisions of the plan by the jurisdiction. • Help disseminate reports to stakeholders and the public.

9.1. Maintenance of the Jurisdiction Annex

In addition to maintaining the **NOVA HMP Base Plan**, the Loudoun County Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annexes**.

9.1.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following a major disaster(s)
- **Evaluate:** Annually and/or following a major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in the fifth year.

Table 36: Loudoun County Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with the jurisdiction planning team.	• Produce an annual report that includes the following:

Activity	Procedure and Schedule	Outcome
	2. Review the status of all mitigation actions, using the Mitigation Action Implementation Worksheet (**NOVA HMP Base Plan, Section 3, Attachment A**).	▪ Status update of all mitigation actions ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities ▪ Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	1. Schedule the annual plan evaluation with the jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the Planning Considerations Worksheet (**NOVA HMP Base Plan, Section 3, Attachment C**).	• Submit the annual report to the NOVA HMP Planning Team Point of Contact
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

Mitigation actions presented in the Loudoun County Jurisdiction Annex and the Town of Leesburg Jurisdiction Annex may be reviewed, revised, and updated at any time. In addition, the *Loudoun County EOP*, p. 83, stipulates that "OEM will contact all agencies for post-disaster mitigation activities and notify them of their role in these operations." This will ensure that mitigation actions remain current and positioned for potential funding as it becomes available.

Loudoun County will continue to be a planning partner with multiple jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan and benefit all communities.

10. Annex Adoption

The Leesburg Town Council will adopt the Town of Leesburg annex at the same time it adopts the 2022 *Northern Virginia Hazard Mitigation Plan*.

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Capabilities Assessment
- Attachment 3: Documentation of Public Participation
- Attachment 4: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Capabilities Assessment

Capability Assessment

Jurisdiction: Town of Leesburg
Date:

Participants:

Name	Position/Title	Department/Agency

Planning and Regulatory

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. Please indicate which of the following your jurisdiction has in place.

Plans	Yes or No? Year	Does the plan address natural and/or human-caused hazards?	Does the plan identify projects to include in the mitigation strategy?	Can the plan be used to implement mitigation actions?
Legacy Leesburg: Comprehensive/Master Plan Town plan: 637838227427570000 (leesburgva.gov)	Yes Adopted March 22, 2022	• Plan describes and overall attitude of protecting the natural environment (pg. 100) and stormwater management (pg. 158) All Things Green Guiding Principal Strategy 5.2.6: Avoid Development in the floodplain and riparian buffer.	• Projects implemented through various methods, including Capital Improvements Plan, and Town Plan Action Program (appendix to Comprehensive Plan)	•

Plans	Yes or No? Year	Does the plan address natural and/or human-caused hazards?	Does the plan identify projects to include in the mitigation strategy?	Can the plan be used to implement mitigation actions?
Capital Improvements Plan Budget Book - Operating-2022-05-03-15-01 (leesburgva.gov)	Yes, 2023	• Recommends use of FEMA floodplain information as guide for proposed land development and capital improvement projects • National Resources Objective 9 calls for the protection of people and property from natural hazards such as flooding. • Kincaid Forest Drainage Improvements (27402) • Lawson Road Pedestrian Crossing (27401) • Town Branch Stream Channel Improvements (23402) •	•	
Economic Development Plan Economic Development | Leesburg, VA (leesburgva.gov) https://www.leesburgva.gov/home/showpublisheddocument/12822/637484834028770000	Yes	• Comprehensive Plan, Appendix A includes an Economic Development Action Plan, p. A-9		
Impact fees for new development				
Local Emergency Operations Plan Emergency Preparedness | Leesburg, VA (leesburgva.gov)	Yes	Yes	Yes	Yes

Plans	Yes or No? Year	Does the plan address natural and/or human-caused hazards?	Does the plan identify projects to include in the mitigation strategy?	Can the plan be used to implement mitigation actions?
Continuity of Operations Plan				
Transportation Plan Transportation Plan, Loudoun County, Countywide Transportation Plan | Loudoun County, VA - Official Website Comp Plan, Town Plan Action Program	Yes	• Comprehensive Plan, Appendix A includes a Transportation Action Plan, p. A-10		
Stormwater Management Plan - Stormwater Master Plan Introduction, https://www.leesburgva.gov/home/showpublisheddocument/36234/637558850239070000 Water Quality & Stormwater Management | Leesburg, VA (leesburgva.gov) About Stormwater and the Stormwater Management Program | Leesburg, VA (leesburgva.gov)	Yes	• FY 2020 Annual Report includes stormwater projects, primarily addressing reduction of discharge pollutants		
Community Wildfire Protection Plan	No			
Other special plans (e.g., brownfields redevelopment, disaster recovery, Local Waterfront Redevelopment Plan, climate change adaptation, etc.)				

Table 37: Building Code, Permitting, and Inspection Assessment

Building Code, Permitting, and Inspection	Yes or No?	Are codes adequately enforced?
Building Code https://www.loudoun.gov/5012/Building-Codes-Regulations	Yes	Virginia Uniform Statewide Building Code
Building Code Effectiveness Grading Schedule (BCEGS) Score		
Fire Department ISO rating		
Site Plan review requirements	Yes	

Table 38: Land Use Planning and Ordinances Assessment

Land Use Planning and Ordinances	Yes or No?	Is the ordinance an effective measure for reducing hazard impacts?	Is the ordinance adequately administered and enforced?
Zoning ordinance - https://www.leesburgva.gov/departments/planning-zoning/zoning-information/zoning-ordinance Codes, ordinances, and maps: Codes, Ordinances & Maps | Leesburg, VA (leesburgva.gov)	Yes		Subdivision ordinance
Floodplain ordinance - Floodplain Overlay District - Zoning Ordinance, Section 7.11, Floodplain Overlay District, https://www.leesburgva.gov/departments/planning-zoning/zoning-information/zoning-ordinance Article 14 - Creek Valley Buffer, https://www.leesburgva.gov/home/showpublisheddocument/4536/635602935566730000	Yes	• Defines major floodplain (SFHA), and minor floodplain • "Floodplain areas are primarily intended to remain as open or common areas", p. 7-84 • Article 14 - Creek Valley Buffer controls development/construction adjacent to rivers and major stream areas draining more than 640 acres, by providing for a setback area beyond the 100-year flood	

Land Use Planning and Ordinances	Yes or No?	Is the ordinance an effective measure for reducing hazard impacts?	Is the ordinance adequately administered and enforced?
		Additional requirements in the Town's Subdivision & Land Development Regulations, Division 7, Article 5 of the Design & Construction Standards Manual; and Section 14-40 through 14-49 of the Town Code.	
Natural hazard specific ordinance (stormwater, steep slope, wildfire)			
Flood insurance rate maps https://www.leesburgva.gov/departments/planning-zoning/development-tool-box/interactive-floodplain-map	Yes	• Floodplain maps can be searched by address	
Acquisition of land for open space and public recreation uses			
Other			
How can these capabilities be expanded and improved to reduce risk?			

Administrative and Technical

Identify whether your community has the following administrative and technical capabilities. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. If your jurisdiction does not have local staff resources, please indicate if these are available through an agreement with other entities or at the county level to provide the services or technical assistance.

Staff/Personnel Resources	Have Capability Y/N	Department/ Agency and Position	Effective Coordination?	Adequate Staffing?	Integrated into Mitigation Planning?
A. Planner(s) or engineer(s) with knowledge of land development and land management practices	Y	Planning and Zoning			
B. Engineer/professionals trained in construction practices related to buildings and/or infrastructure	Y	Planning and Zoning			
C. Planners/engineer(s) with an understanding of natural and/or manmade hazards	Y	Planning and Zoning			
D. Floodplain manager	Y	Planning and Zoning			
E. Surveyor(s)	N				
F. Staff with education or expertise to assess the community's vulnerability to hazards	Y	Police Department			
G. Personnel skilled in GIS and/or Hazus	Y	Police Department			
H. Scientist familiar with hazards of the community					
I. Emergency manager	Y	Police Department; Emergency Management			
J. Grant writer(s)	Y	Town Council			
K. Warning systems or services (automated callout, sirens, etc.)					
How can these capabilities be expanded and improved to reduce risk?					

Safe Growth

This worksheet identifies potential gaps in your community's growth guidance instruments and improvements that could be made to reduce vulnerability to future development.

Comprehensive Plan	Yes	No
Land Use		
1. Does the future land-use map clearly identify natural hazard areas?		
Green infrastructure zone does identify FEMA floodplain. Under preserve – open space and natural resource locations are clearly identified as areas to be protected.		
2. Do the land-use policies discourage development or redevelopment within natural hazard areas?		
Areas to preserve have been identified and if the development or redevelopment occurs in these zones, there are policies in place to address protection.		
3. Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?		
Yes. Expected future growth is anticipated to be redevelopment of areas such as the crescent district. The Town is 97% built out already so there is not much greenfield development.		
Transportation		
1. Does the transportation plan limit access to hazard areas?		
When new roadways are constructed, there is an environmental assessment completed.		
2. Is transportation policy used to guide growth to safe locations?		
Not specifically stated in policy. There are land-use policies that focus on growth in risk areas (creek valley buffer, etc.).		
3. Are movement systems designed to function under disaster conditions (e.g., evacuation)?		
Public Works has incorporated redundant power supplies into design standards for traffic signals. Some primary roadways that would be used for evacuation are the responsibility of VDOT.		
Environmental Management		
1. Are environmental systems that protect development from hazards identified and mapped?		
Stormwater management ponds, dams/impoundments, karst soil are identified.		
2. Do environmental policies maintain and restore protective ecosystems?		
Areas to preserve in the draft Legacy Leesburg Plan. Acquire environmentally sensitive land.		
3. Do environmental policies provide incentives to development that is located outside protective ecosystems?		
This is regulated, but no incentives. No formalized incentive policy.		

Comprehensive Plan	Yes	No
Public Safety		
1. Are the goals and policies of the comprehensive plan related to those of the FEMA-approved Local Hazard Mitigation Plan?		
Yes, include FEMA floodplains and sensitive area.		
2. Is safety explicitly included in the plan's growth and development policies?		
Flooding, traffic and pedestrian safety are all covered. Community enhancement through policing is also discussed. Applications are also sent to Loudoun County Fire Rescue to get comments in regards to public safety.		
3. Does the monitoring and implementation section of the plan cover safe growth objectives?		
See above.		
Zoning Ordinance		
1. Does the zoning ordinance conform to the comprehensive plan in terms of discouraging development or redevelopment within natural hazard areas?		
2. Does the ordinance contain natural hazard overlay zones that set conditions for land use within such zones?		
Floodplain overlay does set conditions for land use. First thing when land use applications are received is to look at floodplains and sensitive areas. Conditions for activities in these areas are in place.		
3. Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?		
If in floodplain don't allow greater uses.		
4. Does the ordinance prohibit development within, or fining of, wetlands, floodways, and floodplains?		
Subject to FEMA procedures		
Subdivision Regulations		
1. Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?		
Restrict building, but not the subdivision itself.		
2. Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources?		
See cluster subdivision ordinance.		
3. Do the regulations allow density transfer where hazard areas exist?		
Capital Improvement Program and Infrastructure Policies		
1. Does the capital improvement program limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?		
Must meet FEMA requirements and environmental assessment.		

Comprehensive Plan	Yes	No
2. Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?		
When planning for the CIP, this concept is taken into consideration.		
3. Does the capital improvement program provide funding for hazard mitigation projects identified in the FEMA-approved Local Hazard Mitigation Plan?		
Tuscarora Creek is a recently completed project.		
Other		
1. Do small area or corridor plans recognize the need to avoid or mitigate natural hazards?		
Eastern Gateway plan considers the green infrastructure and avoid development in these areas.		
2. Does the building code contain provision to strengthen or elevate construction to withstand hazard forces?		
N/A – Handled by Loudoun County		
3. Do economic development or redevelopment strategies include provisions for mitigation of natural hazards?		
At King Street Station development the Town worked with the developer to complete mitigation activities that were in accordance with FEMA and Town Ordinance. Not specifically identified in the Comp Plan.		
4. Is there an adopted evacuation and shelter plan to deal with emergencies from natural hazards?		
Yes, Loudoun County maintains both plans. The Town is also going to develop an incident specific evacuation annex to support the Town EOP.		

Financial

Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in the past and for what type of activities?	Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Numerous stormwater mitigation projects have been undertaken utilizing CIP funds.	Yes
Authority to levy taxes for specific purposes	Y	Depends on the type of tax and would have to be in the State Code, due to Virginia being a Dillion Rule state	Dependent on State Code as to what the locality could use funding for.
Fees for water, sewer, gas or electric services	Y	Water and Sewer availability fees support capital needs of the system.	Yes
Impact fees for new development	N		
Storm water utility fee	N		
Incur debt through general obligation bonds and/or special tax bonds	Y		
Incur debt through private activities	N		
Community Development Block Grant	Y	Town has to request funding through Loudoun County. Many services eligible for CDBG funding are not provided by the Town	
Other federal funding programs	Y	ARP, UASI	
State funding programs	Y	DEQ, DCR	
Public–private partnership funding sources	N		
How can these capabilities be expanded and improved to reduce risk?			

Education and Outreach

Identify education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Program/ Organization	Yes/No	Describe program/organization and how it relates to disaster resilience and mitigation.	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	Town Council has formed and appointed members to the Environmental Advisory Committee	
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education, household recycling, etc.)	Yes	• Town of Leesburg, Dept. Of Public Works – Stormwater Management outreach website: https://www.leesburgva.gov/departments/public-works/water-quality-stormwater-management/additional-stormwater-information-and-resources • Town Emergency Preparedness information – https://www.leesburgva.gov/residents/emergency-preparedness Social Media Campaigns on a variety of topics (Severe weather, MS4 related info)	
Natural disaster or safety related school programs	No	Office of Emergency Management has undertaken small awareness campaigns, however additional resources would be	

Program/ Organization	Yes/No	Describe program/organization and how it relates to disaster resilience and mitigation.	Could the program/organization help implement future mitigation activities?
		needed to create and provide specific programs.	
StormReady certification	No	Office of Emergency Management investigating the possibility of seeking StormReady certification. Loudoun County OEM handles this for the entire county.	
Firewise Communities certification	No		
Public–private partnership initiatives addressing disaster-related issues	Yes	Northern Virginia Regional Commission or Metro Washington Council of Government regarding a variety of emergency management topics.	
Other			
How can these capabilities be expanded and improved to reduce risk?			

National Flood Insurance Program (NFIP) Survey Form

Jurisdiction: Town of Leesburg
Floodplain/NFIP Administrator:
Phone:
Date:
Email:
Jurisdiction Participants:
Please provide the information below to document your community's participation in and continued compliance with the NFIP, as well as to identify areas for improvement that could be potential mitigation actions. Indicate the source of information, if different from the one included.

Category	NFIP Topic	Source of Information	Comments
Insurance	How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist	
Insurance	Community Information System Database		
Insurance	How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist	
Insurance	Community Information System Database		
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability).	Community FPA	
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	

Category	NFIP Topic	Source of Information	Comments
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	
Compliance History	Are there any outstanding compliance issues (i.e., current violations)?		
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		

Town of Leesburg Risk Ranking

Table 39: Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Natural Hazards				
Dam failure	1	1	1	1.0
Drought	2	3	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	1	2.3
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	0	0	0	0.0
Tornado	1	2	2	1.7
Wildfire	1	1	1	1.0
Winter weather	3	4	3	3.3
Non-Natural Hazards				
Active violence	1	1	1	1.0
Civil unrest	1	1	1	1.0
Communication disruption	1	2	1	1.3
Cyberattack	1	3	1	1.7
Hazardous materials	1	1	1	1.0
Infectious disease/public health	4	1	1	2.0
Terrorism	1	1	1	1.0

Table 40: Total Consequence Score (TCS) Calculation

Hazard	Impact Elements					Impact Score (PE + PR + PC + E + PO/5 = Impact)	Consequence Elements								TCS (Impact + Consequence)
	People (PE)	Property - Residential (PR)	Property - Commercial (PC)	Environment (E)	Program Operations/Resources (PO)		Population (POP)	Responders (RES)	Continuity of Operations/Services (COS)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Condition/Loss (ECL)	Public Confidence in Governance (PC)	Consequence score (POP + RES + COS + PFI + E + ECL + PC/7 = Consequence)	
Natural Hazards															
Dam failure	4	4	3	2	1	2.8	2	1	1	2	2	1	2	1.6	4.4
Drought	2	1	1	3	1	1.6	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	3	2	1	1	1.8	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	3	1	1	1	1	1.4	2	2	1	1	1	1	1	1.3	2.7
Flood	2	3	3	2	1	2.2	3	2	1	2	2	2	1	1.9	4.1
High wind/severe storm	2	3	2	2	1	2.0	1	2	1	2	2	1	1	1.4	3.4
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4	1	1	1	1	2	1	1	1.1	2.5
Landslide	0	0	0	0	0	0.0	0	0	0	0	0	0	0	0.0	0.0
Tornado	3	3	3	1	1	2.2	3	2	1	2	2	2	1	1.9	4.1
Wildfire	1	1	2	1	1	1.2	2	2	1	1	3	1	1	1.6	2.8
Winter weather	2	2	2	1	2	1.8	2	2	1	2	2	2	1	1.7	3.5
Non-Natural Hazards															
Active violence	4	2	2	1	1	2.0	1	3	1	1	1	2	2	1.6	3.6
Civil unrest	4	3	3	1	2	2.6	1	3	2	2	1	3	4	2.3	4.9

Hazard	Impact Elements						Consequence Elements								
	People (PE)	Property - Residential (PR)	Property - Commercial (PC)	Environment (E)	Program Operations/Resources (PO)	Impact Score (PE + PR + PC + E + PO/5 = Impact)	Population (POP)	Responders (RES)	Continuity of Operations/Services (COS)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Condition/Loss (ECL)	Public Confidence in Governance (PC)	Consequence score (POP + RES + COS + PFI + E + ECL + PC/7 = Consequence)	TCS (Impact + Consequence)
Communication disruption	1	1	2	1	2	1.4	1	4	2	3	2	2	2	2.3	3.7
Cyberattack	1	2	3	1	3	2.0	1	3	3	4	2	3	3	2.7	4.7
Hazardous materials	2	2	2	2	1	1.8	2	4	1	1	3	2	2	2.1	3.9
Infectious disease/public health	5	1	1	1	4	2.4	1	4	3	3	1	4	4	2.9	5.3
Terrorism	5	1	4	3	2	3.0	1	4	2	5	2	4	4	3.1	6.1

Table 41: Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Natural Hazards			
Dam failure	1.0	4.4	5.4
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.3	2.7	5.0
Flood	1.7	4.1	5.7
High wind/severe storm	2.7	3.4	6.1
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	0.0	0.0	0.0
Tornado	1.7	4.1	5.7
Wildfire	1.0	2.8	3.8
Winter weather	3.3	3.5	6.8
Non-Natural Hazards			
Active violence	1.0	3.6	4.6
Civil unrest	1.0	4.9	5.9
Communication disruption	1.3	3.7	5.0
Cyberattack	1.7	4.7	6.4
Hazardous materials	1.0	3.9	4.9
Infectious disease/public health	2.0	5.3	7.3
Terrorism	1.0	6.1	7.1

11.3. Attachment 3: Documentation of Public Participation[39]

The Town of Leesburg solicited public input via a survey on the city website. Loudoun County residents were also asked to participate in a survey asking for their experience with local hazards. *Loudoun Now*, a community news source, published an article requesting community input.

A Loudoun County Fire-Rescue technical rescue crew trains at the Panda Stonewall Energy Center in the fog Thursday, Oct. 22. [Renss Greene/Loudoun Now]

Loudoun Residents Asked to Take Hazard Survey

2021-08-20 Loudoun Now

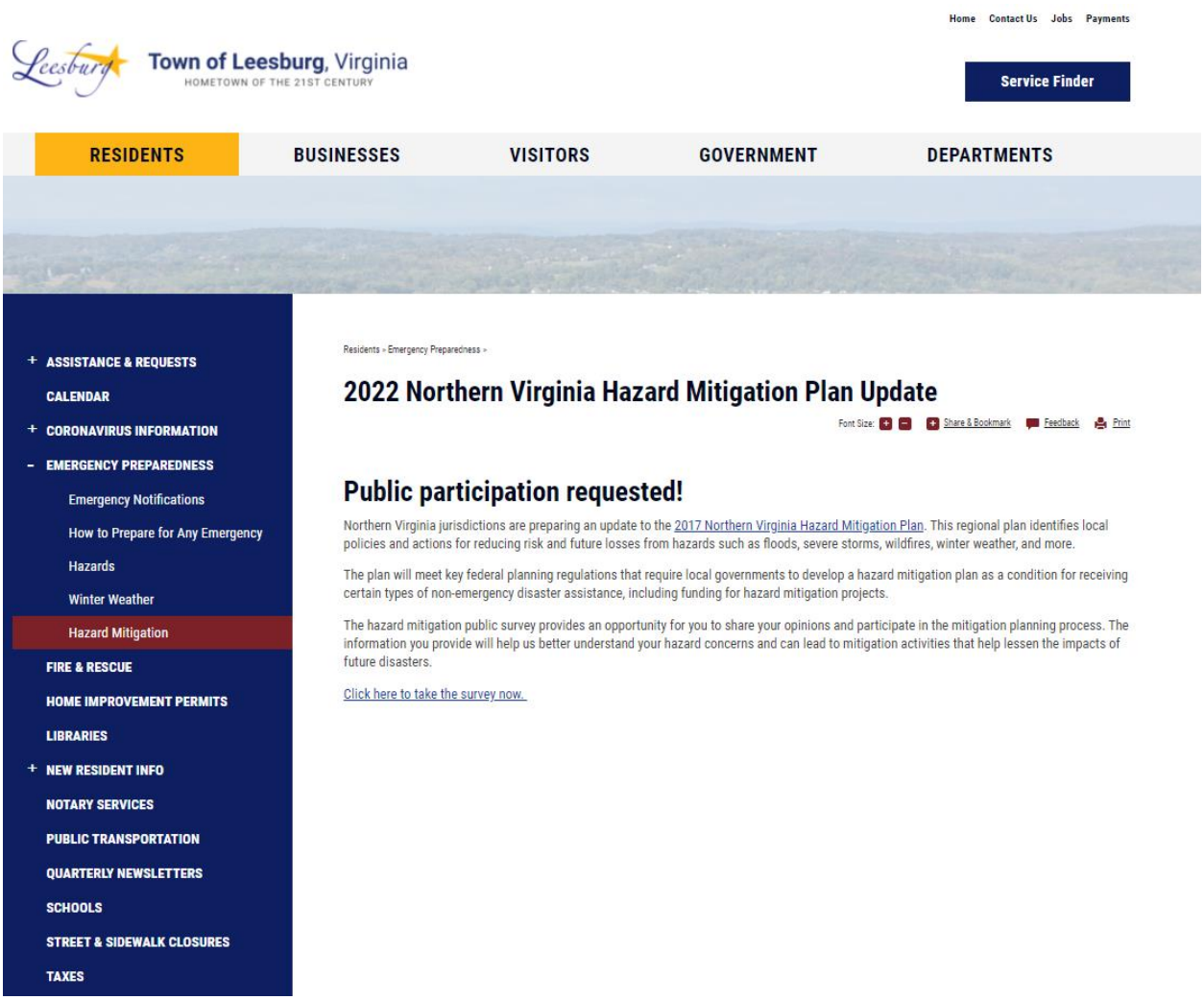
County officials are encouraging Loudoun residents and business owners to help build community resilience to disasters by participating in the Northern Virginia Hazard Mitigation Survey.

Loudoun County and its towns are part of a regionwide effort to update the Northern Virginia Hazard Mitigation Plan. The Plan identifies strategies for reducing or eliminating loss of life, injury, and property damage caused by disasters as well as the long-term risks that result from hazards such as floods, severe storms, tornadoes, wildfires and winter weather.

In addition to preventing loss of life, injury and damage to buildings and infrastructure, hazard mitigation can prevent damage to a community's economic, social and environmental well-being.

The survey asks questions about natural hazards they are concerned about or have directly experienced in the past five years, as well as for opinions on proposed mitigation strategies. The survey is open through Sept. 15 and is online at surveymonkey.com/r/NorthernVirginiaHazardMitigationSurvey.

[39] *Loudoun Now*, 08/20/2021, https://loudounnow.com/2021/08/20/loudoun-residents-asked-to-take-hazard-survey/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Town of Leesburg, Virginia
HOMETOWN OF THE 21ST CENTURY
Service Finder
RESIDENTS
BUSINESSES
VISITORS
GOVERNMENT
DEPARTMENTS
+ ASSISTANCE & REQUESTS
CALENDAR
+ CORONAVIRUS INFORMATION
- EMERGENCY PREPAREDNESS
Emergency Notifications
How to Prepare for Any Emergency
Hazards
Winter Weather
Hazard Mitigation
FIRE & RESCUE
HOME IMPROVEMENT PERMITS
LIBRARIES
+ NEW RESIDENT INFO
NOTARY SERVICES
PUBLIC TRANSPORTATION
QUARTERLY NEWSLETTERS
SCHOOLS
STREET & SIDEWALK CLOSURES
TAXES
Residents » Emergency Preparedness »
2022 Northern Virginia Hazard Mitigation Plan Update
Font Size:
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Public participation requested!
Northern Virginia jurisdictions are preparing an update to the 2017 Northern Virginia Hazard Mitigation Plan. This regional plan identifies local policies and actions for reducing risk and future losses from hazards such as floods, severe storms, wildfires, winter weather, and more.
The plan will meet key federal planning regulations that require local governments to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance, including funding for hazard mitigation projects.
The hazard mitigation public survey provides an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that help lessen the impacts of future disasters.
Click here to take the survey now.

11.4. Attachment 4: Mitigation Actions[40]

The actions presented here were included in the 2017 Northern Virginia Hazard Mitigation Plan. The Town of Leesburg Mitigation Planning Team reviewed all actions to see if they were completed, no longer relevant, or moved forward and included in the 2022 Plan.

The Town of Leesburg has identified the following new natural hazard mitigation strategies to include in its 2022 HMP update.

#	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-01	Design and construction of a second finished water interconnect with Loudoun Water (LW) in the Sycolin Zone to enhance water security in the event of a water emergency	Utilities Department, Water Supply Division	All Hazards	Approved Capital Improvements Program (CIP) in 2022–2027 budget	Summer 2024	Complete design/engineering in FY 2023 Complete construction in FY 2023	High	
2022-02	Installation of a flood gauges to provide real-time condition monitoring capability	Emergency Management Public Works	Dam Failure Drought Earthquake Flood Winter Weather	Undetermined General Fund Virginia Dam Safety, Flood Prevention and Protection Assistance grant	2027	Complete scoping on the project to determine the full cost.	Medium	This project is intended to have operation and planning impacts. Operationally, this project would improve understanding of when watersheds in the Leesburg area reach flood stage. Currently there are no flood gauges within town limits. In terms of planning, this project would allow for enhanced data collection to better understand the impacts from flooding hazards and improve mitigation actions in the future. It also would allow better data collection on high water marks that would assist with future planning efforts.

[40] Loudoun Now, 08/20/2021, https://loudounnow.com/2021/08/20/loudoun-residents-asked-to-take-hazard-survey/

#	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-03	Creation of a stormwater committee that is cross-jurisdictional that works to improve overall stormwater management	Town of Leesburg Public Works Loudoun County Building & Development	Dam Failure Flood	Funded through general fund	Summer 2022	Identify participants for the committee and hold kick off meeting.	Low	This project requires coordination with Loudoun County.
2022-04	Create posted lightning warning signage at Town Parks.	Parks and Recreation	High Wind/Severe Storm	General fund or possible grant. NWS will provide one sign if a StormReady survey is completed	2027	Determine funding mechanism and explore possibility of Town Shop making the signs in-house.	Low	
2022-05	Install backup power equipment at traffic signals.	Public Works	Dam Failure Earthquake Extreme Temperatures Flood High Wind/Severe Storm Karst/Sinkholes/ Land Subsidence Tornado Winter Weather	UASI funding has been secured; expected to be distributed in fall 2021	Summer 2023	Receive funding from NVERS, purchase equipment.	High	This project is funded through NVERS. Awaiting release of funding, expected this fall.

The Town of Leesburg has identified the following new non-natural hazard mitigation strategies to include in its 2022 HMP update.

#	Agency/ Department Mitigation Action	Lead Agency/Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-06	Water Supply and Wastewater supervisory control and data acquisition (SCADA) Systems Replacement	Utilities Department IT Emergency Management	Cyberattack	Unidentified				Requires IT personnel to deploy and maintain systems
2022-07	Develop additional incident specific annexes in support of the Town of Leesburg Emergency Operations Plan.	All Departments	Active Violence Civil Unrest Communications Disruption Cyberattack Hazardous Materials Terrorism	Unidentified				Requires additional planning support above current resources
2006-2	Improve security measures as needed around critical facilities.	Executive Office	Active Violence Civil Unrest Communications Disruption Cyberattack Hazardous Materials Terrorism	Unidentified	R - Retain for HMP 2022	Recommend moving this to non-natural hazards section. There are a number of possible projects under this action. • Physical security modifications to buildings • Staff training (STB and TA) • Continued work of Town Security Working Group	Moved from natural hazards 2017 action items	
	Update Town of Leesburg Citizen guide to emergency Preparedness. Mail to residents and post on web.	Emergency Management	Active Violence Civil Unrest Communications Disruption Cyberattack Hazardous Materials Terrorism Pandemic/Public Health	U.S. Department of Homeland Security, Office of Domestic Preparedness: Homeland Security Grant Program (HSGP)	Summer 2023	Identify additional personnel to assist with this project. Consider onboarding a summer intern to help with the project.	Medium	No

Northern Virginia Hazard Mitigation Plan

Annex 8-B: Town of Lovettsville

November 2022

Town of Lovettsville Overview

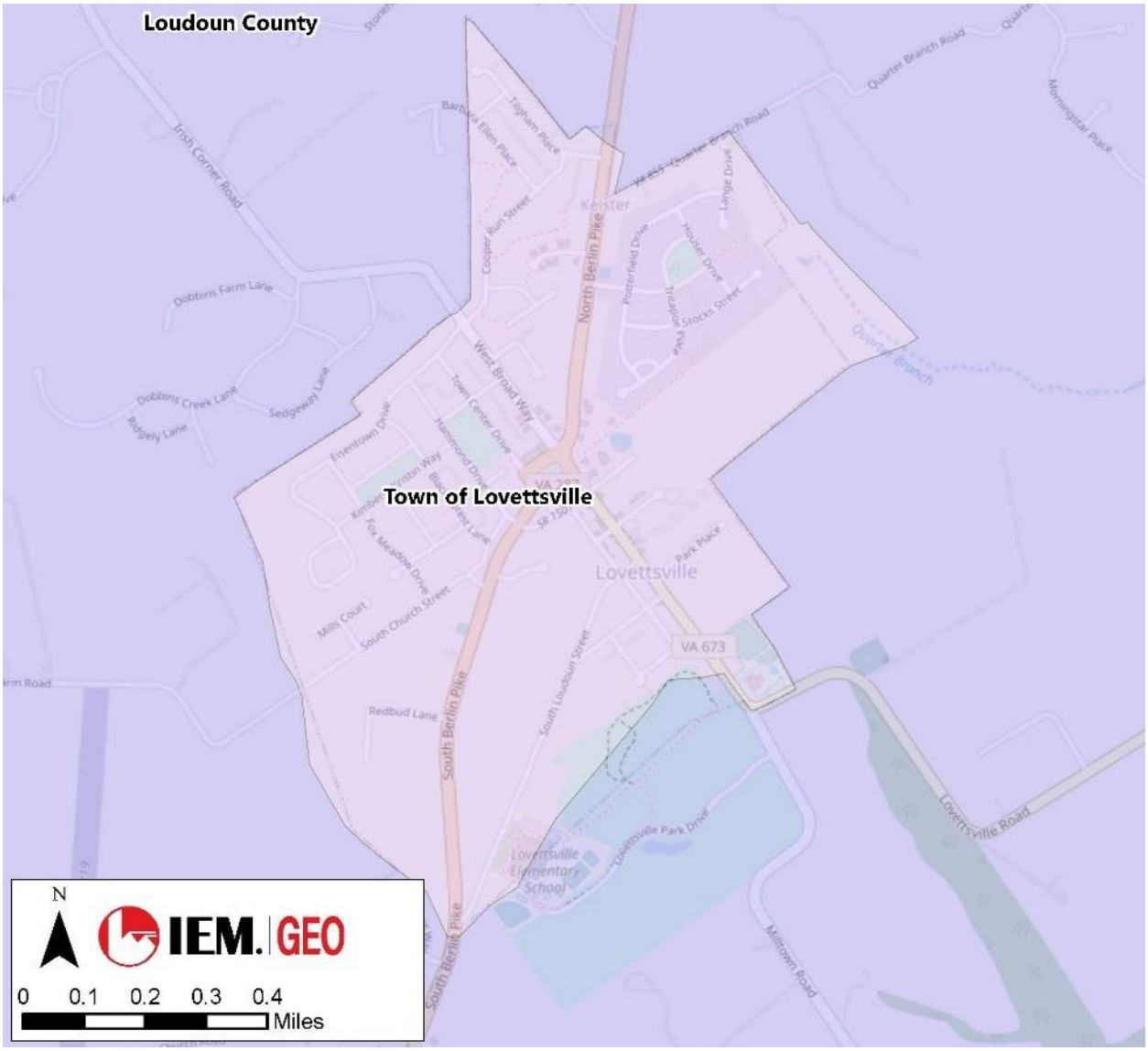

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1836	.85 sq. mi.	2,649	6 East Pennsylvania Avenue Lovettsville, VA 20180	737	Winter Weather, High Wind/ Severe Storm, and Flood/ Flash Flood

Town of Lovettsville Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

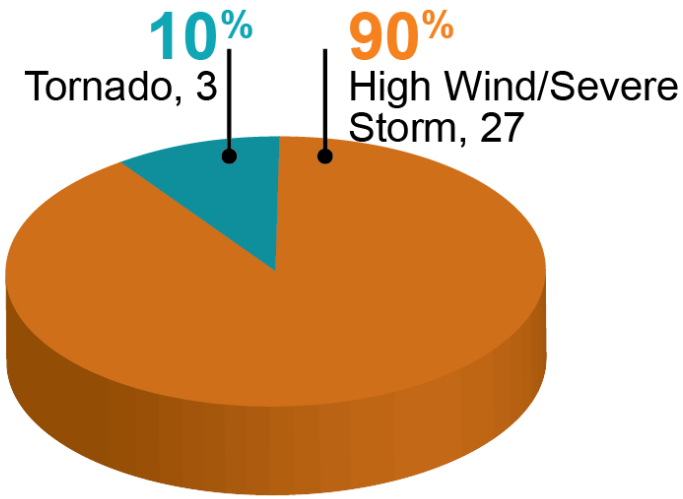

Figure 1: Percentage of Hazards

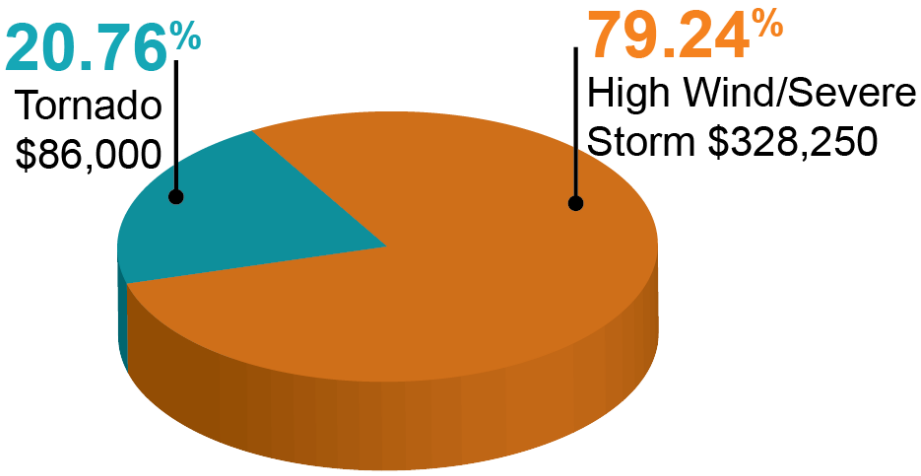

Figure 2: Property Damage

Natural Hazard Risk Ranking

Table 2: Natural Hazard Risk Ranking Summary

Hazard	Hazard Ranking
Winter Weather	**High**
High Wind/Severe Storm	**High**
Flood/Flash Flood	**High**
Tornado	**High**
Dam Failure	**Medium**
Drought	**Medium**
Extreme Temperatures	**Medium**
Earthquake	**Medium**
Landslide	**Low**
Wildfire	**Low**
Karst/Sinkhole/Land Subsidence	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines, Town of Lovettsville

Sector	Number of Assets
Safety and Security	1
Food, Water, Shelter	17
Health and Medical	-
Energy	-
Communications	1
Transportation	5
Hazardous Materials	-
Education	2
Cultural/Historical	5
High Hazard Dams	-

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking, Town of Lovettsville

Capability	Ranking
Planning and Regulatory	Low
Administrative and Technical	Low
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Low

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Point of Contact Priority	Contact Information
Primary Point of Contact	Charles Mumaw, Project Manager Town of Lovettsville 540-755-3004 cmumaw@lovettsvilleva.gov PO BOX 209 Lovettsville, VA 20180
Secondary Point of Contact	John Merrithew, Planning and Zoning Administrator Town of Lovettsville 540-755-3004 jmerrithew@lovettsvilleva.gov PO BOX 209 Lovettsville, VA 20180

Town of Lovettsville

This annex presents the following jurisdiction-specific information provided by the Town of Lovettsville for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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1. Jurisdiction Profile

Established	1836
Total Land Area	.88 sq. mi.
Geographic Region	Piedmont Region
Persons Per Household	3.5
Persons Per Square Mile	3,116
Median Age	31.8
Elevations	Near Sea Level – 505 ft

1.1. Location

Lovettsville is a town in Loudoun County, located near the northern tip of the Commonwealth of Virginia.

Due to its location on both the Virginia Piedmont near the Potomac River and its mountainous western region, the county experiences weather of all types, thus increasing the area's vulnerability to a range of hazards, notably flooding and severe storms. In addition to snow melt and rain-related river flooding episodes, low-lying areas of Loudoun County along the Potomac River are also subject to tidal and storm surge flooding. As sea levels rise, permanent inundation of low-lying areas along and near the river shoreline is also a threat. Additionally, winter storms pose significant threats, as evidenced during the 2015–2016 winter season, when snow levels in late January reached 23 to 31 inches across the county, and ice and blizzard-related wind conditions impacted travel and caused power outages and property damage.

1.2. History

Following the 1722 Treaty of Albany, which established the Blue Ridge Mountains as the buffer between Native Americans and white settlers, German immigrants began arriving in the northern Loudoun Valley to farm the area's rich topsoil. These groups founded several villages, many constructed of log and wooden buildings, and began to expand their land holdings and develop agriculture-based communities.

1.3. Demographics, Economy, and Governance

In the centuries since, Northern Virginia counties have transitioned economically to become what Loudoun County is today—a suburban community near Washington, D.C. that has retained its charm while serving as home to federal workers who work in the capital or for the many large and small businesses in the region.

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context to the entire plan. The 2020 U.S. Census population estimate for the Loudoun County is 422,784, an approximate 35% increase since 2010. The population density is 810 persons per square mile. This significantly lower than other Northern Virginia counties, such as Fairfax County with 2,941.8 residents per square mile. Since 2008, the county has been ranked among the highest in the U.S. in median household income among jurisdictions with a population of 65,000 or more.

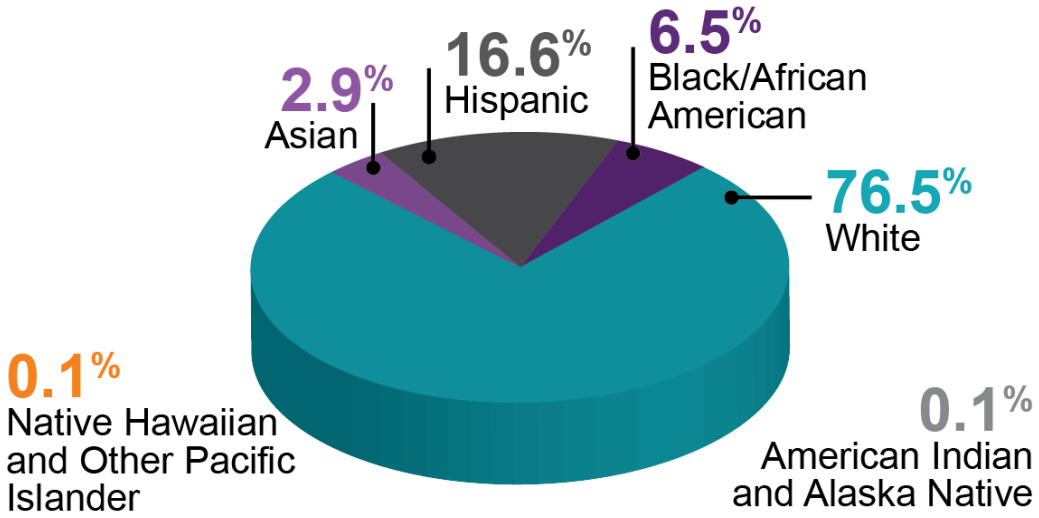

Figure 4: Race and Ethnicity Demographics

Table 6: Economy, and Governance

Economy	Governance
• Median household income (2020): $124,667 • Unemployment rate (September 2021): 1.9% • Per capita income (2020): $38,605 • Percentage below poverty (2020): 5.7%	• Council-Manager Form • Elected Mayor • Six Town Council Members • Town Manager • Town Clerk • Town Departments

Table 7: Population and Growth Rate

Year	Population	Annual Percent Increase
1970	185	
1980	613	231.4%
1990	749	22.19%
2000	853	13.89%
2010	1,613	89.10%
2020	2,694	64.23%

1.4. Built Environment and Community Lifelines

The information presented in this section related to Community Lifelines and critical assets in the Town of Lovettsville has been collected from multiple sources, including Hazus (Version 4.2), the Town participants in the NOVA HMP 2022 update planning process, and government websites. During the planning process, the Town submitted a list of 31 sites or structures that are considered critical assets.

Critical facility data extracted from the Hazus Level 1 assessment indicates that the Town has an estimated five critical and historic assets. Due to the time lag in collecting and verifying data, and the method of documenting location and jurisdiction used in Hazus, this does not reflect the current inventory maintained by the Town. The Town identified an additional 26 critical and historic assets. All 31 assets are included in the table and analysis below.

Table 8: Number of Community Lifelines and Critical Assets in the Town of Lovettsville

Sector	Number of Assets
Safety and Security	1
Food, Water, Shelter	17
Health and Medical	-
Energy	-
Communications	1
Transportation	5
Hazardous Materials	-
Education	2
Cultural/Historical	5
High Hazard Dams	-

1.4.1. Safety and Security

There is one fire station in the Town of Lovettsville.

1.4.2. Food, Water, Shelter

Food commodities are available in the Town via two convenience stores retailing food and nine restaurants. There are no grocery or wholesale operations in the Town. Additional contracts may be entered into for post-disaster needs. There is one wastewater plant in the Town.

There is one wastewater treatment plant and one water treatment plant in the Town and the Town's water source is three wells. There are three water storage tanks.

The Hazus database does not identify schools that might be designated as public shelters. The public elementary school may be used as a shelter but was not included within the Hazus analysis.

1.4.3. Health and Medical

There are several doctors who practice in the Town; however, there are no health or medical facilities in the Town. Residents are served by facilities located in nearby communities.

1.4.4. Energy

There are no energy plants in the Town of Lovettsville.

1.4.5. Communications

Hazus does not include information on any no communication facilities in the Town; however, there is one Verizon switching station in the community and several wireless carriers.

1.4.6. Transportation

There are no transportation entities shown in Hazus for the Town of Lovettsville except for State Highways 672, 673, 675, and 855, and State Highway 287/Berlin Turnpike. The Town is also within 2.5 miles of one of two bridges that cross the Potomac River and the Maryland Area Rail Commuter (MARC) train station in Brunswick, Maryland.

1.4.7. Hazardous Materials

There are no hazardous materials storage or facilities in the Town of Lovettsville.

1.4.8. Education

There are two educational facilities in the Town of Lovettsville: Lovettsville Elementary School and Lovettsville Montessori School.

1.4.9. Recreational, Cultural and Historic Sites, and Assets

Among these sites and assets, Hazus identifies the Town's Historic District as well as the Lovettsville Historical Society and Museum, which serves as a repository for the Town's history and educates the public about the Town through programs, resource materials, and special events, including an Oktoberfest.[1]

The Town is home to a 97-acre community park, a library, the Lovettsville Historical Museum, and a community recreational center.

- The wastewater treatment plan and water treatment plant can be impacted by hazards such as a high rain event.
- Recreation Areas: Most of the recreational areas in the Town are at low risk to hazards.
- Critical Habitat: Habitat for the wildlife in Lovettsville are at risk to fire and habitat degradation from some developments in Town.

Economy

- Major employers: Some employers are along the main road in Town and are at risk of flooding during a high rain event.
- Primary economic sectors: The main economic sector of the Town is the hospitality sector of restaurants and other than flooding isn't at risk.

Population

- General Demographics: Some residents experience flooding due to the poor drainage in certain areas of the Town.

[1] Lovettsville Historical Society and Museum, http://www.lovettsvillehistoricalsociety.org/

- Concentration/Density: In some areas of the Town the houses are closer together, but those areas are the more developed and have the necessary drainage features to limit the impacts on these residents.
- Access and Functional Needs Populations: The biggest risk to these populations is the high flooding that could limit access to some sidewalks.
- Built Environment: Similar to other assets, the biggest risk is from flooding.

Built Environment

- Existing structures: Some bridges in Town have a low risk for flooding.
- Infrastructure: The infrastructure of the Town is solid and there isn't much long-term risk.
- Critical Facilities: The biggest risk to critical facilities is the impact of flooding from heavy rain.
- Cultural/Historical Resources: Some historical resources in the Town are at risk from storm damage but overall, they are sturdy and should be able to handle high winds.
- Future Development: Future development's largest hazard would be from flooding. This must be taken into consideration before beginning any future development.

Climate Change

- Natural Environment: Potential habitat degradation.
- Built Environment: storms continue to worsen then there is some risk to the built environment from flooding and damage from storms.

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the Town of Lovettsville followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Team, the Town supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction.

Table 9: Local Planning Group Participants

Name	Position/Title	Department/Agency
John Merrithew	Director	Town of Lovettsville Department of Public Works
Bob Custard	Planning Commission Chair	Town of Lovettsville Planning Commission
Jaymie Brooks Dumproff	Vice Chair	Town of Lovettsville Planning Council
Charles Mumaw	Project Manager	Town of Lovettsville
Joe Betts	Previous Project Manager	Town of Lovettsville

The jurisdiction identified its chief hazard mitigation planning responsibility as representing the Town in coordination with the Loudoun County representative to the Emergency Manager's Group. The Town also identified the following tasks as part of its mitigation planning responsibilities:

- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Public outreach activities
- Implementing the Plan
- Maintaining the Plan

Town of Lovettsville planning participants coordinated primarily by means of virtual meetings during the planning process, and as needed, independently to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a Public Hazard Survey, which was posted and advertised on the Town's website.

In addition to the survey, the public was offered the opportunity to review and provide input to the Draft 2022 Plan update. Notification of the Draft Plan release was made through the same Town web link. Documentation of the public survey and draft plan review is included in **Attachment 2** of this annex.

3. Jurisdiction-Specific Hazard Event History

The Town of Lovettsville's comprehensive hazard history is combined with that of Loudoun County when data is provided at the county level. Information such as this is described in **Sections 4 and 5, Base Plan**.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,132 recorded natural meteorological events that took place in Loudoun County between January 1, 1950, and May 2021. The county and its municipalities have been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 10: Federal Disaster and Emergency Declarations (2017–2021), Loudoun County

Declaration	Date	Hazard	Assistance Type
DR 4512	Apr. 2020	Virginia COVID-19 Pandemic	PA-B
EM 3448	Mar. 2020	Virginia COVID-19	PA-B
EM 3403	Sep. 2018	Virginia Hurricane Florence	PA-B

Tables 20 and 21 in Annex 8 provide a summary of all high wind/severe storm and severe winter storm events that have occurred in Loudoun County between 1950 and June 30, 2021.

Table 11: Significant Hazard Events in the Town of Lovettsville, 2017–2021

Date	Hazard	Event and Description
June 11, 2021	Flood/Flash Flood	A high rain event led to some flooding and property damage, including flooding in yards of businesses and impacts to the wastewater infrastructure. There is a high likelihood that this type of event and damage will reoccur in the future because no good drainage systems are set up for the Town's older roads.
May 2021	Fire	A historic barn was demolished by a fire and had to be condemned. The cause of the fire was not determined but there was risk of properties being damaged from fire spread due to the close proximity of some properties in the Town.
March 2020 to Present	COVID-19 Pandemic	There were business closures and restrictions, which impacted the Town economically. Schools used remote classes to continue providing education during the pandemic. The Town received $2.5 million in federal and state disaster relief funding to assist with impacts.

4. Hazard Risk Ranking

After developing hazard profiles, the Town of Lovettsville conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step Hazard Risk Ranking methodology is detailed in **Section 4, Base Plan**.

The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5, Base Plan**, and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II** of this Plan.

Table 12: Town of Lovettsville – Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.3	3.5	6.8	**High**
High Wind/Severe Storm	2.7	3.4	6.1	**High**
Flood/Flash Flood	1.7	4.1	5.8	**High**
Tornado	1.7	4.1	5.7	**High**
Dam Failure	1.0	4.4	5.4	**Medium**
Drought	2.0	3.2	5.2	**Medium**
Extreme Temperatures	2.3	2.7	5.0	**Medium**
Earthquake	1.7	3.2	4.9	**Medium**
Landslide	1.3	2.5	3.9	**Low**
Wildfire	1.0	2.8	3.8	**Low**
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	**Low**

Table 13: Town of Lovettsville – Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	2.0	5.3	7.3	**High**
Terrorism	1.0	6.1	7.1	**High**
Cyber Attack	1.7	4.7	6.4	**High**
Civil Unrest	1.0	4.9	5.9	**Medium**
Communication Disruption	1.3	3.7	5.0	**Medium**
Hazardous Materials	1.0	3.9	4.9	**Low**
Active Violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, the Town of Lovettsville evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter Weather, High Wind/Severe Storm, Flood/Flash Flood and Tornado
- **Medium:** Dam Failure, Drought, Extreme Temperatures, and Earthquake

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, and Cyber Attack
- **Medium:** Civil Unrest and Communication Disruption

All other hazards are ranked as “low,” signifying a minimal risk to the Town of Lovettsville.

4.1. Additional Hazard Risk Considerations

4.1.1. Non-Natural Hazards

Volume II of the *2022 Northern Virginia Hazard Mitigation Plan* addresses non-natural hazards identified by the jurisdiction.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

Annex 8, Loudoun County includes a statistical compilation of the number of events and related impacts for the two highest-ranked hazards for the Town: winter weather and high wind/severe storm.

5.1. National Flood Insurance Program

The Town of Lovettsville is a participant in the National Flood Insurance Program (NFIP).

Table 14: National Flood Insurance Program Status, Town of Lovettsville

Init FHBM Identified	04/15/1977
Init FIRM Identified	07/05/2001
Current Effective Map Date	02/17/2017
Reg-Emer Date	10/22/2013

Table 15: Town of Lovettsville NFIP Policy and Claims Statistics[2]

Policies In Force	5
Total Coverage	$1,585,000
Total Claims	Unknown
Total Payment	Unknown

Table 16: NFIP Status, as of September 24, 2021

Category	NFIP Topic	Source of Information	Comments
Insurance	How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Unknown
Insurance	How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims	EMA NFIP or Insurance Specialist	Unknown

[2] FEMA NFIP Community Status Report, September 9, 2021

Category	NFIP Topic	Source of Information	Comments
	were for substantial damage?		
Insurance	How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA)	Numerous structures are at risk to damage from flooding due to the elevation differences in the Town and the age of some structures.
Insurance	Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	The lower elevation sections of the Town are most at risk. In the older part of Town there is a lack of proper storm water management, and this could have a larger impact if there were a flood.
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	Unknown
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	In Town code, there are specific details regarding floodplain management and how it must be taken seriously.
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	The NFIP provides flood insurance to property owners, renters, and businesses; having this coverage helps them recover faster when floodwaters recede. The NFIP works with communities required to adopt and enforce floodplain management regulations that help mitigate flooding effects.
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	Town residents sometimes are not the most enthusiastic volunteers and would resist the adoption of the program.
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	
Compliance History	Are there any outstanding compliance issues (i.e., current violations)?		No
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community		

Category	NFIP Topic	Source of Information	Comments
	Assistance Contact (CAC)?		

Other hazard information for the Town of Lovettsville is presented in the **Base Plan**.

5.2. Population

Estimates of the number of residents in the Town of Lovettsville vulnerable to each hazard are presented in the various hazard sections in the **Base Plan**.

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations using county-level data.

5.3. Built Environment and Community Lifelines and Assets

Using the best Hazus data available, scenarios were run at the county level for earthquake, flood, and hurricane wind to determine potential exposure of buildings, infrastructure, and economy. Information presented in **Annex 8, Loudoun County** includes the Town of Lovettsville.

Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events. The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA.

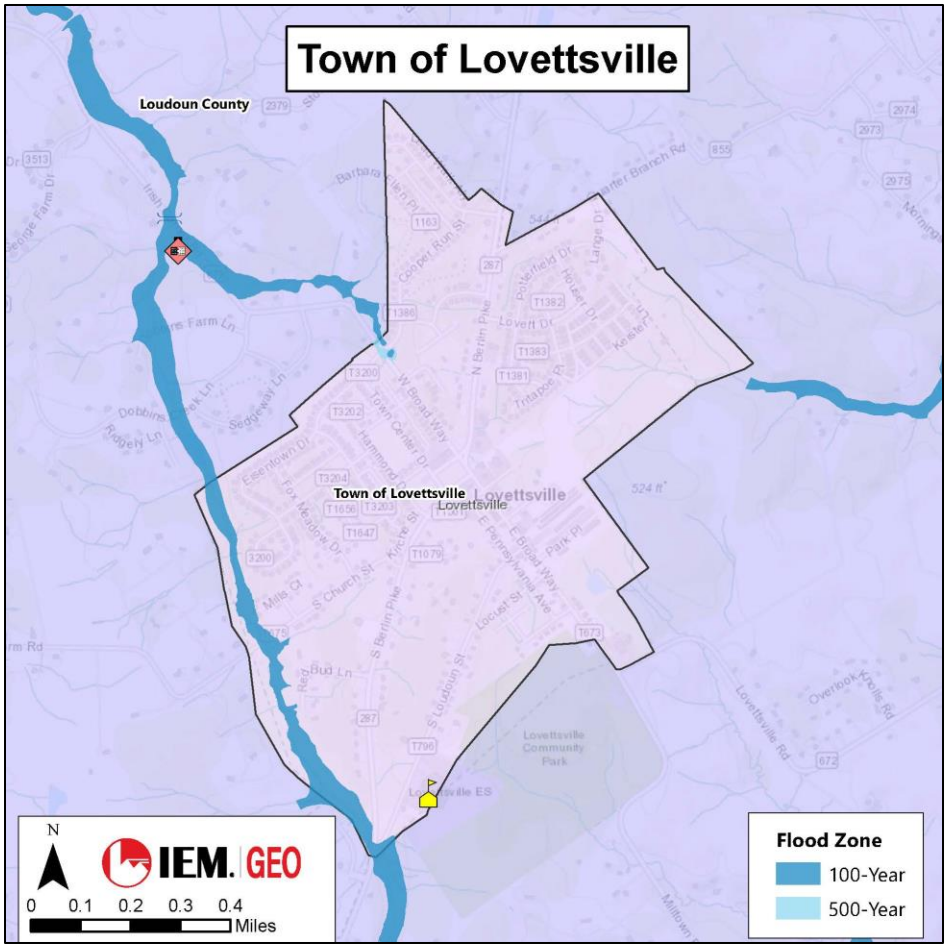

Figure 5: Critical Facilities Exposed to FEMA Floodplains, Town of Lovettsville

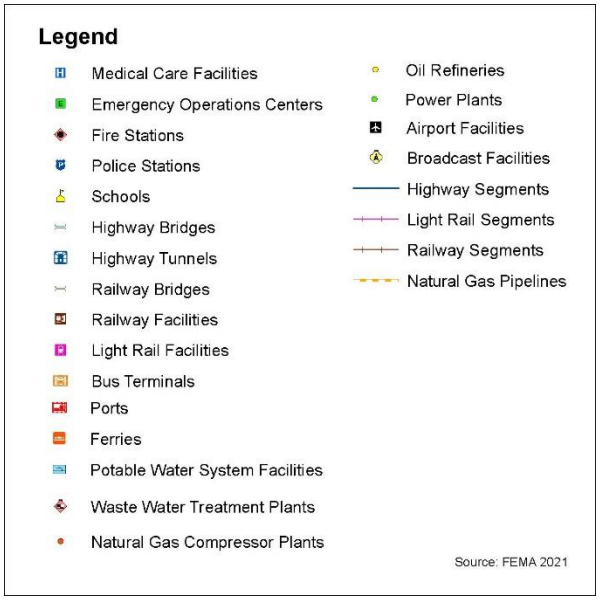

Figure 6: Legend for Figure 6 - Critical Facilities Exposed to FEMA Floodplains, Town of Lovettsville

Overlaying the critical facilities in the Town on the mapped flood zones illustrates that a school is the only facility within the 100- or 500-year floodplains.

5.4. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

5.5. Economy

Information related to economic vulnerability is presented in the hazard sections of the **Base Plan**.

5.6. Cultural/Historical

Historic structures and sites are frequently more vulnerable to flood hazards because, historically, cities and towns have tended to develop along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile assets. The Town recognizes that although these assets are vulnerable, they are sturdily built and should be able to withstand impacts from natural hazard events.

6. Capability Assessment

The Town of Lovettsville reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the Town completed a Jurisdiction Needs Identification Questionnaire that summarized changes and enhancements to capabilities since the last plan. This information has been integrated into the summaries in this section.

6.1. Capabilities Assessment Summary, Ranking, and Gap Analysis

The jurisdiction ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction has limited capabilities within this category and is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities within this category and can implement few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities within this category, but improvement is needed in order to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities within this category, as demonstrated by its authorities, programs, plans and/or resources, and can implement most mitigation actions.

Table 17: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	Low
Administrative and Technical	Low
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Low

6.1.1. Planning and Regulatory Capabilities Summary

The Town currently does not incorporate natural hazards into most plans or ordinances, except for stormwater management. The largest issue facing the Town is stormwater management due to older infrastructure and increasing occurrences of flooding. The Capital Improvement Plan has several projects that address stormwater drainage improvements and enhancements, and the Transportation Master Plan also identifies current and future projects that can positively impact stormwater management within the Town. A Wellhead Protection Plan has been adopted to protect groundwater. Zoning, subdivision, and floodplain ordinances are in place, are adequately administered and enforced, and are an effective measure for reducing hazard impacts.

The following plans have been newly developed or updated since the 2017 HMP:

- Town of Lovettsville Capital Improvement Plan
- Town of Lovettsville Transportation Master Plan
- Town of Lovettsville Wellhead Protection Plan

Planning and Regulatory Capability Analysis: Low

The Town's plans and ordinances could be improved by utilizing an all-hazards approach. This holistic approach can be incorporated when new plans and ordinances are written and when current documents and regulations are updated. The Town could also consider either creating an emergency operation plan or partnering with the county. A formalized continuity of operations plan can be very beneficial for any government or organization, as was demonstrated by the COVID-19 pandemic.

6.1.2. Administrative and Technical Capabilities Summary

- The Town currently has an engineer or professional with an understanding of natural and manmade hazards and who is trained in construction practices related to buildings and infrastructure.
- The Town has staff with the expertise to assess the community's vulnerability to hazards, including a GIS staff member and a planner or engineer with an understating of risk.
- The Town can utilize a warning system to alert residents and visitors of a hazard event.

Administrative and Technical Capability Analysis: Low

The Town has limited staff; most perform more than one function. The Town's staff have a basic understanding of hazard mitigation, and the Town can fulfill basic hazard mitigation planning tasks by using internal staff, partnering with the county, or using outside contractors. These capabilities can be

expanded to reduce risk by further educating all internal staff members on the concept of risk and how it is incorporated into all business decisions. If everyone has a full understanding of risk, then they will be able to make better decisions and reduce risk. Additional staff and coordination between staff members would also enhance this capability.

6.1.3. Safe Growth Capabilities Summary

- Land use policies fully discourage any development in the natural hazard areas of the Town. Development in flood plains is prohibited.
- The Comprehensive Plan allows for future Town growth that is outside of the natural hazard areas and avoids development in flood plain areas.
- The Transportation Master Plan specifically limits access to the hazard areas of the Town, such as floodplains.
- The Town's environmental management policy specifically identified areas in the Town that are protected and at risk. The policies were made to ensure that the ecosystems of the Town are protected and maintained, as well as to restore any ecosystems that have degraded over time.
- The zoning ordinance limits the rezoning of natural hazard areas and limits the amount of use and development in these areas. It also prohibits the development within wetlands, floodways, and floodplains.
- The subdivision regulations of the Town restrict the subdivision of land within or adjacent to the hazard areas. There are no regulations the provide for conservation subdivisions or cluster subdivisions.
- The Capital Improvement Plan does not include any projects that would be in the areas that are vulnerable to natural hazards. The projects included in the plan were chosen because they are safe and do not involve any vulnerable areas. There are policies in place to make sure no projects or improvements planned for any areas would increase the risk of natural hazards. Some funding in the Capital Improvement Plan is set aside for hazard mitigation. There are currently no projects that involve any high-risk hazard areas.
- The Economic Development Plan for the Town does include provisions for mitigation of natural hazards for future construction.

Safe Growth Capability Analysis: Moderate

The Town of Lovettsville has significant safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment. This capability could be enhanced by offering incentives to develop outside protected ecosystems, creating specific provisions to strengthen construction to withstand hazard forces, and by creating an evacuation plan for natural hazards, especially for when roads in the Town are flooded.

6.1.4. Financial Capabilities Summary

- The Town has made correcting and mitigating stormwater issues a financial priority. Capital improvement funds have been used in the past to increase stormwater management capabilities, and it is anticipated that these funds will continue to be utilized for this purpose as needed.
- The Town has the authority to levy taxes for specific purposes and incur debt through general obligation bonds.
- The Town imposes impact fees for new development and fees for water, and sewer.

- The Town can incur debt through private activities and utilize public/private partnership funding sources if needed.
- The Town participates federal and state funding programs, including the Community Development Block Grant program.

Financial Capability Analysis: Moderate

The Town of Lovettsville has the ability to use all financial sources available for hazard mitigation. This capability could be enhanced by increasing the amount of money available through taxes, partnerships, and/or federal and state programs.

6.1.5. Education and Outreach Capabilities Summary

- The Town publicized the Public Survey for the NOVA HMP update process by posting information on their website.
- The Lovettsville Waterford Ruritan Club is an active local community service organization that can assist with the implementation of future mitigation activities through the promotion of environmental protection and emergency preparedness.

Education and Outreach Capability Analysis: Low

Jurisdictions have multiple opportunities to promote hazard mitigation and increase the involvement of stakeholders and the public. There is a critical need to inform the additional stakeholders as well as the public about the benefits of hazard mitigation planning and implementation. This capability can be enhanced by using more and different forms of community engagement, especially non-internet-based methods. The Town could also partner with the county to increase access to educational and outreach tools and opportunities.

7. Resilience to Hazards

7.1.1. National Risk Index

The National Risk Index (NRI) is a dataset and online tool developed by FEMA and other partners to help illustrate communities in the United States at risk for 18 natural hazards. Hazard risk is calculated based on data for a single hazard type and reflects the relative risk for that hazard type; it should be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local Hazard Risk Ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently from the hazards in this plan, so a direct hazard-to-hazard comparison of risk cannot be determined. The NRI is a county-level risk ranking, which includes the Towns and is presented in **Annex 8, Loudoun County**.

The NRI provides an overview of hazard risk, vulnerability, and resilience. The “low-risk” designation is marked by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

7.2. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

The Town of Lovettsville identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- Increasing storm intensity and temperature related to climate change

8. Mitigation Actions

8.1. Goals and Objectives

The Town of Lovettsville Planning Team adopted the regional goal statements and is supporting Loudoun County mitigation actions.

8.2. Status of Previous Actions

The Town did not have action items in the 2017 HMP.

8.3. New Mitigation Actions

The Town of Lovettsville Planning Team identified eight new mitigation actions that will be implemented in the next planning cycle. Proposed actions address risks consistent with the jurisdiction's highest risk hazards (i.e., winter storm, high wind/severe storm, and flood/flash flood) in addition to actions that address hazard mitigation education programs for all hazards.

Attachment 3 of this annex includes a table that summarizes each new and continued action, describing the proposed activity, priority level, estimated cost, and lead agency.

8.4. Action Plan for Implementation and Integration

The Town of Lovettsville Project Manager and Public Works Director are responsible for coordinating the implementation of the hazard mitigation activities. They will monitor the implementation of the jurisdiction's actions and participate in the implementation of the multi-jurisdictional regional plan as it relates to the Town. Tasks to ensure that the Town's actions are implemented are integrated into the *Action Plan for Implementation and Integration* (which includes the prioritized list of Mitigation Actions) and plan maintenance procedures described in the next section. The *Action Plan for Implementation and Integration* describes how the Town's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 18: Action Plan for Implementation and Integration

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plan.	When the Town of Lovettsville updates its comprehensive plan, add mitigation and actions goals to the plan.
Review/update building/zoning codes for consistency with mitigation goals.	Review Town of Lovettsville building/zoning codes and make sure they are consistent with new mitigation plan.
Continue public engagement in mitigation planning.	Lovettsville will continue to hold public engagement meetings to give the residents some voice in mitigation planning.
Review/update stormwater plans and procedures for consistency with mitigation goals.	The Town will update the stormwater plans to include the new mitigation plan and goals.

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Maintain ongoing enforcement of existing policies.	The Town will continue to enforce and update its existing policies to reflect the most up to date information.
Incorporate goals into day-to-day development policies, reviews, and priorities.	The Town will make sure to incorporate these mitigation and hazard identification policies in future Town plans.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 19: Town of Lovettsville Plan Maintenance Responsibilities for the *Northern Virginia Hazard Mitigation Plan,* Base Plan

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA HMP Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA HMP Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the NOVA HMP Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP, Base Plan**, the Town of Lovettsville Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**. The Town's maintenance method and schedule may coincide with that of Loudoun County and be conducted simultaneously.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in fifth year

Table 20: Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with jurisdiction planning team. 2. Review the status of all mitigation actions, using the *Mitigation Action Implementation Worksheet* (**Section 3, Attachment A, NOVA HMP Base Plan**).	• Produce an annual report that includes the following: ▪ Status update of all mitigation actions ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities ▪ Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	1. Schedule the annual plan evaluation with jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the *Planning Considerations Worksheet*, (**Section 3, Attachment C, NOVA HMP Base Plan**).	• Submit the annual report to the NOVA HMP Project Team Point of Contact
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

Mitigation actions may be reviewed, revised, and updated at any time.

The Town of Lovettsville will continue to be a planning partner with Loudoun County and other county jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk of the hazards identified in this plan.

10. Annex Adoption

The Town of Lovettsville Jurisdiction Annex will be adopted when the community adopts the *Northern Virginia Hazard Mitigation Plan*.

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Action Worksheets

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Documentation of Public Participation

lovettsvilleva.gov/news/help-build-community-resilience-to-disasters-by-participating-in-the-regional-hazard-mitigation-survey-before-september-30-2021/

Email Gmail Google Earth Town of Lovettsville... Transportation Alter... VDOT Smart Portal Teamwork Homepa... Loudoun County GIS Flip Your Future E

Home Our Town Visitors Services Business Government I Want To… Documents Careers

Help Build Community Resilience to Disasters by Participating in the Regional Hazard Mitigation Survey Before September 30, 2021

FEMA

Residents and business owners in the Town of Lovettsville are encouraged to help build community resilience to disasters by participating in the Northern Virginia Hazard Mitigation Survey.

Loudoun County and the incorporated towns of Hamilton, Hillsboro, Leesburg, Lovettsville, Middleburg, Purcellville and Round Hill are part of a regionwide effort to update the Northern Virginia Hazard Mitigation Plan.

The plan identifies strategies for reducing or eliminating loss of life, injury, and property damage caused by disasters as well as the long-term risks that result from hazards such as floods, severe storms, tornadoes, wildfires and winter weather.

In addition to preventing loss of life and injury and damage to buildings and infrastructure, hazard mitigation can prevent damage to a community's economic, social and environmental well-being.

Members of the community can participate in the mitigation planning process by answering questions about natural hazards they are concerned about or have directly experienced in the past five years. The survey also asks for opinions on proposed mitigation strategies.

The survey will be open through September 30.

Click here for the NOVA Hazard Mitigation Plan online survey https://www.surveymonkey.com/r/NorthernVirginiaHazardMitigationSurvey.

← Lovettsville Game Protective Association Hosts an Oktoberfest Event – September 25, 2021

11.3. Attachment 3: Mitigation Actions

Table 21: New Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-1	Dutchman's Creek Shoring and Restoration.	Transportation and Environmental Services	Flood High Wind/Severe Storm	Town Reserves	Summer 2022	Design plans are being discussed and deliberated on by Engineers and Town.	High	Design phase
2022-2	E. Broadway Streetscapes Project.	Transportation and Environmental Services	Flood High Wind/Severe Storm Winter Weather	VDOT Funding, County Funding, Town Reserves	Fall 2023	Design plans are 60% complete and ROW is expected to begin in 2022.	High	Design phase
2022-3	South Church St. Improvements Project.	Transportation and Environmental Services	Flood High Wind/Severe Storm Winter Weather	Loudoun County Funding, Town Reserves	Fall 2023	Design plans are also about 60% complete for this project.	High	Design phase
2022-4	Update Transportation Master Plan.	Transportation and Environmental Services	Extreme Temperatures Flood High Wind/Severe Storm Winter Weather	Town Reserves	July 2021	Draft plans are currently being reviewed and soon to be submitted to Town Council for review.	High	Plan was adopted July 2021
2022-5	Identify road network flood inundation areas.	Town engineer	Flood	Town Reserves	July 2021	Transportation Master Plan is being finalized.	Medium	Plan was adopted July 2021
2022-6	Determine feasibility of redundancy of internet services and direct TLS between facilities.		Earthquake Tornado Winter Weather	Town Reserves	Winter 2021	Support Tech Consultant is being pursued by the Town.	Medium	Planning phase

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
2022-7	Create and distribute public education materials about natural and non-natural hazards to community members and town staff.	Town staff	All Hazards	Loudoun County, Town Reserves	2025	Look into existing public education materials that may be available for the Town to use	Medium	
2022-8	Review current building codes and policies to determine whether any updates can be made to increase mitigation activities and resiliency.	Town engineer	All Hazards	Loudoun County, Town Reserves	2025	Review current building codes and policies	Medium	

Northern Virginia Hazard Mitigation Plan

Annex 8-C: Town of Middleburg

November 2022

Town of Middleburg Overview

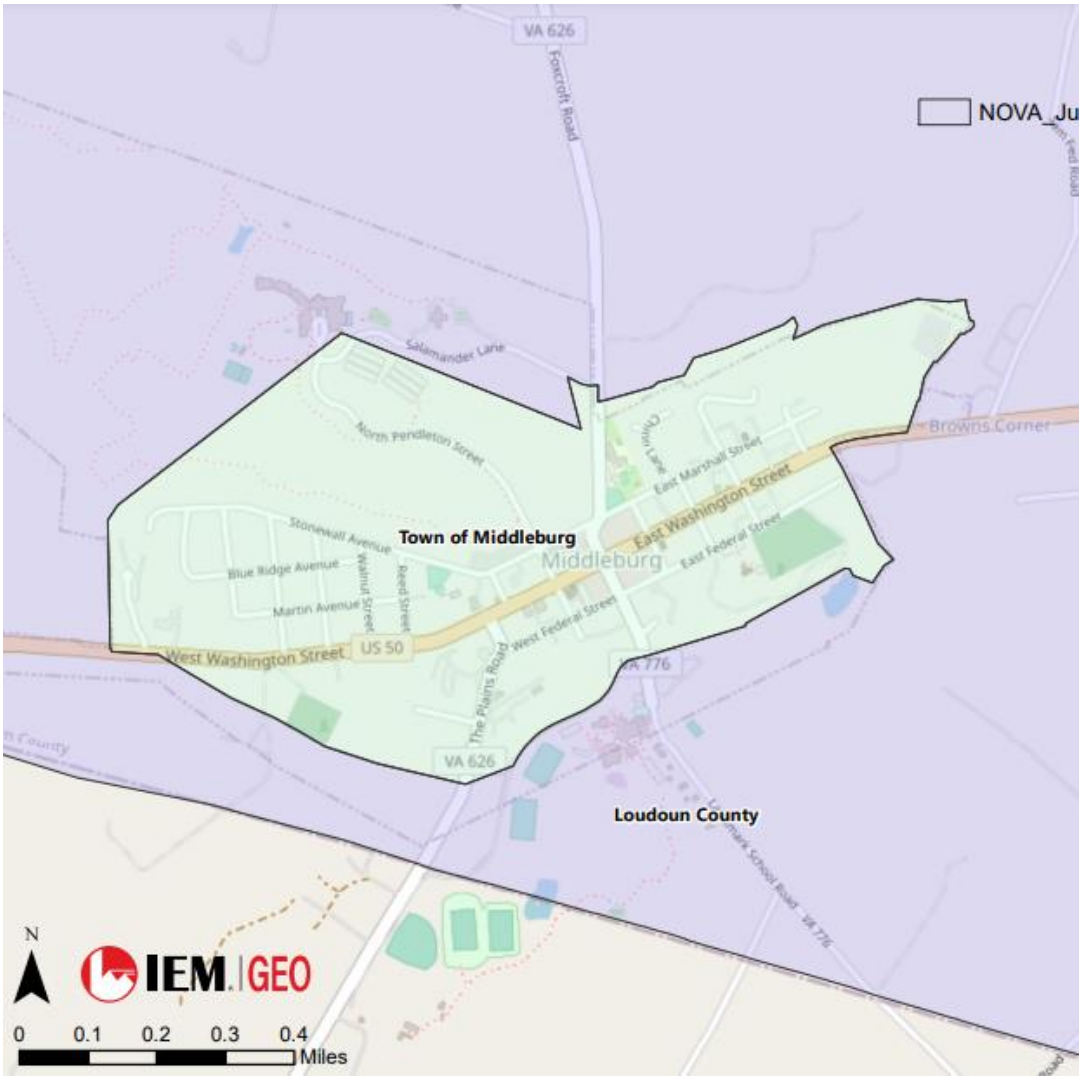

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1787	1.04 sq. mi.	669	10 W Marshall Street, P.O. Box 187, Middleburg, VA 20118	428	Winter Weather High Winds/Severe Storm

Town of Middleburg Risk Environment[1]

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

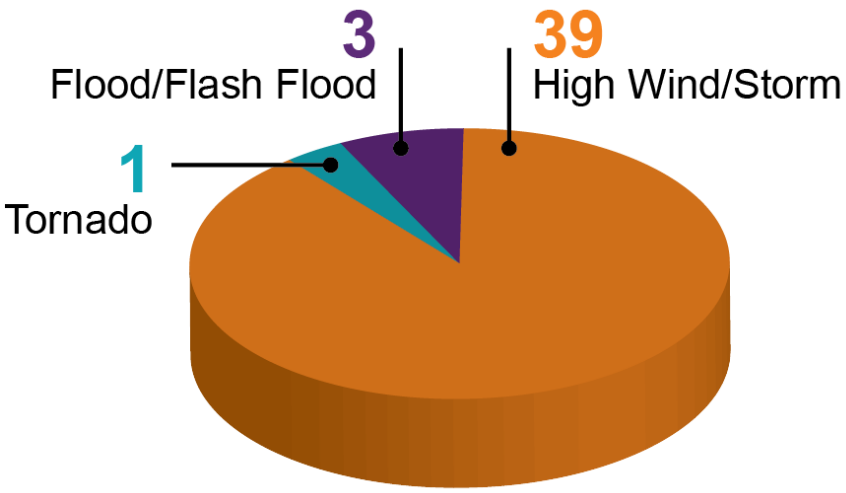

Figure 1: Number of Events

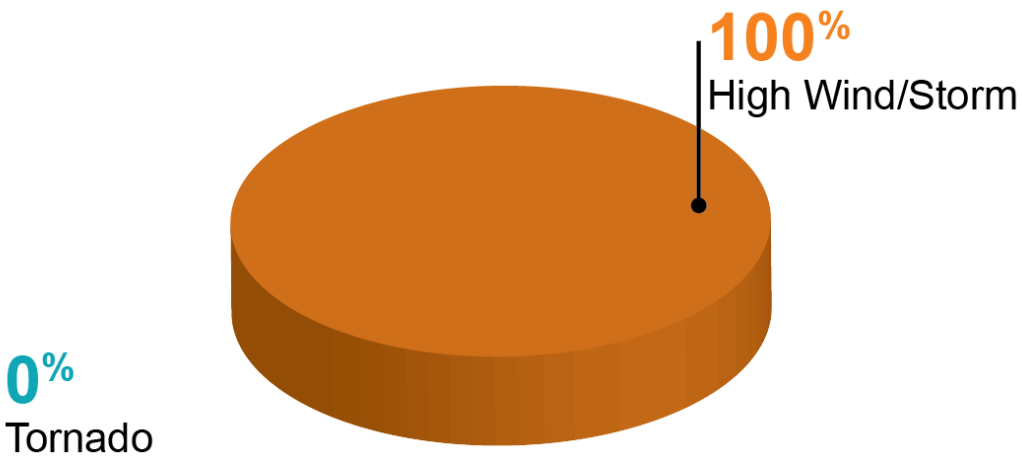

Figure 2: Property Damage from Natural Hazard Events

1 Data Source: NOAA, National Centers for Environmental Information, Storm Events Database, https://www.ncdc.noaa.gov/stormevents

Natural Hazard Risk Ranking

Table 2: Natural Hazard Risk Ranking Summary

Hazard	Hazard Ranking
Winter Weather	**High**
High Wind/Severe Storm	**High**
Flood/Flash Flood	**High**
Tornado	**High**
Dam Failure	**Medium**
Drought	**Medium**
Extreme Temperatures	**Medium**
Earthquake	**Medium**
Landslide	**Low**
Wildfire	**Low**
Karst/Sinkhole/Land Subsidence	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	2
Food, Water, Shelter	2
Education	4
Cultural/Historical	9

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for Town of Middleburg

Capability	Ranking
Planning and Regulatory	Moderate
Administrative and Technical	Moderate
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Point of Contact

Table 5: Point of Contact Information

Contact Type	Contact Information
Point of Contact	Danny Davis, Town Manager Town of Middleburg 540-687-5152 ddavis@middleburgva.gov P.O. Box 187 Middleburg, VA 20118

Town of Middleburg

This annex presents specific information to update the 2022 *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*. Information was provided by the Town of Middleburg and, where municipal-level data was unavailable, by Loudoun County and other resources.

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List of Figures

1. Jurisdiction Profile

Geographic Region	Piedmont
Average Household Size	1.9
Persons per Square Mile	643
Median age	51.4
Elevation	486 feet

1.1. Location

The Town of Middleburg is in the southern part of Loudoun County, VA, and has contiguous borders on all sides with unincorporated lands in Loudoun County.

1.2. History

Middleburg was first established in 1787 by Lieutenant Colonel Leven Powell, a veteran of the American Revolutionary War, who purchased the land from a cousin of George Washington. The community, located on a trading route midway between Alexandria and Winchester, VA, became a stopping point for travelers. The center of town, part of a historic district today, is the location of an inn and tavern that promotes itself as the oldest continually operated inn in the United States.

In the early 1900s, Middleburg became a well-known destination for foxhunting and steeple chasing and is the home of the National Sporting Library museum and research center for horse and field sports.

Since the end of the twentieth century, the ring of counties within commuting distance of Washington, D.C have seen significant growth and development. Middleburg has experienced this growth to a lesser extent but anticipates increased growth in the future.

1.3. Demographics, Economy, and Governance

The Town of Middleburg is included as part of the Loudoun County profile and the regional Northern Virginia profile as presented in **Section 1 of the Base Plan** as context to the entire plan.

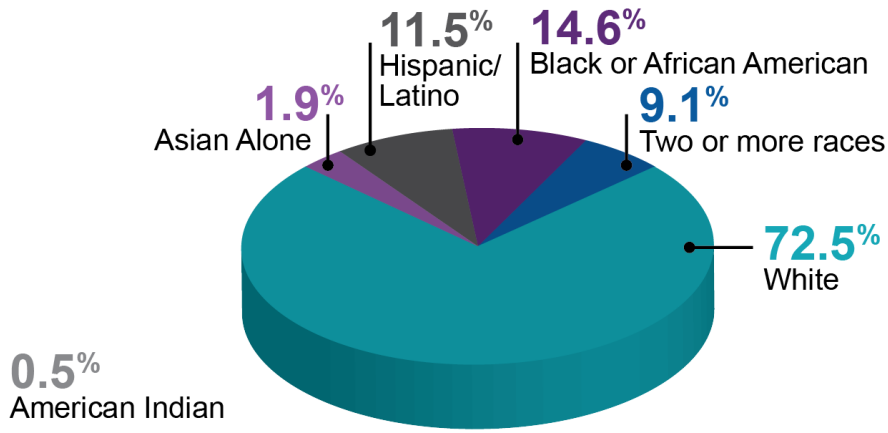

Figure 4: Race and Ethnicity Demographics

Table 6: Demographics, Economy, and Governance in the Town of Middleburg[2]

Demographics	Economy	Town Governance[3]
Population • 2010 population: 673 • 2020 population: 669 (0.60% decrease since 2010)	• **Median household income (2020):** $58,438 • **Unemployment rate (June 2021):** 3.6% • **Per capita income (2019):** $59,056 • **Median house or condo market value (2019):** $539,620 • **Percentage below poverty (2020):** 7.2%	• Mayor • Vice Mayor • Town Council: 8 members • Town Manager • Deputy Town Manager

The Town has a significant percentage of residents with higher education. More than 31% of town residents have a bachelor's degree, and over 18% have a graduate degree.

1.4. Built Environment and Community Lifelines

The information presented in this section related to Community Lifelines and critical assets in the Town of Middleburg was collected from multiple sources, including Hazus (Version 4.2), the Town participants in the NOVA HMP 2022 update planning process, and Loudoun County.

Critical facility data extracted from the Hazus Level 1 assessment indicates that the Town has an estimated 17 critical and historic assets. Due to the time lag in collecting and verifying data and the method of documenting location and jurisdiction used in Hazus, this may not reflect the current inventory maintained by the Town of Middleburg. Additional information about assets is included in the **Base Plan**.

1.4.1. Safety and Security

Hazus data has one Loudoun County fire station and one town police station located in the Town of Middleburg.

1.4.2. Food, Water, Shelter

Food commodities are available throughout the Town and Loudoun County from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

The Hazus database identified two wastewater treatment facilities within the Town; however, only one is currently operational. There are two water treatment plans and four operational municipal wells in Town.

[2] U.S. Census (1970–2020), (www.census.gov), American Community Survey Five-Year estimates, https://data.census.gov/cedsci/profile?g=1600000US5151448, and Loudoun County, (www.Loudouncounty.gov); Homefacts.com (https://www.homefacts.com/unemployment/Virginia/Loudoun-County/Middleburg.html).
[3] www.worldpopulationview.com. Retrieved at: https://worldpopulationreview.com/us-cities/middleburg-va-population

1.4.3. Health and Medical

The Hazus program does not identify any health or medical facilities within the Town; however, these services are available to residents in the Town and surrounding areas of Loudoun County, as well as Fauquier and Prince William Counties.

1.4.4. Energy

There are no energy assets identified in the Town in the Hazus database.

1.4.5. Communications

According to Hazus the Town's broadcasting abilities come from the county as well as all of its other communications needs.

1.4.6. Transportation

U.S. Route 50 is the only major highway directly serving Middleburg, connecting through Winchester, VA, on the west across the County and the City of Alexandria on the east. Metrorail lines do not directly serve the jurisdiction.

Other transportation facilities are identified in the Loudoun County annex.

1.4.7. Hazardous Materials

According to Hazus, there are no hazardous materials facilities or storage sites located in the Town.

1.4.8. Education

The Hazus database identified four public or private schools within the Town of Middleburg.

1.4.9. Recreational, Cultural, and Historic Sites and Assets

The Middleburg Historic District, in addition to the Burrland Farm Historic District, Unison Historic District, and seven additional sites, are listed on the National Register of Historic Places.

The Historic District Program enables the Town of Middleburg to be a Certified Local Government. This gives the Town standing with the State Preservation Office to comment on nominations of property to the national and state registers and allows the Town to apply for grant money specifically allocated for local preservation efforts.

Hazus identifies nine historical assets, including two historical districts, two historical polygons, and five historical buildings.

The Town of Middleburg identified the following concerns in Community Assets at Risk: Worksheet 3.

Natural Environment

- Natural Resources (clean air/water): Source water wells could be impacted by drought or a major storm. The wastewater plant could be impact by flooding or a major storm.

Economy

- Major Employers: Lodging properties and education facilities are among the major employers in Town. Major storms could affect water, sewer, or electricity service to these facilities.
- Primary Economic Sectors: Financial businesses could be impacted by major storms that disrupt telephone or internet service.

Population

- General Demographics: Strong storms, tornados, and severe winter weather can affect trees, utility service, and damage personal property and homes.

Built Environment

- Critical Facilities: Source water wells could be impacted by drought or major storms. Wastewater plant could be impacted by flood or major storm.

Climate Change

- Natural Environment: Source water is at risk to extended drought
- Economy: Extreme temperatures can impact the long-term viability of tourism economy.
- Population: Extreme storms can impact residents and their property.
- Built Environment; Extreme storms or winds can damage existing buildings in Town.

Figure 5: Middleburg Historic District Map[4]

[4] Town of Middleburg, VA, Official Website. Retrieved at https://www.middleburgva.gov/

1.5. Growth and Development Trends

The Town's population is currently declining very slightly. Despite enormous growth in some parts of Loudoun County, Middleburg growth trend is largely attributed to the few remaining buildable sites in the Town. As of 2019, the Town had approximately 114 approved but unbuilt residential lots, mostly due to planned residential development on the Salamander Resort property. The lack of buildable sites will further restrict development and population growth in coming years. The projected population at build-out in 2040 is 872, indicating a future population increase of 216, or about 25% since 2010[5].

A critical issue for consideration in the Town's approval to allow future building is protection of groundwater quality, recreation opportunities, and the historic and natural beauty of the community. The Town's focus on working with the county and non-profits in coming years to promote land trusts, tax incentives for land conservation, open space easements, and the purchase of development rights as strategies to protect rural, undeveloped lands will help to ensure appropriate growth[6]. A Land Use Policy Map included in the 2019 Town Comprehensive Plan shows that a significant portion of the community is identified as being for Conservation/Targeted Use and for Low Density Residential Use.[7]

Table 7: U.S. Census Bureau Population Comparison, 2010–2020, Town of Middleburg[8]

Year	Population
2010	673
2020	669

Loudoun County will continue to be a planning partner with local jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk. Projected growth trends should be monitored in the next planning cycle with the intent of providing a more detailed statistical analysis of vulnerable populations and how this could potentially impact hazard consequences and mitigation opportunities.

Additional information related to Loudoun County's projected growth and its potential impact on the Town of Middleburg is presented in the Loudoun County annex.

[5] Town of Middleburg, Comprehensive Plan, Projecting Future Population and Housing, October 2019. Retrieved at: https://www.middleburgva.gov/DocumentCenter/View/787/Town-of-Middleburg-Comprehensive-Plan-2019-PDF?bidId=
[6] Town of Middleburg, Comprehensive Plan, October 2019. Retrieved at: https://www.middleburgva.gov/DocumentCenter/View/787/Town-of-Middleburg-Comprehensive-Plan-2019-PDF?bidId=
[7] Ibid.
[8] Town of Middleburg Economic Development Strategy, accessed at https://www.middleburgva.gov/DocumentCenter/View/1522/FINAL---Middleburg-Economic-Development-Strategy-2020

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the Town of Middleburg followed the planning process described in **Section 2 of the Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Team, the Town supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction.

Table 8: Local Planning Group Participants

Name	Position/Title	Department/Agency
Danny Davis	Town Manager	Administration
William Moore	Deputy Town Manager	Planning & Zoning
AJ Panebianco	Chief of Police	Police Department

The jurisdiction identified its chief hazard mitigation planning responsibility as providing oversight in the planning process and representation in the Emergency Managers Group. The Town of Middleburg also identified the following tasks as part of its mitigation planning responsibilities:

- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review plan drafts and provide input
- Public outreach activities
- Implementation of the plan
- Maintaining the plan

Town of Middleburg planning participants coordinated primarily by means of email during the planning process, and as needed, independently to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, and capabilities. Additional planning process documentation of the Planning Group meetings is included in **Appendix A of the Base Plan**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a public hazard survey made available through Loudoun County's website, as well as access to the draft plan for public review and comment. The Town of Middleburg's public participation and feedback opportunities were included in Loudoun County's outreach efforts.

In reviewing both documents, the community was offered the opportunity to provide input to the community hazards of concern and the draft 2022 plan update that recommends mitigation strategies to minimize the impact of all hazards. Notification of the draft plan release was made through the same county web link used to enable residents to participate in the community hazard survey. Documentation of how the public participated the planning process by taking a community survey and reviewing the draft plan is included in **Attachment 2** of this annex.

3. Jurisdiction-Specific Hazard Event History

The Town of Middleburg's comprehensive hazard history is combined with that of Loudoun County when data is provided at the county level. Information such as this is described in **Sections 4 and 5, Base Plan**.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,132 recorded natural meteorological events that took place in Loudoun County between January 1, 1950, and May 2021. The county and its municipalities have been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 9: Federal Disaster and Emergency Declarations (2017–2021), Loudoun County

Declaration	Date	Hazard	Assistance Type
DR-4512-VA	4/2/2020 (continuing)	COVD-19 Pandemic	Individual Assistance, Public Assistance
EM-3448-VA	3/13/2020 (continuing)	COVID-19 Pandemic	Public Assistance (Category B)
EM-3403-VA	9/11/2018	Hurricane Florence	Public Assistance (Category B)

Annex 8, Tables 22 and 23 provide a summary of all high wind/severe storm and severe winter storm events that have occurred in Loudoun County between 1950 and May 31, 2021.

The Town did not report any significant hazard events occurring since the 2017 plan.

4. Hazard Risk Ranking

After developing hazard profiles, the Town of Middleburg Mitigation Planning Committee conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4 of the Base Plan**.

The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5 of the Base Plan**, and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II of the Base Plan**.

Table 10: Hazard Risk Ranking Summary: Natural Hazards, Town of Middleburg

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.3	3.5	6.8	**High**
High Wind/Severe Storm	2.7	3.4	6.1	**High**
Flood/Flash Flood	1.7	4.1	5.8	**High**
Tornado	1.7	4.1	5.8	**High**
Dam Failure	1.0	4.4	5.4	**Medium**
Drought	2.0	3.2	5.2	**Medium**
Extreme Temperatures	2.3	2.7	5.0	**Medium**
Earthquake	1.7	3.2	4.9	**Medium**
Landslide	1.3	2.5	3.9	**Low**
Wildfire	1.0	2.8	3.8	**Low**
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	**Low**

Table 11: Hazard Risk Ranking Summary: Non-Natural Hazards, Town of Middleburg

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	2.0	5.3	7.3	**High**
Terrorism	1.0	6.1	7.1	**High**
Cyberattack	1.7	4.7	6.4	**High**
Civil Unrest	1.0	4.9	5.9	**Medium**
Communication Disruption	1.3	3.7	5.0	**Medium**
Hazardous Materials	1.0	3.9	4.9	**Low**
Active Violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, the Town of Middleburg evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter storms, high wind/severe storm, tornado, and flood/flash flood
- **Medium:** Dam failure, drought, extreme temperatures, and earthquake

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious disease/public health, terrorism, and cyberattack
- **Medium:** Civil unrest and communication disruption

Remaining hazards are ranked as “low,” signifying a minimal risk to the Town of Middleburg.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4 of the Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

Annex 8: Loudoun County includes a statistical compilation of the number of events and related impacts for the two highest-ranked hazards for the Town: winter storm and high wind/severe storm.

5.1. National Flood Insurance Program

The Town of Middleburg participates in the National Flood Insurance Program (NFIP).

Table 12: National Flood Insurance Program Status, Town of Middleburg[9]

Initial FHBM Identified	Initial FIRM Identified	Current Eff Map Date	Reg-Emer Date
Unknown	07/05/01	02/17/17	07/31/01

The Town did not submit an updated NFIP survey. As of 2017, there were 19 policies in force and $4,691 in premiums paid.

Other hazard information for the Town of Middleburg is presented in the **Base Plan**.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.2. Population

Estimates of the number of residents in the Town of Middleburg vulnerable to each hazard are presented in the various hazard sections in the **Base Plan**.

In addition to the county level information, the Town noted the following hazards that may impact the general population in the jurisdiction:

- Strong storms, tornadoes, winter storms that affect trees, utility service, and damage personal property and homes.

5.3. Built Environment, Community Lifelines, and Critical Assets

The critical assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards. As is the case with some other resources consulted, most vulnerability data related to the built environment is county level and is included in **Annex 8: Loudoun County**.

Using the best Hazus data available, scenarios were run at the county level for earthquake, flood, and hurricane wind to determine potential exposure of buildings, infrastructure, and economy. Information presented in **Annex 8: Loudoun County** includes the Town of Middleburg.

[9] FEMA, NFIP Community Status Report, May 3, 2022, accessed at https://www.fema.gov/cis/VA.html

Critical facility data extracted from the Hazus Level 1 assessment indicates that the Town has an estimated 17 critical and historic assets. The Town also identified additional critical facilities that may be impacted by hazards:

- Source water wells may be impacted by drought or severe storm/high wind.
- Wastewater plant may be impacted by flood or severe storm/high wind.
- Time-honored historic structures listed in the U.S. National Register for Historic Places and other sites of note, including of the Civil War Battle of Middleburg, Civil War Trail Markers, and National Sporting Library and Museums may be impacted by all hazards.

Table 13: Community Lifelines/Critical Assets Exposed to FEMA Floodplains, Town of Middleburg[10]

Type of Critical Facility	Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
Safety and Security	2	0	0
Food, Water and Shelter (wastewater treatment facility)	2	1	0
Education	5	0	0
Cultural/Historical	9	0	0

Data identified through Hazus flood scenario runs indicates one Community Lifeline within the Town of Middleburg that is in the 100-Year (Special Flood Hazard Area) floodplain, which is a water/wastewater treatment facility in the northeast area of the Town (indicated in Figure 6). The map also depicts four additional facilities—a fire station, police station, and two schools—that are not in a flood zone.

[10] Hazus 100- and 500-Year Flood Scenarios. August 4, 2021.

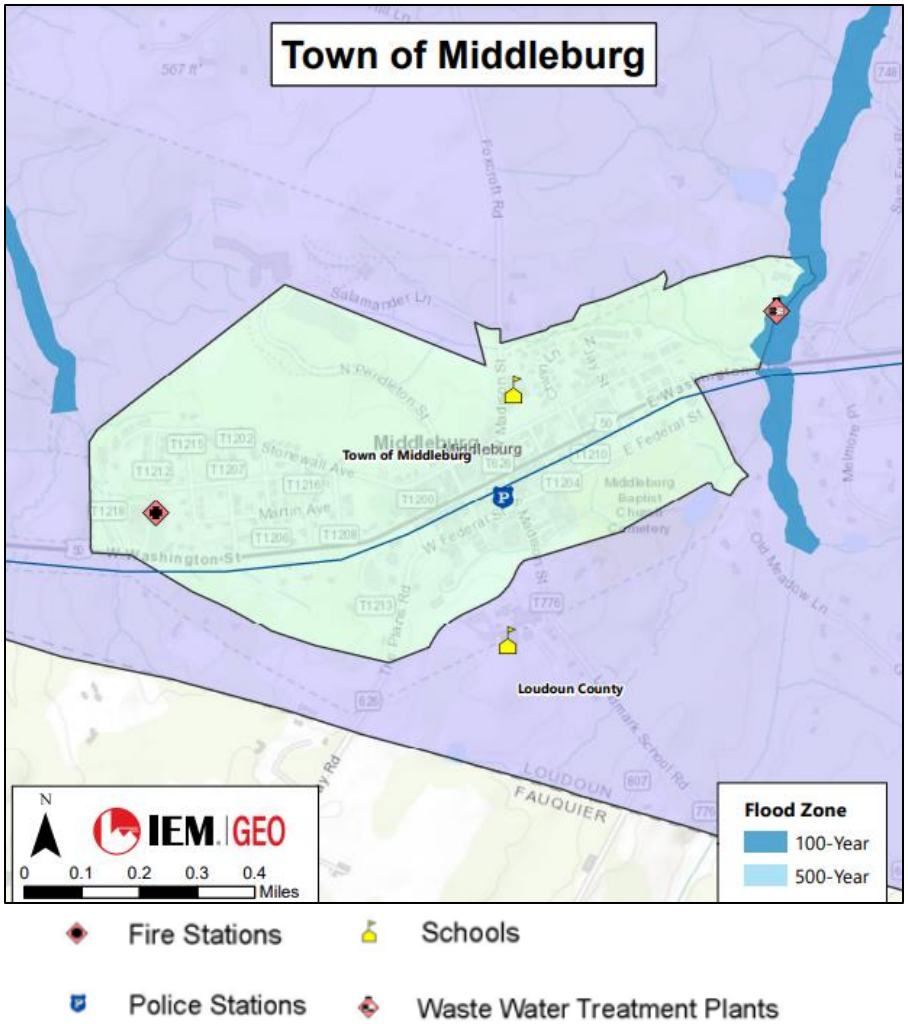

Figure 6: Town of Middleburg Critical Assets located in the 100- and 500-Year Floodplain[11]

5.4. Natural Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**. In addition to the county level information, the Town noted that source water wells could be impacted by drought or a severe storm/high wind. The Town does not have any recreation areas or critical habitats.

5.5. Economy

Information related to economic vulnerability are presented in the hazard-specific sections of the **Base Plan**. In addition to the county-level information, the Town noted the following economic assets that may be impacted by specific hazards:

- Lodging properties and education facilities may be impacted if severe storms or high wind effects water, sewer, or electricity services.

[11] Hazus 100- and 500-Year Flood Scenario Models, August 4, 2021.

- Financial sector may be impacted if severe storms or high wind effect telephone poles and/or internet service.

5.6. Cultural/Historical

The Town of Middleburg holds significant historical and cultural landmarks, some of which are National Trust Historic Sites and others locally designated landmarks, including two historic districts. There is no record of previous hazard impacts to cultural or historic sites within the Town.

Historic structures and sites and other types of facilities are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites while following historic preservation standards and guidelines.

Additional information related to vulnerability of cultural and historical assets are presented in the hazard-specific sections of the **Base Plan**.

6. Capability Assessment

The Town of Middleburg reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the Town of Middleburg participated in the Loudoun County Jurisdiction Needs Assessment that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans and/or resources, and it can implement most mitigation actions.

Table 14: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	Moderate
Administrative and Technical	Moderate
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary

The Town of Middleburg takes an all-hazards approach when developing jurisdictional plans, including emergency operations, and continuity of operations, as well as the hazard mitigation plan.

The following plans have been newly developed or updated since the 2017 HMP:

- *Town of Middleburg Comprehensive Plan*, adopted October 10, 2019 (includes transportation and acquisition of land for open space and public recreation uses elements)
- *Town of Middleburg, VA, Fiscal Year 2021 Budget* (including Capital Fund)
- *Town of Middleburg Economic Development Strategy*, November 2020
- Loudoun Health District, *Pandemic Response Plan*, March 2020
- *Continuity of Operations Plan for COVID-19 Pandemic*, 2020
- FEMA Flood Insurance Rate Maps, 2019
- *Town of Middleburg Historic District Design Guidelines*
- *Floodplain Overlay District Ordinance,* last amended February 9, 2017

Capability Analysis: Moderate

The Town of Middleburg is mindful of the need to develop plans, codes, and regulations that minimize the risk that hazard events will negatively affect people, property, economy, and environment. The Town falls under the county's Emergency Operations Plan and Stormwater Management Ordinance and Plan. The County also enforces building codes within the Town and holds a Building Code Effectiveness Grading Schedule (BCEGS) Score of 3 and Fire Department ISO ratings: rural-5; suburban-2; and no fire station within a five-mile drive-10. The town enforces the following ordinances: site plan review requirements, zoning, subdivision, and floodplain.

The Town identified the following areas for improvement in planning and regulatory capabilities:

- Be aware of the effects of stormwater issues as they occur to see how to mitigate them and the response to the issues.
- Continue to review zoning ordinances for risks from hazards. Think about hazards and stormwater impacts while supporting growth in development. Most of the Town was built out between 1960 and 1980 before modern stormwater construction and regulation.

The Town's utility system master plan is going to be updated and provides an opportunity for further mitigation integration into planning efforts. The Town runs its own water system, which is under the county's review and approval process.

6.1.2. Administrative and Technical Capabilities Summary

The Town of Middleburg identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and implementation of the plan:

- Town Administration
- Town Manager
- Planning and Zoning Department
- Police Department
- Planners/engineers with an understanding of natural and/or non-natural hazards

Additionally, the Town has the ability to use online notification and automated phone callback system to provide warning services about boil water notices and other town-specific warnings. Larger scale notices and warning matters are handled by Loudoun County.

Capability Analysis: Moderate

The Town of Middleburgh staff have a general understanding of natural and/or non-natural caused hazards and are trained in how to maintain current services for managing business, societal, and economic sectors. The Planning and Zoning Department has a grant writer and the emergency manager responsibilities are shared by the Town Administration/Manager and Police Department. The Town contracts surveying services with a third party. The Town identified the following areas of improvement related to administrative and technical capabilities:

- Hire new staff as needed.
- Train staff on hazards as needed and appropriate.

6.1.3. Safe Growth Capabilities Summary

The Town of Middleburg addresses safe growth through a variety of methods. The Town's Comprehensive Plan and related ordinances include policies and guidance to cover or reinforce best practices in the following:

- Land Use
- Transportation
- Environmental Management
- Public Safety
- Zoning
- Subdivision Regulations
- Capital Improvement Program and Infrastructure Policies
- Small Area or Corridor Plans
- Economic Development and Redevelopment Strategies

Capability Analysis: Moderate

The Safe Growth Capabilities in plan and/or on the planning board show that the Town is proud of its illustrious past and endeavors to maintain a balance between honoring historic assets while taking

advantage of future opportunities available to a community located near the nation's capital. The Town pays a great deal of attention to the needs of growing communities and may provide more feedback about its efforts in future plan updates.

6.1.4. Financial Capabilities Summary

The Town of Middleburg has the capability to take advantage of financial mechanisms to generate funding for current and future mitigation opportunities.

- Capital improvements project (CIP) funding
- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, or electric services
- Stormwater utility fee
- Ability to incur debt through general obligation bonds and/or special tax bonds
- Community development block grants and other federal funding programs
- Public–private partnerships
- State funding programs

Capability Analysis: Moderate

The Town of Middleburg has utilized funding sources in the past to complete mitigation projects, including infrastructure improvements, construction of a new town hall, transportation improvements, emergency management projects, and the ongoing provision of water and sewer services. The Town recognized that all funding sources available could be used to fund future mitigation actions. The Town identified an area for improvement in relation to financial capabilities to apply for additional funding for projects in the capital improvement plan.

6.1.5. Education and Outreach Capabilities Summary

The Town of Middleburg identified the following methods of promoting hazard mitigation:

- Land conservation and preservation organizations
- Piedmont Environmental Council
- Local groups and nonprofits focused on preserving natural resources and protecting open space
- Utility bills that can promote safety issues, responsible water use, and environmental protection education
- Sustainability Committee performs community outreach
- Police Department talking to kids about safety by partnering with schools
- Designating the Town of Middleburg as a StormReady community via the county, supported by INOVA Health System and Middleburg Corner Premium Outlets
- Promoting of ReadyVA by the County and the Town

Capability Analysis: Moderate

The Town of Middleburg is well positioned to coordinate with Loudoun County and other jurisdictions to build on its current education and outreach programs to promote hazard awareness and mitigation efforts that can be practiced by businesses, community groups, individuals, households, and other stakeholders. The array of print, web-based, and broadcast media available to the jurisdictions present multiple opportunities to create community awareness about hazards and their impacts on the community. The Town identified expanding and improving its education and outreach capabilities through continued partnership with community groups and information sharing with residents.

7. Resilience to Hazards

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of “low risk” is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience. The NRI assessment was conducted at the county level and is presented in **Annex 8: Loudoun County**.

7.1. Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household level risk factors. The CRE was also conducted at the county level and is presented in **Annex 8: Loudoun County**.

7.2. New Hazard Risk Challenges or Obstacles

The Town of Middleburg Planning Committee identified specific hazard challenges and obstacles in relation to climate change to be monitored in the next planning cycle:

- Source water wells due to extended drought
- Extreme temperatures that impact the long-term viability of the tourism economy
- Extreme storms that impact residents and their properties
- Extreme storms that bring damaging winds or damage can impact existing buildings in town

8. Mitigation Actions

8.1. Goals and Objectives

The Town of Middleburg Planning Team adopted the regional goal statement presented in **Section 8 of the Base Plan**.

8.2. Status of Previous Actions

The Town of Middleburg previously identified projects that contribute to risk reduction. The statuses of these actions are unknown. A list of previous mitigation actions is presented in **Attachment 3** of this annex.

8.3. New Mitigation Actions

The Town falls under Loudoun County's new natural and non-natural hazard mitigation action items. Partnering with the county on these projects and initiatives will increase the resiliency of the Town significantly more than if the Town were to undertake mitigation actions on their own.

8.4. Action Plan for Implementation and Integration

The Town Manager is responsible for coordinating the implementation of the hazard mitigation activities. The Town falls under Loudoun County's Action Plan for Hazard Mitigation Implementation and Integration and new action items. The Town Manager will coordinate with the county to monitor the implementation of actions and participate in the implementation of the multi-jurisdictional regional plan, as related to the Town of Middlebury.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 15: Town of Middleburg Plan Maintenance Responsibilities for the Northern Virginia Hazard Mitigation Plan (Base Plan)

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction, in coordination with Loudoun County, during the monitoring process. • Collect, analyze, and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Help disseminate reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction, in coordination with Loudoun County, during the evaluation process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Help disseminate information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction, in coordination with Loudoun County, during the planning cycle, including plan review, revision, and updating. • Collect and report data to the NOVA Planning TEwam. • Maintain records and documentation of all reviews and revisions of the plan by the jurisdiction. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP Base Plan**, the Town of Middleburg Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**. The Town's maintenance method and schedule may coincide with that of Loudoun County and be conducted simultaneously.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in fifth year.

Table 16: Town of Middleburg Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with jurisdiction planning team. 2. Review the status of all mitigation actions, using the Mitigation Action Implementation Worksheet (**NOVA HMP Base Plan, Section 3, Attachment A**).	• Coordinate with the county to produce an annual report that includes the following: ▪ Status update of the Town's mitigation actions ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities relevant to the Town. ▪ Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	1. Schedule the annual plan evaluation with jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the Planning Considerations Worksheet (**NOVA HMP Base Plan, Section 3, Attachment C**).	• Participate with Loudoun County to submit the annual report to the NOVA HMP Project Team Point of Contact
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the process and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adopt the FEMA-approved plan every five years to maintain the jurisdiction's eligibility for federal post-disaster funding.

The Town falls under Loudoun County's mitigation actions. These actions may be reviewed, revised, and updated at any time. The Town of Middleburg will continue to be a planning partner with Loudoun County and other county jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan.

10. Annex Adoption

The Town of Middleburg Jurisdiction Annex will be adopted simultaneously with the adoption of the *NOVA HMP*.

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Action Worksheets

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Documentation of Public Participation

The Town of Middleburg's public participation and feedback opportunities were included in Loudoun County's outreach efforts.

News item published in the Loudoun Now newspaper

A Loudoun County Fire-Rescue technical rescue crew trains at the Panda Stonewall Energy Center in the fog Thursday, Oct. 22. [Renss Greene/Loudoun Now]

Loudoun Residents Asked to Take Hazard Survey

2021-08-20 Loudoun Now

County officials are encouraging Loudoun residents and business owners to help build community resilience to disasters by participating in the Northern Virginia Hazard Mitigation Survey.

Loudoun County and its towns are part of a regionwide effort to update the Northern Virginia Hazard Mitigation Plan. The plan identifies strategies for reducing or eliminating loss of life, injury, and property damage caused by disasters as well as the long-term risks that result from hazards such as floods, severe storms, tornadoes, wildfires, and winter weather.

In addition to preventing loss of life, injury and damage to buildings and infrastructure, hazard mitigation can prevent damage to a community's economic, social, and environmental well-being.

The survey asks questions about natural hazards they are concerned about or have directly experienced in the past five years, as well as for opinions on proposed mitigation strategies. The survey is open through Sept. 15 and is online at surveymonkey.com/r/NorthernVirginiaHazardMitigationSurvey

11.3. Attachment 3: Mitigation Actions

The actions presented here were included in the *2017 Northern Virginia Hazard Mitigation Plan*. The Town of Middleburg Mitigation Planning Team reviewed all actions to see if they were completed, no longer relevant, or moved forward and included in the 2022 plan.

Table 17: Previous Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status
2006-1	Improve drainage in low-lying or poor drainage areas along primary and secondary roads where needed town-wide. During heavy rain events, several area roadways become inundated with water runoff. Priority Projects: 1) Tuscarora Creek Improvements, 2) Town Branch Improvements-King Street, 3) Turner-Hardwood Drainage.	Public Works, Office of Capital Projects, Planning	All Hazards	Coordinate with Virginia Department of Transportation (VDOT)	Undetermined at this point-based on funding availability	Identifying funding	High	No	Unknown
2006-2	Improve security measures as needed around critical facilities.	Executive Office	All Hazards	U.S. Department of Homeland Security. Office of Domestic Preparedness: Homeland Security Grant Program (HSGP); Buffer	Undetermined at this time-dependent on funding source availability	Develop security enhancement plan	Moderate	No	Unknown

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status
				Zone Protection Program (BZPP)					
2006-3	Provide backup power (generators, where needed) for critical facilities (i.e., fire stations, police stations, water facilities, etc.).	Executive Office/all depts.	All Hazards	U.S. Department of Homeland Security. Office of Domestic Preparedness: Homeland Security Grant Program (HSGP); Buffer Zone Protection Program (BZPP)	Time schedule is dependent on funding source and availability	Identify Funding	Moderate	No	Unknown
2010-1	Develop and test government continuity of operations (COOP) plans.	Town Manager/ Dept. Directors	All Hazards	Internal Town of Middleburg	Ongoing	Develop plan/ Train staff	High	Department Managers are reviewing respective components of the COOP	Unknown
2010-2	Develop and test model evacuation and shelter-in-place plans for government facilities to include identifying and stocking shelter areas, testing notification systems.	All departments	All Hazards	Internal Town funding, U.S. Department of Homeland Security, Office of Domestic Preparedness; Homeland Security Grant Program (HSGP)	Ongoing	Develop evac and shelter-in-place plan for town facilities	Moderate	No	Unknown

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status
2010-3	Provide additional automation and display equipment for emergency operations center (EOC). Develop means for inclusion of GIS capability to track storm-related events including road closures, traffic signal status, power outages and building damage due to storm events. Identify and train staff required to operate EOC.	Police, Public Works, and IT Department	All Hazards	Internal town funding, Federal Highway Administration Grants, Tiger Grants, Department of Homeland Security grants, County Funding	Ongoing	Identifying and purchasing needed equipment	Moderate	Display equipment upgraded in the TOL EOC with similar upgrades in other meeting areas for redundancy. Dedicated GIS computer has been added to the EOC and migration of data to a GIS server is in progress	Unknown
2010-4	Variable Traffic Message Signs: This project will add several traffic message boards to the town's inventory. These boards are effective in the dissemination of information in the event of an emergency. They can be programmed with various messages including general traffic rerouting information, and	Police, Public Works, and IT Department	All Hazards	Internal town funding, Federal Highway Administration Grants, Tiger Grants, Department of Homeland Security grants, County Funding	Ongoing	Identify locations	Moderate	Variable Message Boards have been purchased. Work continues on pad and dedicated power locations for expanded deployment	Unknown

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status
	other emergency messages. Additionally, locations will be identified, and pads prepared with power for deployment.								
2010-5	Practical emergency operations training exercise on a town-wide basis for a natural disaster.	Town Manager/ Police (All Agencies)	All Hazards	Internal town funding Department of Homeland Security grants, UASI funding, County funding	Ongoing	Develop exercise	High	Practical exercises have been completed for some departments as well as for the Department Directors, Continuing work on town wide training exercise	Unknown
2010-6	Update Town of Middleburg Citizen Guide to Emergency Preparedness. Mail to residents and post on web.	Police, Executive/ IT	All Hazards	U.S. Department of Homeland Security, Office of Domestic Preparedness: Homeland Security Grant Program (HSGP)	Ongoing	Identify Funding	Moderate	No	Unknown
2010-7	Establish and full test emergency notification procedures and protocols for key government personnel to include emergency email groups, text-based alerts, etc. as well as establishment of emergency call trees.	Executive/ All Depts.	All Hazards	Internal town funding Department of Homeland Security grants, UASI funding, County funding	Ongoing	Develop Protocols	High	Enhancements of upgraded Everbridge system have been incorporated into routine, incident, and emergency exercise alerts. Continuing work on the establishment of phone trees and review of the Town Crisis Communication Plan	Unknown

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status
2010-8	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.	Public Works	Flood High Wind Severe Weather	FEMA Unified Hazard Mitigation Assistance funding for qualified structures	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011	Medium	No	Unknown
2010-9	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.	Public Works	Flood High Wind Severe Weather	FEMA Unified Hazard Mitigation Assistance funding for qualified structures	Ongoing	Identify all priority flood-prone structures by December 2011	Medium	No	Unknown

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status
2010-10	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	Public Works	Flood High Wind Severe Weather	FEMA Unified Hazard Mitigation Assistance funding for qualified structures	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review	Medium	No	Unknown
2010-11	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activates in the 100-year floodplain. Additionally, conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location	Public Works	Flood High Wind Severe Weather	General Funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011	Medium	No	Unknown

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status
	of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.								
2010-12	Determine feasibility of developing a drought preparedness and response plan.	Public Works	Drought	Internal town funding Department of Homeland Security grants, UASI funding, County funding	Ongoing	Research and identify applicable funding mechanisms to develop the plan.	Medium	No	Unknown

Northern Virginia Hazard Mitigation Plan

Annex 8-D: Town of Purcellville

November 2022

Town of Purcellville Overview

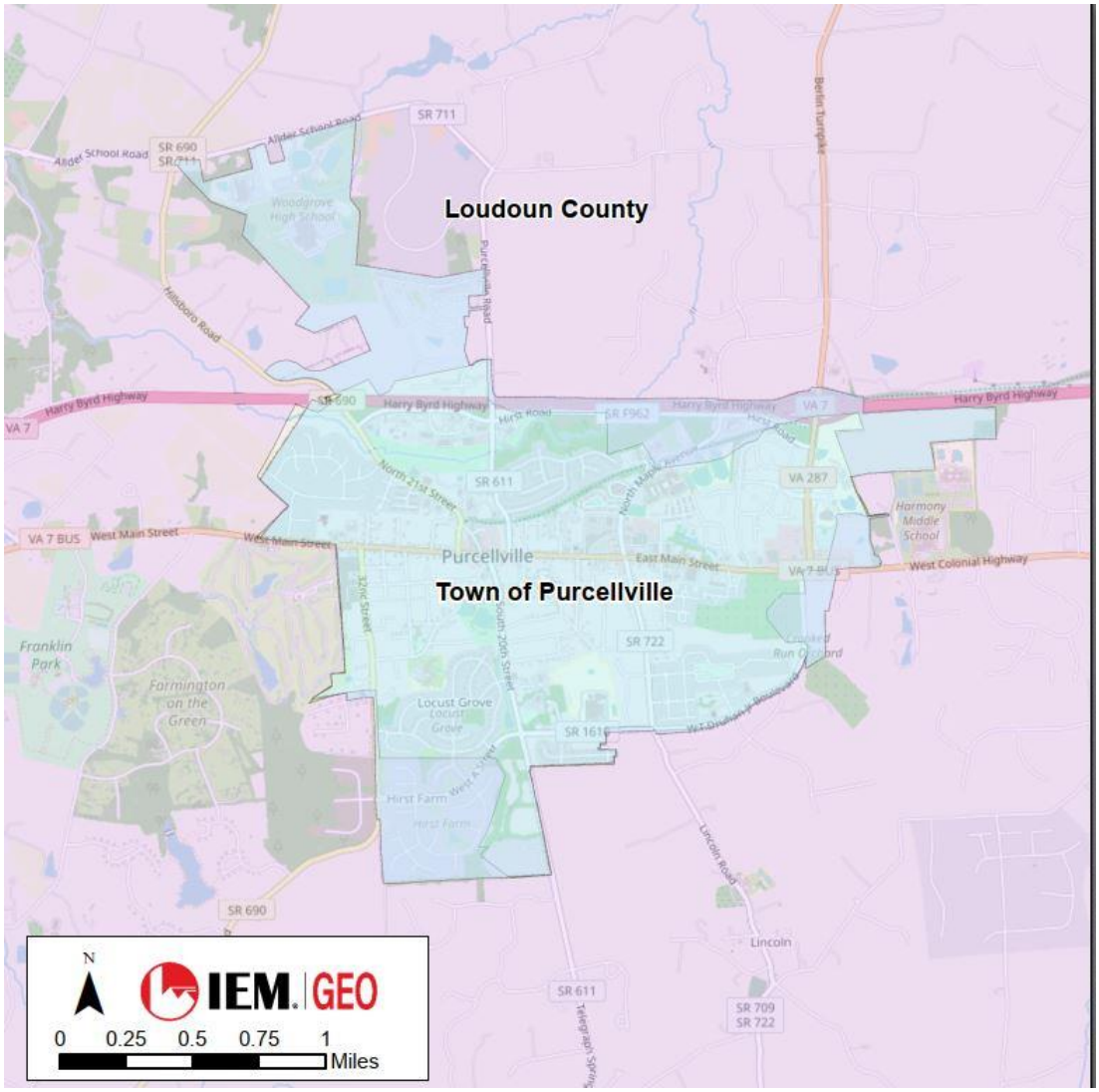

Table 1: Specific Jurisdictional Data

INCORPORATED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
March 14, 1908	3.38 sq. mi	8,929	221 South Nursery Ave, Purcellville, VA 20132	3,034	Winter Weather, High Wind/Severe Storm, Flood/Flash Flood

Town of Purcellville Risk Environment[1]

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

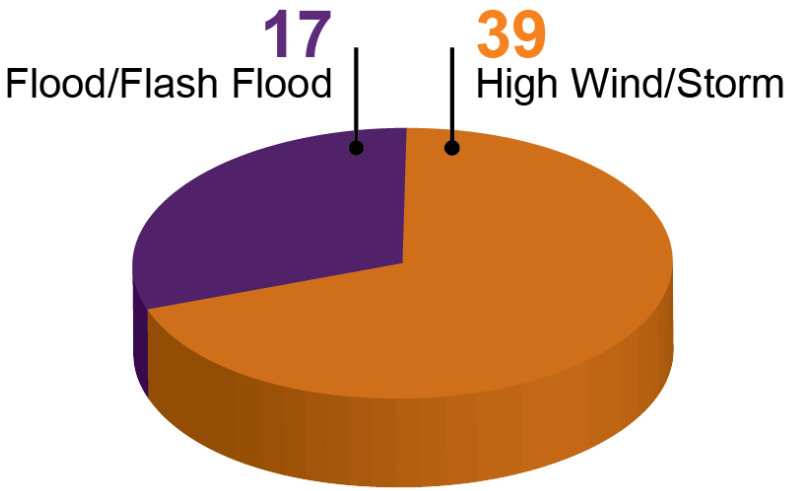

Figure 1: Number of Hazards

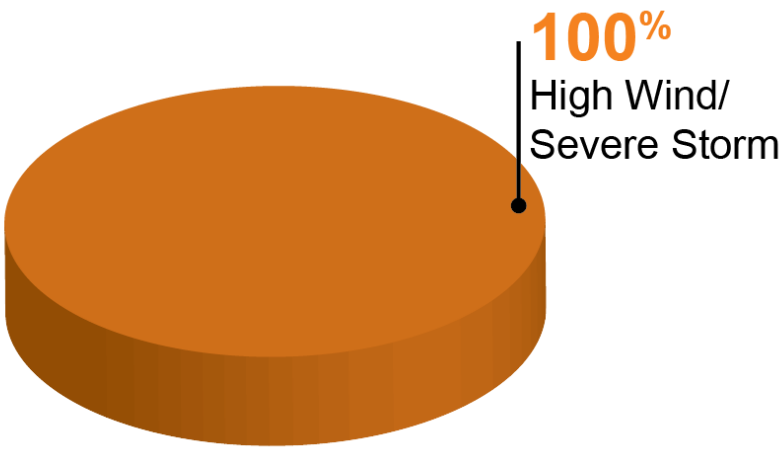

Figure 2: Property Damage Percentages from Natural Hazard Events

[1] Data Source: NOAA, National Center for Environmental Information, Storm Events Database, https://www.ncdc.noaa.gov/stormevents

Natural Hazard Risk Ranking

Table 2: Natural Hazard Risk Ranking Summary

Hazard	Hazard Ranking
Winter Weather	**High**
High Wind/Severe Storm	**High**
Flood/Flash Flood	**High**
Tornado	**Medium**
Dam Failure	**Medium**
Drought	**Medium**
Extreme Temperatures (Hot/Cold)	**Medium**
Earthquake	**Medium**
Landslide	**Low**
Wildfire	**Low**
Karst/Sinkhole/Land Subsidence	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	4
Food, Water, Shelter	2
Health and Medical	1
Transportation	5
Education	8
Cultural/Historical	7

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for Town of Purcellville

Capability	Ranking
Planning and Regulatory	Moderate
Administrative and Technical	High
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Low

Hazard Mitigation Plan Point of Contact

Table 5: Point of Contact Information

Contact Type	Contact Information
Point of Contact	Cindy McAlister, Chief of Police Town of Purcellville 540.338.7422, cmcalister@purcellvilleva.gov David Mekarski, Emergency Manager Town of Purcellville 540-338-7421, dmekarski@purcellvilleva.gov 221 South Nursery Avenue Purcellville, VA 20132

Town of Purcellville

This annex presents specific information for the purpose of updating the 2022 *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*. The information was provided by the Town of Purcellville and, where municipal-level data were unavailable, by Loudoun County and other available resources*:*

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1. Jurisdiction Profile

Geographic Region	Piedmont
Average Household Size	3.23
Persons Per Square Mile	2,626
Median Age	35.5
Elevations	Near sea level – 574 feet

1.1. Location

The Town of Purcellville is in the north-central section of Loudoun County, bordered on all sides by unincorporated Loudoun County.

1.2. History[2]

In 1764, settlers traveled westward from Leesburg on a constricted ox cart track westward. The track later became the "Great Road" and, in 1795, the road became an authorized turnpike. Among the earliest businesses to be established was Purcell's Store, from which the Town's name was derived.

With the construction of this turnpike in 1832, travel through Purcellville began to increase, and the first stagecoach arrived in 1841. A railroad link was built to Leesburg prior to the Civil War, and travel to points further west were continued by stagecoach through Purcellville. When the railroad was extended to Purcellville in 1874, the Town took Leesburg's place as the beginning of the stage route until the railroad was extended to Round Hill in 1875. The Town of Purcellville was fully incorporated on March 14, 1908, and the turnpike is now a four-lane highway called the Robert Byrd Parkway.

From its beginning, the Town's dependence on transportation links to the more populous eastern sections of Northern Virginia has remained strong and is now more important than ever. Since its earlier years the Virginia Department of Transportation (VDOT) has widened the original turnpike, also known as Route 7, and extended the Toll Road to western Loudoun County in the 1970s and 1980s. Purcellville's traditional dependence on agriculture as its primary source of income has diminished as a growing number of residents were employed outside of the community, thanks in part to improved transportation. The Town now makes every effort to accept such changes without diminishing its historic identity and small-town amenities.

Located within the ring of counties that encircle the Nation's Capital, Purcellville has since the end of the 20th century seen growth and development along with other Virginia and Maryland communities within commuting distance of Washington, DC.

1.3. Demographics, Economy, and Governance

The Town of Purcellville is included as part of the Loudoun County profile and the regional Northern Virginia profile as presented in **Section 1, Base Plan** to provide context for the entire plan.

[2] The History of Loudoun County, accessed at https://www.loudounhistory.org/history/purcellville-history/, summarized from *The Story of Purcellville* by Eugene M. Scheel, reprinted in commemoration of the town's 75th anniversary 1908–1983.

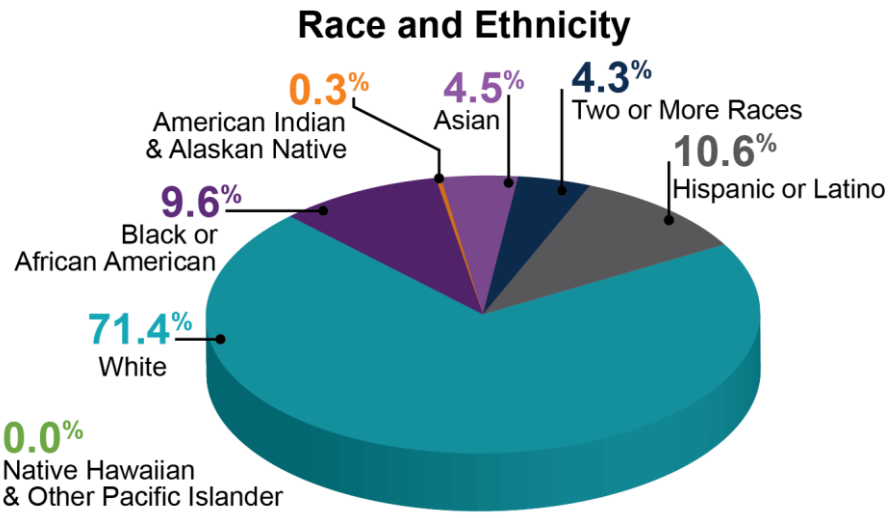


Figure 4: Race and Ethnicity Demographics from 2020 Census

Table 6: Demographics, Economy, and Governance in the Town of Purcellville[3] [4] [5]

Demographics	Economy	Town Governance
Population • 2010 population: 7,727 • 2020 population: 8,929 (15.55% increase since 2010)	• Median household income (2021): $132,063 • Unemployment rate (June 2021): 3.6% • Per capita income (2021): $47,394 • Median house market value (2021): $686,000 • Percentage below poverty (2021): 2.7%	• Mayor • Vice Mayor • Town Council: 5 members • Town Manager • Assistant Town Manager • Town Clerk

A significant percentage of the town's residents have received a higher education, with approximately 53% holding a bachelor's degree or higher, which is above the state average.

1.4. Built Environment and Community Lifelines

The information presented in this section regarding Community Lifelines and critical assets in the Town of Purcellville has been collected from multiple sources, including Hazus®–MH (Version 4.2), the Town participants in the NOVA HMP 2022 update planning process, and Loudoun County. Critical facility data extracted from the Hazus Level 1 assessment indicates that the Town has an estimated 28 critical and historic assets. The Town also identified 44 additional critical facilities that may be impacted by hazards.

3 U.S. Census (1970–2020), U.S. Census Bureau (www.census.gov), American Community Survey Five-Year estimates, https://data.census.gov/cedsci/profile?g=1600000US5151448,
[4] Zillow, (https://www.zillow.com/purcellville-va/home-values/); Homefacts.com, June 2021 (https://www.homefacts.com/unemployment/Virginia/Loudoun-County/Purcellville.html).
[5] www.worldpopulationview.com. Retrieved at: https://worldpopulationreview.com/us-cities/Purcellville-va-population

1.4.1. Safety and Security

Hazus data has one fire station, one rescue station, and one police station located in the Town of Purcellville.

1.4.2. Food, Water, Shelter

Food commodities are available from the 52 food establishments located throughout the Town from public retail providers, wholesalers, and contracted services for specific institutions and facilities[6]. Additional contracts may be entered into for post-disaster needs.

The Hazus database identified one wastewater treatment facility and one wastewater treatment facility as being located in the Town.

1.4.3. Health and Medical

The Hazus program identified one health or medical facility located in the Town.

1.4.4. Energy

There are no natural gas or power plants located in the Town of Purcellville according to Hazus.

1.4.5. Communications

According to Hazus, the Town's broadcasting abilities, as well as all of its other communications needs, come from the County.

1.4.6. Transportation

A segment of the Harry Byrd Parkway, also known as Highway 7, crosses the Town from east to west in the center of the jurisdiction as part of a longer parkway running between Leesburg and Winchester, respectively, at the eastern and western ends of the state. A two-lane road also named Highway 7 crosses through downtown as Main Street.

There are five highway bridges in the Town, according to Hazus.

1.4.7. Hazardous Materials

There are no hazardous materials facilities or storage sites located in the Town of Purcellville.

1.4.8. Education

The Hazus database identified a total of eight public or private schools in the Town of Purcellville.

[6] https://www.purcellvilleva.gov/724/Fast-Facts-and-Data

1.4.9. Recreational, Cultural, and Historic Sites and Assets

The Purcellville Historic District is included on the Virginia Landmarks Register and in 2007 was added to the National Register of Historic Places. Hazus identified eight cultural and historical sites and assets, including the historic district.

1.5. Growth and Development Trends

The Town of Purcellville had a population increase of 16% between 2010 and 2020, and it saw an average annual growth rate of 2.7% between 2011 and 2021. Although the area continues to expand, the growth rate was smaller between 2017 and 2021, which was the time covered by the 2017 jurisdictional annex of the current hazard mitigation plan (HMP). During this period, the Town experienced a 15% annual growth rate.[7] Despite enormous growth in some parts of Loudoun County, Purcellville's recent lower growth trend is largely attributed to the few remaining available buildable sites within the Town limits. The Town indicated that future development will not be significant.

A critical issue for consideration in the Town's approval to allow future building is the protection of groundwater quality, opportunities for recreation, and the historic and natural beauty of the community. Hence, the Town intends to focus on working with the county and nonprofit organizations in the coming years to maintain its current quality of life.

In November 2018, an article in *Loudoun Now* reported that the growth rate hitherto seen appeared to be leveling off. Mayor Kwasi Fraser was cited as being focused on existing businesses and residents and not future expansion. The article also stated the following:

> *Looking ahead five years, he wants to retain the Town's current size, help existing businesses thrive and extract value from the Town's $130 million in assets. To do this, he's focused on infill developments instead of more annexations, and improving broadband connectivity and the Town's transportation and utility systems.*
>
> *Fraser is pushing for the installation of solar panels and the construction of a $280,000, 175-foot cell tower at the Basham Simms Wastewater Facility, both of which help alleviate the Town's utility fund debt, with the tower also helping to improve residents' cell phone coverage.*
>
> *"We have to find ways to better utilize our assets," he said. "We want to listen to the will of the people."*[8]

Table 7: U.S. Census Bureau Population Comparison, 2010–2020, Town of Purcellville[9]

Year	Population
2010	7,727
2020	8,929

Additional information related to Loudoun County's projected growth and its potential impact on the Town of Purcellville is presented in the Loudoun County annex.

[7] www.worldpopulationview.com. Retrieved at: https://worldpopulationreview.com/us-cities/Purcellville-va-population
[8] *Loudoun Now*, November 11, 2018, retrieved at https://loudounnow.com/2018/11/29/purcellville-shifts-focus-after-building-boom/.
[9] U.S. Census Bureau

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the Town of Purcellville followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Team, the Town supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction and in Loudoun County.

Table 8: Local Planning Group Participants

Name	Position/Title	Department/Agency
David Mekarski	Town Manager	Town Manager
Cindy McAlister	Chief of Police	Police Department
Dale Lehnig	Director	Engineering, Planning, & Development
Don Dooley	Director	Planning & Economic Development
Jason Didawick	Director	Public Works
Shannon Bohince	Director	Information Technology
Bob Dryden	Facilities Coordinator	Engineering, Planning, & Development
Hooper McCann	Director	Administration

The jurisdiction identified its chief hazard mitigation planning responsibility as providing oversight in the planning process through Loudoun County representation to the Emergency Manager's Group. The Town of Purcellville also identified the following tasks as part of its mitigation planning responsibilities:

- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Public outreach activities
- Implementation of the Plan
- Maintaining the Plan

The Town of Purcellville planning participants coordinated primarily by means of email during the planning process, and, when necessary, independently to conduct planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, and capabilities. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a public hazard survey made available through Loudoun County's website, as well as access to the draft plan for public review and comment. The Town of Purcellville's public participation and feedback opportunities were included in Loudoun County's outreach efforts.

In reviewing both documents, the community was offered the opportunity to provide input to the community hazards of concern and the draft 2022 plan update that recommends mitigation strategies to minimize the impact of all hazards. Notification of the draft plan release was made through the same county web link used to enable residents to participate in the community hazard survey. Documentation of how the public participated in the planning process by taking a community survey and reviewing the draft plan is included in **Attachment 2** of this annex.

3. Jurisdiction-Specific Hazard Event History

The Town of Purcellville's comprehensive hazard history is combined with that of Loudoun County when data are provided at the county level. Information such as this is described in **Sections 4 and 5, Base Plan**.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,132 recorded natural meteorological events that took place in Loudoun County between January 1, 1950, and May 2021. The county and its municipalities have been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 9: Federal Disaster and Emergency Declarations (2017–2021), Loudoun County

Declaration	Date	Hazard	Assistance Type
DR-4512	Apr. 2020	Virginia COVID-19 Pandemic	PA-B
EM-3448	Mar. 2020	Virginia COVID-19	PA-B
EM-3403	Sep. 2018	Virginia Hurricane Florence	PA-B

Annex 8, Tables 8.14 and 8.15 provide a summary of all high wind/severe storm and severe winter storm events that have occurred in Loudoun County between 1950 and May 31, 2021.

The Town did not report any significant hazard events since the 2017 Plan.

4. Hazard Risk Ranking

After developing hazard profiles, the Town of Purcellville conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is assigned one of the following risk and vulnerability classifications:

- **Low:** Minimal potential probability and impact. Minimal or no property damage or loss of life expected.
- **Medium:** Moderate probability and potential impact; moderate threat level to the general population and/or the built environment. The potential damage is more isolated and less costly than that caused by a widespread disaster.
- **High:** Significant probability and widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past, causing significant impact.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan**.
The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard subsections in **Section 5, Base Plan**, and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II** of this Plan.

Table 10: Hazard Risk Ranking Summary: Natural Hazards, Town of Purcellville

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.3	3.5	6.8	**High**
High Wind/Severe Storm	2.7	3.4	6.1	**High**
Flood/Flash Flood	1.7	4.1	5.7	**High**
Tornado	1.7	4.1	5.7	**High**
Dam Failure	1.0	4.4	5.4	**Medium**
Drought	2.0	3.2	5.2	**Medium**
Extreme Temperatures (Hot/Cold)	2.3	2.7	5.0	**Medium**
Earthquake	1.7	3.2	4.9	**Medium**
Landslide	1.3	2.5	3.9	**Low**
Wildfire	1.0	2.8	3.8	**Low**
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	**Low**

Table 11: Hazard Risk Ranking Summary: Non-Natural Hazards, Town of Purcellville

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	2.0	5.3	7.3	**High**
Terrorism	1.0	6.1	7.1	**High**
Cyberattack	1.7	4.7	6.4	**High**
Civil Unrest	1.0	4.9	5.9	**Medium**
Communication Disruption	1.3	3.7	5.0	**Medium**
Hazardous Materials	1.0	3.9	4.9	**Low**
Active Violence	1.0	3.6	4.6	Low

Based on the hazard risk scores, the Town of Purcellville evaluated the level of risk for 18 hazards: 11 natural and seven non-natural hazards.

Eight natural hazards were identified as high- or medium-risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter Weather, High Wind/Severe Storm, and Flood/Flash Flood.
- **Medium:** Tornado, Dam Failure, Drought, Extreme Temperatures, and Earthquake.

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, and Cyberattack.
- **Medium:** Civil Unrest and Communication Disruption.

The remaining hazards are ranked as “low,” signifying that they pose a minimal risk to the Town.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

Annex 8, Loudoun County includes a statistical compilation of the number of events and related impacts for the two highest-ranked hazards for the Town: winter storm and high wind/severe storm.

5.1. National Flood Insurance Program

The Town of Purcellville is a participant in FEMA's National Flood Insurance Program (NFIP).

Table 12: National Flood Insurance Program Status, Town of Purcellville[10]

Initial FHBM Identified	Initial FIRM Identified	Current Eff Map Date	Reg-Emer Date
07/11/75	11/15/89	02/17/17	11/15/89

Table 13: NFIP Status, as of September 23, 2021[11]

NFIP Topic	Source of Information	Comments
Insurance Summary		
How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist Community Information System Database	Unknown
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist Community Information System Database	Unknown
How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA) Estimate from FEMA	None
Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	None
Staff Resources		
Is the Community FPA or NFIP Coordinator certified?	Community FPA	Yes

[10] FEMA, NFIP Community Status Report, May 3, 2022, accessed at https://www.fema.gov/cis/VA.html
[11] Town of Purcellville

NFIP Topic	Source of Information	Comments
Is floodplain management an auxiliary function?	Community FPA	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	GIS, permit review, inspections, engineering capability
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	None
Compliance History		
Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Are there any outstanding compliance issues (i.e., current violations)?		No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		Unknown

Other hazard information for the Town of Purcellville is presented in the **Base Plan**.

5.2. Population

Estimates of the number of residents in the Town of Purcellville vulnerable to each hazard are presented in the various hazard sections in the **Base Plan**.

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations using county-based data.

5.3. Built Environment and Community Lifelines and Critical Assets

Using the best Hazus data available, scenarios were run at the county level for earthquake, flood, and hurricane wind to determine potential exposure of buildings, infrastructure, and economy. Information presented in **Annex 8; Loudoun County** includes the Town of Purcellville.

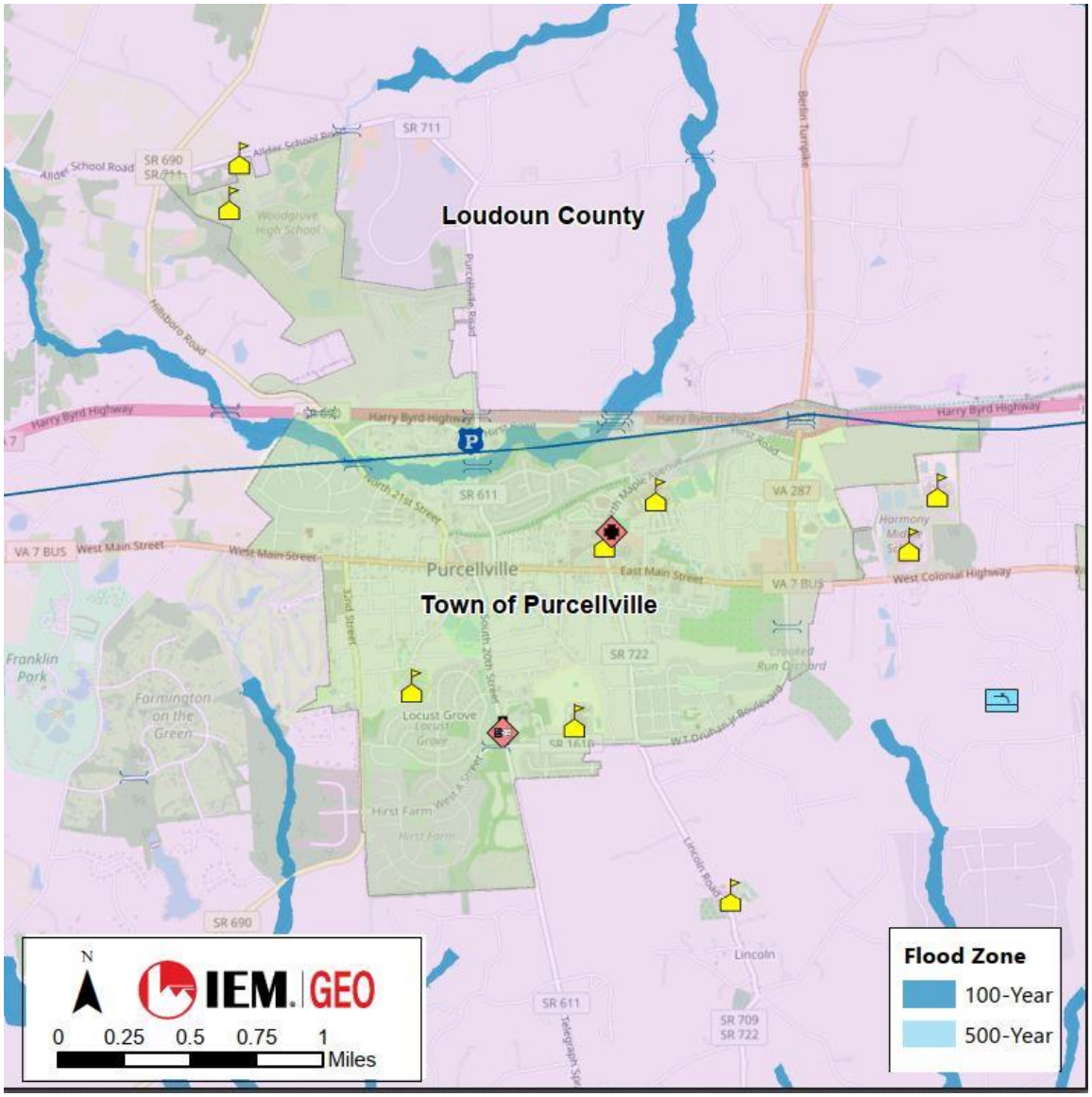
Critical facility data extracted from the Hazus Level 1 assessment indicates that the Town has an estimated 28 critical and historic assets. The Town also identified additional critical facilities that may be impacted by hazards:

- Existing structures:
  - Two elementary schools, two high schools, one middle school, one college, 11 churches, Tree of Life Ministries, two grocery stores, three pharmacies, four gas stations, and one drug store.
- Infrastructure:

  - Elevated water storage with cellular devices attached, including emergency connectivity hardware and fiber optic networks.

- Critical facilities:
  - Town maintenance building, town hall, police station, wastewater plant, water plant, elevated water tower, and a water reservoir facility.
- Cultural and historical resources:
  - Bush Tabernacle Skating Rink, Carver Center, Loudoun County Community Center, and 11 churches.

Overlaying the critical facilities in the Town on the mapped flood zones indicates that there are no facilities in the 100- or 500-year floodplains. Map needs to be updated to include Mayfair and Woodgrove High School.



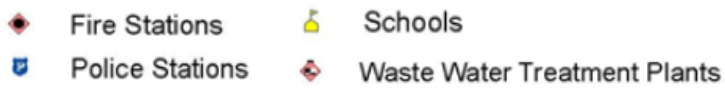


Figure 5: Town of Purcellville Critical Assets Located in the 100- and 500-Year Floodplain[12]

5.4. Natural Environment

Information about environmental vulnerability is presented in the hazard-specific sections of the Base Plan. Besides the county-level information, the Town noted several natural environment assets that may be impacted by specific hazards.

- The Town fosters tourism by promoting opportunities to walk and hike on its scenic trails. More specifically, the Parks and Recreation Department hosts a series of nature walks that are led by experts on the local environment, while the annual Purcellville Green Expo—called Hail to the Trail—focuses on a 10-acre area of old-growth forest in Town, running along the South Fork Catoctin Creek, part of the Chesapeake Bay Watershed.
- Other major attractions that serve central Virginia's outdoor enthusiasts include the Suzanne R. Kane Nature Preserve, historic Dillion's Woods adjacent to Fireman's Field, and the 100-foot-wide Washington & Old Dominion Railroad Regional Park (W&OD Trail). The latter features a 45-mile asphalt trail for walking, running, bicycling and other activities and a 30.5-mile, parallel, gravel bridle path for horseback riding and hiking. The W&OD Trail is managed by the Northern Virginia Regional Parks Authority, but the Town can boast that the trail terminus is in Purcellville.

These assets may be affected by flood, severe storms, winter weather, or tornados, all of which may damage the tree canopy and cause wires fall onto sensitive environmental areas and damage them.

5.5. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the Base Plan.

5.6. Cultural/Historical

In 2007, the Town of Purcellville Historic District was added to the National Register of Historic Places, a record maintained by the U.S. National Park Service, and Hazus identified two other locally designated landmarks. The first is Locust Grove, a historic home built in the early 19th century. The second site is the Purcellville Train Station, which is also listed on the National Register and on the Virginia Landmarks Register. It is the largest train station in Loudoun County, which is particularly noteworthy given the number of persons countywide who daily commute to Washington, DC, and other regional business hubs. This train station is merely a meeting room and restroom. Serves no transporting service.

Historic structures and sites and other types of facilities are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites while following historic preservation standards and guidelines.

Additional information related to the vulnerability of cultural and historical assets is presented in the hazard-specific sections of the Base Plan.

[12] Hazus 100- and 500-Year Flood Scenario Models, August 4, 2021.

5.7. New Hazard Risk Challenges or Obstacles

The Town of Purcellville Planning Committee identified the water reservoir and wells as specific assets that are vulnerable to future conditions related to climate change. In addition, the Town recognizes that the economy, population, and built environment may also be impacted by climate change in the future, depending on the degree of climate change that occurs. Changes to risk due to climate change should be monitored in the next planning cycle.

6. Capability Assessment

The Town of Purcellville reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed according to the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the Town of Purcellville participated in the Loudoun County Jurisdiction Needs Assessment that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction has limited capabilities within this category and is generally unable to implement most mitigation actions.

- **Low:** The jurisdiction has some capabilities within this category and can implement few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities within this category, but improvement is needed in order to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities within this category as demonstrated by its authorities, programs, plans and/or resources, and can implement most mitigation actions.

Table 14: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	Moderate
Administrative and Technical	High
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Low

6.1.1. Planning and Regulatory Capabilities Summary

The Town of Purcellville takes an all-hazards approach when developing any jurisdictional plans, including emergency operations, continuity of operations, and the hazard mitigation plan.

The following plans have been newly developed or updated since the 2017 *HMP*:

- *Plan Purcellville, a* Town of Purcellville comprehensive plan, adopted June 30, 2020
- *A Capital Improvement Plan*
- *Emergency Operations Plan (County)*
- *Continuity of Operations Plan*
- *Dam Emergency Action Plan*
- Updated FEMA Flood Insurance Rate Maps were recently developed (2/12/2017)
- Fire Department ISO Rating
- *Floodplain Overlay District Ordinance,* last amended 2/9/2017

Capability Analysis: Moderate

The Town of Purcellville is mindful of the need to develop plans, codes, and regulations that minimize the risk that hazard events will negatively affect people, property, the economy, and the environment. The town falls under the County's Emergency Operations Plan. The Town does not collect impact fees for new development. The Town identified the following areas for improvement in planning and regulatory capabilities:

- Amend the Town's Zoning Ordinance to implement all recommendations contained within Purcellville's adopted 2030 Comprehensive Plan that pertain to environmental management issues.

6.1.2. Administrative and Technical Capabilities Summary

The Town of Purcellville's Engineering, Planning, & Development Department has the following capabilities that can increase mitigation awareness, coordination, and implementation:

- Planner(s) and engineer(s) with knowledge of land development and land management practices.
- Engineer/professionals trained in construction practices related to buildings and/or infrastructure.
- Planners and engineer(s) with an understanding of natural and/or manmade hazards.
- Floodplain management.
- Personnel skilled in GIS and/or HAZUS.
- Grant writing.

The Town's Police Department employs staff with expertise in assessing the community's vulnerability to hazards. The Town Manager acts as the Emergency Manager. The Town's Administration Department also has grant writing capabilities, and the Town uses the county's warning systems.

Capability Analysis: High

The Town of Purcellville staff have a general understanding of natural and/or human-caused hazards and are trained in how to maintain current services for managing business, societal, and economic sectors. Current staffing levels allow the Town to fulfill basic hazard mitigation planning tasks.

The Town identified the following areas of improvement related to administrative and technical capabilities:

- Greater funding to increase staffing with specific skill sets matching specific job tasks.
- Provision of more training to current staff to better cross-train employees.
- Increase in staffing to ensure oversight of job duties pertaining to hazards.

6.1.3. Safe Growth Capabilities Summary

The Town of Purcellville addresses safe growth through a variety of methods, including funding new and improved infrastructure projects, levying taxes for specific purpose, and incurring debt through general obligation or special tax bonds. The Town's Comprehensive Plan and related ordinances include policies and guidance to cover or reinforce best practices in:

- Land Use
- Transportation
- Environmental Management
- Public Safety
- Zoning
- Subdivision Development
- Historic Preservation

Capability Analysis: Moderate

- Environmental policies maintain and restore protective ecosystems.
- Environmental policies provide incentives to develop only in locations outside protective ecosystems.
- Safety is explicitly included in *Plan Purcellville.*
- The Zoning Ordinance conforms to *Plan Purcellville* by discouraging development or redevelopment within natural hazard areas.
- The monitoring and implementation section of *Plan Purcellville* cover safe growth objectives.
- *Plan Purcellville* contains natural hazard overlay zones that set conditions for land use within such zones.
- Subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas.
- Regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources.
- Infrastructure policies limit the extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards.
- There is an adopted evacuation and shelter plan to deal with emergencies from natural hazards.

6.1.4. Financial Capabilities Summary

The Town of Purcellville has the capability to take advantage of financial mechanisms to generate funding for current and future opportunities.

- Capital Improvements Project (CIP) funding
- Authority to levy taxes for specific purposes
- Fees for water, stormwater, and sewer services
- Impact fees for new development
- Incur debt through general obligation bonds and/or special tax bonds
- Federal funding, including the Community Development Block Grant
- State funding

Capability Analysis: Moderate

While the Town of Purcellville makes the best use of its current finance capabilities, it may look forward to identifying new funding opportunities, including the use of federal grants from FEMA and other agencies. Previously, the Town has used the following funding resources for mitigation projects:

- CIP funding to build a stormwater collection system and repair the Hirst Dam intake structure.
- Fees for water and sewer services have been used to increase the size of small-diameter water lines.
- Federal funds for COVID-19 operations and relief, removal of in-ground fuel tanks, and reimbursement for weather-related events. The Town is currently using American Rescue Plan Act (ARPA) funds to recover from the pandemic.

- State funds have been used in the form of Virginia Department of Transportation (VDOT) revenue sharing and State of Virginia Stormwater Local Assistance Fund (SLAF) monies for stormwater projects.

The Town identified a need for dedicated staffing to implement efforts to expand financial capabilities.

6.1.5. Education and Outreach Capabilities Summary

The Town of Purcellville has local citizen groups that can assist in shelter and feed community members during disaster situations. However, these groups cannot be used to implement future mitigation activities. The Town currently provides publications to residents, utilizes social media, and news distribution regarding public education that could be used to promote and disseminate hazard mitigation information to residents.

Capability Analysis: Low

The Town of Purcellville is well positioned to coordinate with Loudoun County and other jurisdictions to build on its current education and outreach programs to promote hazard awareness and mitigation efforts that can be practiced by businesses, community groups, individuals, households, and other stakeholders. The array of print, web-based, and broadcast media available to the jurisdiction presents multiple opportunities to create community awareness about hazards and their impacts on the community. The Town identified a means of expanding and improving its education and outreach capabilities through continued partnership with community groups, information sharing with residents, and dedicated staff and funding specifically for these efforts.

7. Resilience to Hazards

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of “low risk” is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience. The NRI assessment was conducted at the county level and is presented in **Annex 8, Loudoun County**.

7.1. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

The Town of Purcellville identified hazard risk challenges and/or obstacles that will need to be monitored in the next plan:

- Climate change

7.2. Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household-level risk factors. The CRE was also conducted at the county level and is presented in **Annex 8, Loudoun County**.

8. Mitigation Actions

8.1. Goals and Objectives

The Town of Purcellville Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

The Town of Purcellville monitors actions and tracks progress through the periodic review, evaluation, revision, and update of the NOVA HMP. Some projects that contribute to risk reduction have been completed or are currently in progress, but have not been included in this plan for one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and the resulting risk reduction.

The Town of Purcellville Mitigation Actions list includes previously identified actions from the 2006, 2010, and 2017 plans. The Town did not provide the current statuses of these actions.

8.3. New Mitigation Actions

The Town of Purcellville identified one new mitigation action that will be implemented in the next planning cycle. The proposed action addresses risks consistent with the jurisdiction's highest-ranked hazards of winter storm, high wind/severe storm, and flood/flash flood.

Attachment 3 of this annex includes a table that summarizes each new and continued action, describing the proposed activity, priority level, estimated cost, and lead agency.

8.4. Action Plan for Implementation and Integration

The Town of Purcellville Chief of Police is responsible for coordinating the implementation of the hazard mitigation activities. They will monitor the implementation of the jurisdiction's actions and participate in the implementation of the multi-jurisdictional regional plan, as related to the Town. Tasks to ensure that the Town's actions are implemented are integrated into the *Action Plan for Implementation and Integration* (which includes the prioritized list of Mitigation Actions) and the plan maintenance procedures described in the next section. The Action Plan for Implementation and Integration describes how the Town's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 15: Action Plan for Implementation and Integration, Town of Purcellville

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plan	Mitigation goals will be considered during the next comprehensive plan update.
Review/update land development regulations for consistency with mitigation goals	Mitigation goals will be considered during the 2022 zoning code updates.
Review/update emergency plans to address evacuation and sheltering	The Town will seek funding to engage a consultant to upgrade and update current emergency plans.
Maintain ongoing enforcement of existing policies	Conduct the annual Town of Purcellville Jurisdictional Annex review to ensure policies are continually enforced and mitigation actions carried out. Town staff will self-police and strive for excellence.
Monitor funding opportunities	Seek approval to expand staff capabilities, specifically to engage a grant writer and manager and to monitor funding opportunities to fund this position.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 16: Town of Purcellville Plan Maintenance Responsibilities for the *Northern Virginia Hazard Mitigation Plan*, Base Plan

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction, in coordination with Loudoun County, during the monitoring process. • Collect, analyze, and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction, in coordination with Loudoun County, during the evaluation process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction, in coordination with Loudoun County, during the planning cycle, including plan review, revision, and update process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP, Base Plan**, the Town of Purcellville Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**. The Town's maintenance method and schedule may coincide with that of Loudoun County and hence be conducted simultaneously.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in fifth year.

Table 17: Town of Purcellville Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with jurisdiction planning team. 2. Review the status of all mitigation actions, using the *Mitigation Action Implementation Worksheet* (**Section 3, Attachment A, NOVA HMP Base Plan**).	• Coordinate with the County to produce an annual report that includes the following: • Provide status update of the Town's mitigation actions • Summary of any changes in hazard risk or vulnerabilities and capabilities relevant to the town. • Summarize activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	1. Schedule the annual plan evaluation with jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities and hazard mitigation capabilities using the *Planning Considerations Worksheet* (**Section 3, Attachment C, NOVA HMP Base Plan**).	Work with Loudoun County to submit the annual report to the NOVA HMP Project Team Point of Contact
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	Adopt the FEMA-approved plan every five years to maintain the jurisdiction's eligibility for federal post-disaster funding.

Mitigation actions presented in the Town of Purcellville Jurisdiction Annex may be reviewed, revised, and updated at any time. The Town of Purcellville will continue to be a planning partner with Loudoun County and other county jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan.

10. Annex Adoption

The Town of Purcellville Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation Plan*.

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Action Worksheets

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Documentation of Public Participation

The Town of Purcellville's public participation and feedback opportunities were included in Loudoun County's outreach efforts.

News item published in the *Loudoun Now* newspaper:

A Loudoun County Fire-Rescue technical rescue crew trains at the Panda Stonewall Energy Center in the fog Thursday, Oct. 22. [Renss Greene/ Loudoun Now]

Loudoun Residents Asked to Take Hazard Survey

2021-08-20 Loudoun Now

County officials are encouraging Loudoun residents and business owners to help build community resilience to disasters by participating in the Northern Virginia Hazard Mitigation Survey.
Loudoun County and its towns are part of a regionwide effort to update the Northern Virginia Hazard Mitigation Plan. The plan identifies strategies for reducing or eliminating loss of life, injury, and property damage caused by disasters as well as the long-term risks that result from hazards such as floods, severe storms, tornadoes, wildfires, and winter weather.

In addition to preventing loss of life, injury and damage to buildings and infrastructure, hazard mitigation can prevent damage to a community's economic, social, and environmental well-being.

The survey asks questions about natural hazards they are concerned about or have directly experienced in the past five years, as well as for opinions on proposed mitigation strategies. The survey is open through Sept. 15 and is online at surveymonkey.com/r/NorthernVirginiaHazardMitigationSurvey.

Loudoun County Press Release

For Immediate Release Media Contact: Glen Barbour, Public Affairs and Communications Officer
August 17, 2021, 703-771-5086, Glen.Barbour@loudoun.gov

Community Encouraged to Participate in Regional Hazard Mitigation Survey

Residents and business owners in Loudoun County are encouraged to help build community resilience to disasters by participating in the Northern Virginia Hazard Mitigation Survey.

Loudoun County and the incorporated towns of Hamilton, Hillsboro, Leesburg, Lovettsville, Middleburg, Purcellville and Round Hill are part of a regionwide effort to update the Northern Virginia Hazard Mitigation Plan. The plan identifies strategies for reducing or eliminating loss of life, injury, and property damage caused by disasters as well as the long-term risks that result from hazards such as floods, severe storms, tornadoes, wildfires and winter weather.

In addition to preventing loss of life and injury and damage to buildings and infrastructure, hazard mitigation can prevent damage to a community's economic, social and environmental well-being.

Members of the community can participate in the mitigation planning process by answering questions about natural hazards they are concerned about or have directly experienced in the past five years. The survey also asks for opinions on proposed mitigation strategies.

The brief survey is available online and is open through September 15, 2021.

###

11.3. Attachment 3: Mitigation Action Worksheets

The actions presented here were included in the 2017 Northern Virginia Hazard Mitigation Plan. The Town of Purcellville Mitigation Planning Team reviewed all actions to determine whether they were completed, no longer relevant, or moved forward and included in the 2022 Plan.

Table 18: Previous Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status
2006-4	Assess the roadway structure at various intersections throughout the Town of Purcellville to avoid repeated flooding.	Public Works	• Flood • High Wind • Severe Storm	Hazard Mitigation Assistance grant funding, County funding	Ongoing	Identify funding sources as an ongoing process to remedy and maintain issues identified	Medium	No	Complete
2010-2	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.	Engineering, Planning and Development	• Flood • High Wind • Severe Storm	FEMA Unified Hazard Mitigation Assistance funding for qualified structures	Ongoing	Work w/community to ensure education & outreach materials for dissemination. Continual community education.	Medium	No	Ongoing

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status
2010-3	Support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.	Engineering, Planning and Development	• Flood • High Wind • Severe Storm	FEMA Unified Hazard Mitigation Assistance funding for qualified structures	Ongoing	Continue identifying all priority flood prone structures & environment & climate changes. Develop a permit application that includes mitigation measures.	Medium	No	Ongoing
2010-4	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade electrical panels to accept generators, etc.	Engineering, Planning and Development	• Flood • High Wind • Severe Storm	FEMA Unified Hazard Mitigation Assistance funding for qualified structures	Ongoing	Query local government building services staff about the effectiveness of the information provided regarding the structural review	Medium	No known hazards at this time	Routinely evaluated as part of development/review process

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status
2010-5	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. In addition, conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will verify the location of each repetitive loss property and determine whether that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.	Engineering, Planning and Development	• Flood • High Wind • Severe Storm	FEMA Unified Hazard Mitigation Assistance funding for qualified structures	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review	Medium	No	Updated flood plan ordinance adopted in 2012 to match state requirements
2010-6	Develop a drought preparedness and response plan, mitigate water shortages. Identifying water shortages. Identifying additional water resources.	Town Manager	• Drought	General Funds, FEMA Unified Hazard Mitigation Assistance Funding	Ongoing	Research and identify applicable funding mechanisms to develop the plan.	Medium	Mitigation strategies include mandatory water restrictions, enhanced use of alternate water sources, and	Water Emergency Ordinance – Town Code Article IV. Emergency Response Plan completed

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status
								continued development of water redundancy. Long-term capital improvement projects identified to support these activities	Dec 2021per requirements of the American Water Infrastructure Act. CIP projects in progress.
2017-01	Update and Refine Continuity of Operations Plan (COOP) for Government Operations.	Town Manager	• Earthquake • Flood • High Wind • Severe Weather • Tornado • Winter Weather	General Funds, FEMA Unified Hazard Mitigation Assistance Funding	July 2023	Identify key resources, most critical operations to assist in preparing the plan	High	No	Updating plan
2017-02	Determine feasibility of redundancy of internet services and direct TLS between facilities.	Information Technology	• Earthquake • Flood • High Wind • Severe Weather • Tornado • Winter Weather	General Funds, Rural Broadband Grants, FCC Operations	July 2023	Identify opportunities to gain wireless spectrum and connection to County Facilities	High	No	Unknown

Table 19: New Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
	Continual assessment and training on the J.T. Hirst Reservoir Dam to ensure that an updated EAP remains on file. The EAP is reviewed annually, and tabletop exercises are conducted periodically as staff turnover occurs.	Public Works	All Hazards	General Fund, DCR grant funding, hazard mitigation funding.	Ongoing	Identify funding for continual tabletop exercises with affected jurisdictions, educational material developed for property owners within potential flooding area.	Medium	Tabletop exercise completed December 2020

Northern Virginia Hazard Mitigation Plan

Annex 8-E: Town of Round Hill

November 2022

Town of Round Hill Overview

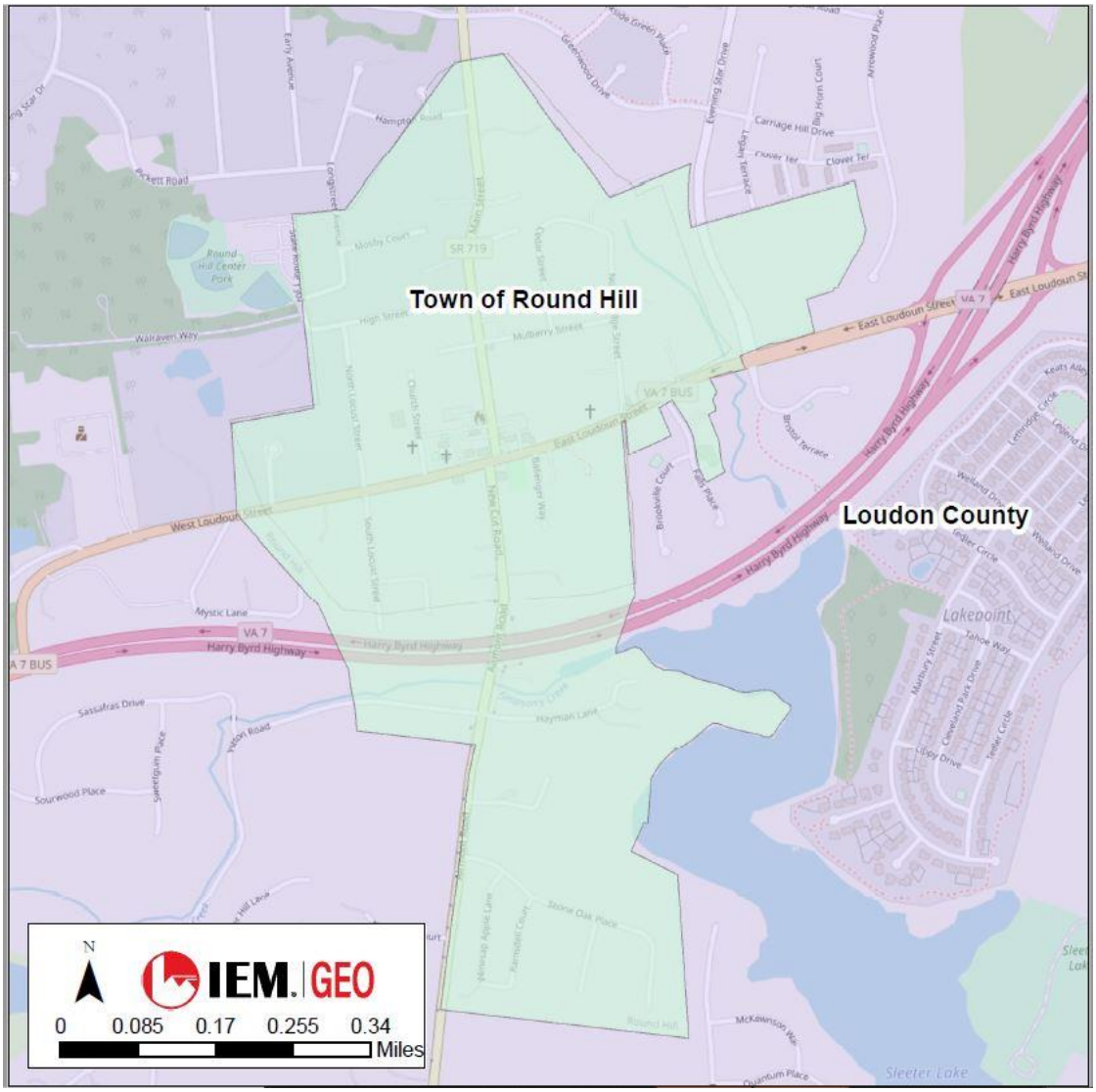


Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1900	0.4 sq. mi.	693	23 Main Street, Round Hill, VA 20141	291	Winter weather, High Wind/ Severe Storm, Flood/ Flash Flood

Town of Round Hill Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

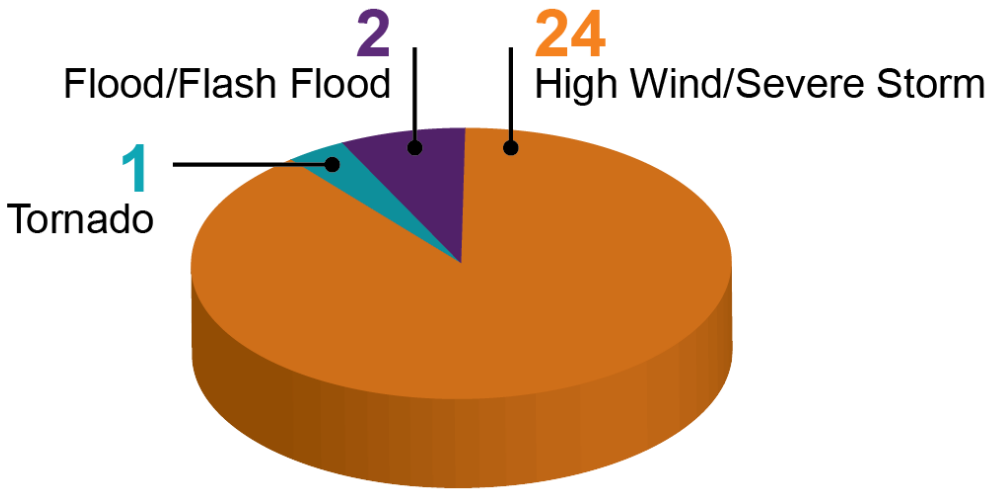


Figure 1: Number of Hazards

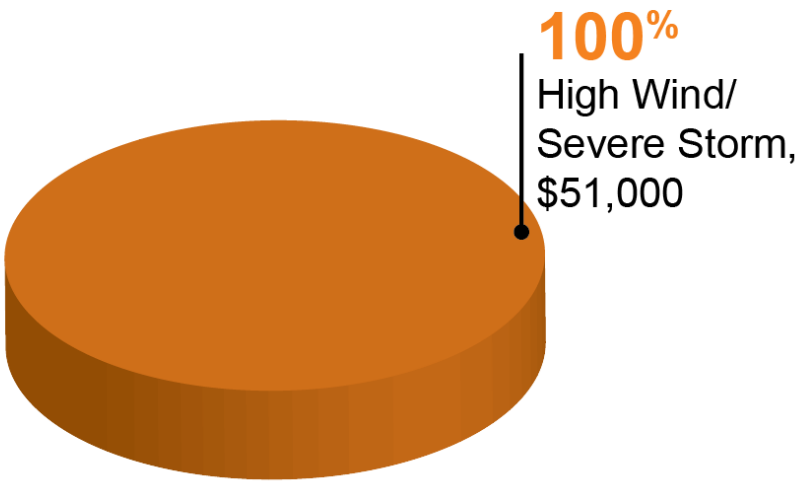


Figure 2: Property Damage Costs from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Natural Hazard Risk Ranking Summary

Hazard	Hazard Ranking
Winter Weather	**High**
High Wind/Severe Storm	**High**
Flood/Flash Flood	**High**
Tornado	**High**
Dam Failure	**Medium**
Drought	**Medium**
Extreme Temperatures	**Medium**
Earthquake	**Medium**
Landslide	**Low**
Wildfire	**Low**
Karst/Sinkhole/Land Subsidence	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines

Lifelines	Number of Assets
Safety and Security	2
Food, Water, Shelter	2
Health and Medical	0
Energy	0
Communications	0
Transportation	0
Hazardous Materials	0
Education	1
Cultural/Historical	1

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for the Town of Round Hill

Capability	Ranking
Planning and Regulatory	Low
Administrative and Technical	Moderate
Safe Growth	Moderate
Financial	Low
Education and Outreach	Low

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Melissa Hynes, Town Administrator Town of Round Hill 540-338-7878 mhynes@roundhillva.org 23 Main Street Round Hill, VA 20142
Secondary Point of Contact	Marty Feltner, Utility Supervisor Town of Round Hill 540-338-7878 mfeltner@roundhillva.org 23 Main Street Round Hill, VA 20142

Town of Round Hill

This annex presents the following jurisdiction-specific information provided by the town for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*. The information was provided by the Town of Round Hill and, where municipal-level data were unavailable, by Loudoun County and other available resources*:*

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1. Jurisdiction Profile

Established	1900
Total Land Area	0.37 square miles
Geographic Region	Piedmont
Persons Per Household	2.76
Persons Per Square Mile	1,732
Median Age	41.6
Elevations	Near sea level – 548 feet

1.1. Location

Located in the northeast region of the Commonwealth of Virginia, Loudoun County, including the Town of Round Hill, is part of the suburban ring of Washington, D.C. The county is partially bounded on the north by the Potomac River. Directly across the river are three Maryland counties: Frederick, Montgomery, and Washington.

Loudoun County is bounded on the east by Fairfax County; on the south by Prince William and Fauquier Counties, and to the west by Clarke County (VA), Jefferson County (WVA), and the Blue Ridge Mountain watershed. The Bull Run Mountains and Catoctin Mountain bisect the county. To the west of the range is the Loudoun Valley. Short Hill Mountain bisects the Loudoun Valley from Hillsboro to the Potomac River.

1.2. History

Round Hill is a town in Loudoun County, Virginia, United States. The Town is located at the crossroads of Virginia Routes 7 and 719 (Woodgrove Road), approximately 50 miles northwest of Washington, D.C. It was named “Round Hill” for being two miles northeast of a 910-foot hill used during the American Civil War as a signal post by both Confederate and Union troops.

Round Hill was incorporated on February 5, 1900. From 1874 to 1900, the settlement served as the terminus of a Washington and Ohio rail line that ultimately became the Washington and Old Dominion Railroad. The railway enabled agricultural products to be brought into Washington, D.C., and allowed the residents of the District to escape to the surrounding countryside for holidays. Many of the Town’s older residences were originally boarding houses, inns, and taverns in which people would stay. The Town was considered a convenient destination as it lies close to the Shenandoah River, the Shenandoah National Park, the Appalachian Trail, Harpers Ferry, the Chesapeake and Ohio Canal Tow Path (used currently as a bike trail), and the paved Washington & Old Dominion Railroad Trail.

Due to its location on both the Virginia Piedmont near the Potomac River and its mountainous western region, the county, including the Town of Round Hill, experiences weather of all types, thus increasing the area’s vulnerability to a range of hazards, most notably flooding and severe storms. Additionally, severe winter weather poses significant threats, as evidenced during the 2015–2016 winter season, when snow levels in late January reached between 23 and 31 inches across the county, and ice and blizzard-related wind conditions impacted travel and caused power outages and property damage.

1.3. Demographics, Economy, and Governance

The Northern Virginia regional profile is presented in **Section 1, Base Plan** to provide a context for the entire plan.

Table 6: Demographics, Economy, and Governance in the Town of Round Hill[1]

Demographics	Economy	Town Governance
Population • 2010 population: 539 • 2020 population: 693 (18.55% increase since 2010)	• **Median household income (2021):** $97,500 • **Unemployment rate (June 2021):** 3.6% • **Per capita income (2019):** $50,668 • **Median house market value (2021):** $416,200 • **Percentage below the poverty line (2021):** 3%	• Mayor • Vice-Mayor • Town Council: five members • Town Administrator • Utility Supervisor

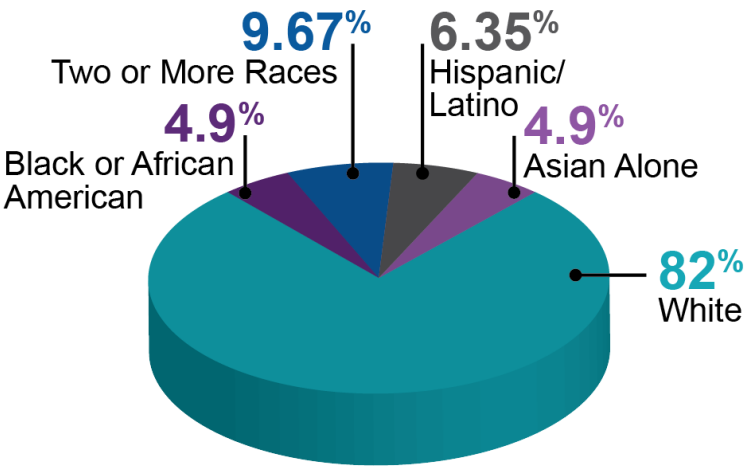

Figure 4: Race and Ethnicity Demographics

1.4. Built Environment and Community Lifelines

The information presented in this section regarding Community Lifelines and critical assets in the Town of Round Hill has been collected from multiple sources, including Hazus–MH (Version 4.2), the Town participants in the NOVA HMP 2022 update planning process, and government websites. During the planning process, the Town submitted a list of 28 current and one future sites or structures that are considered critical assets.

Critical facility data extracted from the Hazus Level 1 assessment indicates that the Town has an estimated five critical and historic assets. Due to the time lag in collecting and verifying data, and the method of documenting location and jurisdiction used in Hazus, this does not reflect the current inventory maintained by the Town.

[1] U.S. Census (1970–2020), City-Data (www.city-data.com), U.S. Census Bureau (www.census.gov), and Loudoun County (www.Loudouncounty.gov).

1.4.1. Safety and Security

Hazus data list one fire station located in the Town of Round Hill.

The Western Loudoun Sheriff Substation serves all Western Loudoun County. The Town of Round Hill does not have a police force.

1.4.2. Food, Water, Shelter

Access to food commodities is limited. The Town of Round Hill does not have a grocery store. The Town has two small convenience stores. The closest grocery store is 3 miles away in Purcellville, Virginia. In the event of a disaster, food commodity contracts must be secured.

The Town of Round Hill provides water and sewer service to 1,800 homes (about 4,000 residents). The Town of Round Hill has one wastewater treatment plant, four water treatment plants, twelve active wells, two water tanks and four sewage lift stations.

1.4.3. Health and Medical

While the Town of Round Hill does not have its own medical facilities, there are several facilities in the surrounding areas close to the Town. The closest hospital to the Town of Round Hill is 13 miles away in Leesburg, Virginia. The closest to urgent care to the Town of Round Hill is 3 miles away in Purcellville, Virginia.

1.4.4. Energy

There are no natural gas or power plants located in the Town of Round Hill according to Hazus.

1.4.5. Communications

According to Hazus, the Town's broadcasting abilities and all of its other communication needs come from the county.

The Evening Star Water Tank has three major cell phone carriers' antenna which provide service to the surrounding area. If something happens to the Evening Star Water Tank to interrupt cell service, the community will lose cell service.

1.4.6. Transportation

The Town of Round Hill is served by VA-7 and Route 719. While these are not shown in the Hazus numbers, they are the major roadways in and out of the Town.

1.4.7. Hazardous Materials

There are no hazardous materials facilities or storage sites located in the Town of Round Hill.

1.4.8. Education

According to Hazus, there is one elementary school located in the town that serves the community.

1.4.9. Recreational, Cultural and Historic Sites, and Assets

There is one historical building, Woodgrove, located in the Town of Round Hill, according to Hazus. The house is listed on the Virginia Landmarks Register, National Register of Historic Places, and is registered with the National Park Service. The original section of the house was built in 1785.

The Town of Round Hill has 207 buildings listed in the National Register of Historic Places
The Town of Round Hill has 3 Town Parks: The Downtown Park (3 acres), Niels Poulsen Park (8 acres), Sleeter Lake Park (11 acres). The County owns one park, (Woodgrove Park) and one community building (Round Hill Aquatic Center).

1.5. Growth and Development Trends

The County's population grew at a slow rate in the 1970s. Until around 1990, the population was under 100,000, but since that time the growth rate has shifted from a relatively flat horizontal line to one that experienced growth spurts between each year from 2000 to the present, at which point the line becomes nearly vertical. The Town of Round Hill has also experienced a growth in population. From 2010 to 2020, the population grew 18.55% from 539 to 693.

Land development in the Town of Round Hill is monitored and controlled by the Mayor and Town Council of Round Hill. The Town of Round Hill has zoning authority in town limits. The Round Hill Joint Land Management Area is an area in which land development is jointly managed by the Town of Round Hill and Loudoun County. Compliance with Building Code is regulated and inspected at the county level.

The Joint Land Management Area (JLMA) is located along the Round Hill town boundary lines. This area is served by town water and sewer but located out of town limits. 82% of the Town Water & Sewer customers are outside of the town limits (in the JLMA). About 1,500 new homes were built in the JLMA the past 20 years, adding almost 3,750 residents. There are about 50 more homes in the development pipeline to be built in the Joint Land Management Area to be completed before 2024. (For the purposes of this plan, one household is equivalent to 2.5 residents).

Round Hill is responsible for more than what is located within the Town boundaries, which becomes challenging when receiving funding or working with the federal or state government. For example, ARPA funding could have been used for water and sewer infrastructure improvements but ARPA funding was based on the Town's official population of 693 and not the Town's water and sewer service area population of 4,500 residents. This meant instead of receiving $4 million in ARPA funding, the Town only received $700,000.

This highlights the reason why a close relationship between the Town and County is key, working together to manage this area to ensure residents are served and there is a link between the people and the County. The outside of Town residents (in the JLMA) view the Town Office of Round Hill as their Point of Contact for general services or emergencies. The Town is not prepared for an emergency in which there is a spike of residents trying to call the main number with only one staff member answering.

Table 7: U.S. Census Bureau Milestone Population Counts for Loudoun County

Year	Population
1990	86,100
2000	315,500
2020	421,600

Loudoun County will continue to be a planning partner with local jurisdictions and regional entities so it can identify hazard mitigation opportunities that reduce risk. Projected growth trends should be monitored in the next planning cycle with the intention of providing a more detailed statistical analysis of vulnerable populations and how this could potentially impact hazard consequences and mitigation opportunities.

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the Town of Round Hill followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the NOVA HMP Planning Team, the Town supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction and in Loudoun County.

Table 8: Local Planning Group Participants

Name	Position/Title	Department/Agency
Harriet West	Town Clerk	Town of Round Hill
Melissa Hynes	Town Administrator	Town of Round Hill
Marty Feltner	Utility Supervisor	Town of Round Hill
Bobby Lohr	Town Planner	Town of Round Hill
Andrew Irvine	Emergency Preparedness Specialist	Loudoun County Office of Emergency Management

The chief hazard mitigation planning responsibility is representing the Town in coordination with the Loudoun County representative to the Emergency Manager's Planning Group. The Town also identified the following tasks as part of its mitigation planning responsibilities:

- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Public outreach activities
- Implementation of the Plan
- Maintaining the Plan

The Town of Round Hill planning participants coordinated primarily by means of virtual meetings during the planning process, and when necessary, by independently carrying out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a Public Hazard Survey, which was posted and advertised on the town's website and the Town's Facebook page. Additionally, the Town Clerk sent an email to residents to inform them of the availability of the survey and to encourage participation.

In addition to the survey, the public was offered the opportunity to review and provide input to the Draft 2022 Plan update. Notification of the Draft Plan release was made through the same mechanisms described above. Documentation of the public survey and draft plan review is included in **Attachment 2**.

3. Jurisdiction-Specific Hazard Event History

The Town of Round Hill's comprehensive hazard history is combined with that of Loudoun County when data are provided at the county level. Information such as this is described in **Sections 4 and 5, Base Plan**.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,132 recorded natural meteorological events that took place in Loudoun County between January 1, 1950, and May 2021. The county and its municipalities have been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 9: Federal Disaster and Emergency Declarations (2017–2021), Loudoun County

Declaration	Date	Hazard	Assistance Type
DR 4512	Apr. 2020	Virginia COVID-19 Pandemic	PA-B
EM 3448	Mar. 2020	Virginia COVID-19	PA-B
EM 3403	Sep. 2018	Virginia Hurricane Florence	PA-B

Annex 8, Tables 22 and 23 provide a summary of all high wind/severe storm and winter weather events that have occurred in Loudoun County between 1950 and May 31, 2021.

Table 10: Significant Hazard Events in the Town of Round Hill, 2017–2021

Date	Hazard	Event and Description
July 29, 2017	Flood/Flash Flood	A great rainstorm led to flooding, property damage, and road closures. Vehicle damage was reported at Bolingbrook Ct and E Colonial Hwy, and Greenwood and Main Street. Greenwood Rd and Main Street were closed, as were several other roads. There is a high probability that flooding will occur at this location again as this area has flooded since 2017. Its most recent flood occurred on August 7, 2020.

Figure 5: Flooding in the Town on August 7, 2020

4. Hazard Risk Ranking

After developing hazard profiles, the Town of Round Hill conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is calculated according to the following risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan.**

The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard subsections in **Section 5, Base Plan**, and local details are provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II** of this Plan.

Table 11: Hazard Risk Ranking Summary: Natural Hazards, Town of Round Hill

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.3	3.5	6.8	**High**
High Wind/Severe Storm	2.7	3.4	6.1	**High**
Flood/Flash Flood	1.7	4.1	5.7	**High**
Tornado	1.7	4.1	5.7	**High**
Dam Failure	1.0	4.4	5.4	**Medium**
Drought	2.0	3.2	5.2	**Medium**
Extreme Temperatures	2.3	2.7	5.0	**Medium**
Earthquake	1.7	3.2	4.9	**Medium**
Landslide	1.3	2.5	3.9	**Low**
Wildfire	1.0	2.8	3.8	**Low**
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	**Low**

Table 12: Hazard Risk Ranking Summary: Non-Natural Hazards, Town of Round Hill

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	2.0	5.3	7.3	**High**
Terrorism	1.0	6.1	7.1	**High**
Cyber Attack	1.7	4.7	6.4	**High**
Civil Unrest	1.0	4.9	5.9	**Medium**
Communication Disruption	1.3	3.7	5.0	**Medium**
Hazardous Materials	1.0	3.9	4.9	**Low**
Active Violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, the Town of Round Hill evaluated the level of risk for 18 hazards: 11 natural and seven non-natural hazards.

Eight natural hazards were identified as high- or medium-risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter weather, High Wind/Severe Storm, Flood/Flash Flood, and Tornado.
- **Medium:** Dam Failure, Drought, Extreme Temperatures, and Earthquake.

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, and Cyber Attack
- **Medium:** Civil Unrest and Communication Disruption

All other hazards are ranked as “low,” signifying a minimal risk to the Town of Round Hill.

4.1. Additional Hazard Risk Considerations

4.1.1. Non-Natural Hazards

Volume II of the *2022 Northern Virginia Hazard Mitigation Plan* addresses non-natural hazards identified by the Town.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impacts and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

Annex 8, Loudoun County includes a statistical compilation of the number of events and related impacts for the two highest-ranked hazards for the Town: winter weather and high wind/severe storm.

5.1. National Flood Insurance Program

The Town of Round Hill participates in the National Flood Insurance Program (NFIP).

Table 13: National Flood Insurance Program Status, Town of Round Hill

Init FHBM Identified	05/13/1977
Init FIRM Identified	07/05/01
Current Effective Map Date	07/05/01
Reg-Emer Date	01/10/06

Table 14: NFIP Status, as of September 13, 2021

Category	NFIP Topic	Source of Information	Comments
Insurance	How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator, FEMA NFIP Specialist, community records	None
Insurance	How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	EMA NFIP or Insurance Specialist	None
Insurance	How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA)	5
Insurance	Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	Unknown
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	No

Category	NFIP Topic	Source of Information	Comments
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	Yes
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	Permit review, education, outreach, inspections (town staff) and engineering (contractor).
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	None
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Compliance History	Are there any outstanding compliance issues (i.e., current violations)?		No
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		Unknown

Other hazard information for the Town of Round Hill is presented in the **Base Plan**.

5.2. Population

Estimates of the number of residents in the Town of Round Hill vulnerable to each hazard are presented in the various hazard sections in the **Base Plan**.

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations using county-based data.

5.3. Built Environment and Community Lifelines and Assets

Using the best Hazus data available, scenarios were run at the county level for earthquake, flood, and hurricane wind to determine the potential exposure of buildings, infrastructure, and the economy. Information presented in **Annex 8, Loudoun County** includes the Town of Round Hill.

Critical facility data extracted from the Hazus Level 1 assessment indicates that the Town has an estimated five critical and historic assets. In addition, the Town provided a list of critical town assets that identifies 28 current assets and one future asset.

Table 15: Current and Future Critical Town Assets

#	Site Name	Site Address
1	Wastewater Treatment Buildings	Rt. 791, 17749 Lakefield Rd
2	Town Office	23 Main Street
3	Rt. 7 Lift Station	35926 Newberry Crossing Place
4	Rt. 719 Well (wellhouse)	59 Main Street
5	Rt. 719 Lift Station	17656 Airmont Rd
6	Stoneleigh Well House (Cottage)	35279 Prestwick Ct
7	Well #2 (Stoneleigh)	Stoneleigh Subdivision
8	Well #2A (Stoneleigh)	Stoneleigh Subdivision
9	Well #2C (Stoneleigh)	Stoneleigh Subdivision
10	Stoneleigh Water Tank	18037 Clendenning Circle
11	Scotland Heights Reservoir	Scotland Heights Road (Structure no longer exists. Property only w/ easement access)
12	Well 22A	Bell Road (ESWF)
13	Well 21NA	Beside 17126 Greenwood Dr (ESWF)
14	Evening Star Water Facility	17144 Evening Star Drive
15	Evening Star Lift Station	17144 Evening Star Drive (Used only for ESWF)
16	Evening Star Water Tank	17144 Evening Star Drive
17	Goose Creek Water Facility	35926 Newberry Crossing Place
18	Town Park (Loudoun St Park)	3 East Loudoun
19	Sleeter Lake Park	17749 Lakefield Rd
20	West Lake Water Facility	17925 Ridgewood Place
21	Well 7A	17925 Ridgewood Place (WLWF)
22	Well 7B	17925 Ridgewood Place (WLWF)
23	Well 12	35600 Sassafras Dr (WLWF)
24	Well 21SA	35926 Newberry Crossing Place (GCWF)
25	Well 21SB	35926 Newberry Crossing Place (GCWF)
26	West Lakes Lift Station	17925 Ridgewood Place
27	Upper Lakes Lift Station	Sweetgum Place (Bluffs Subdivision)
28	Niels Poulson Park	Greenwood Drive (Brentwood Springs)

Overlaying the critical facilities in the Town on the mapped flood zones indicates that there are no facilities in the 100- or 500-year floodplains.

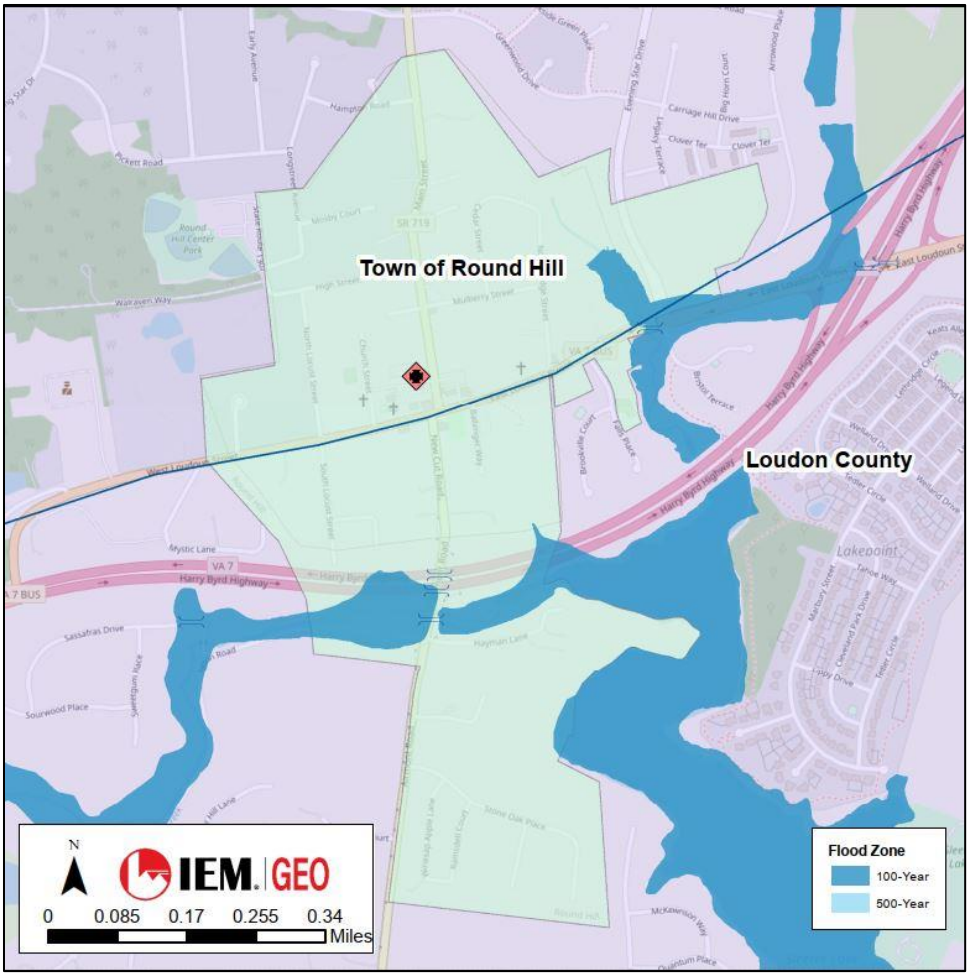

Figure 6: Town of Round Hill Critical Assets Located in a Flood Zone

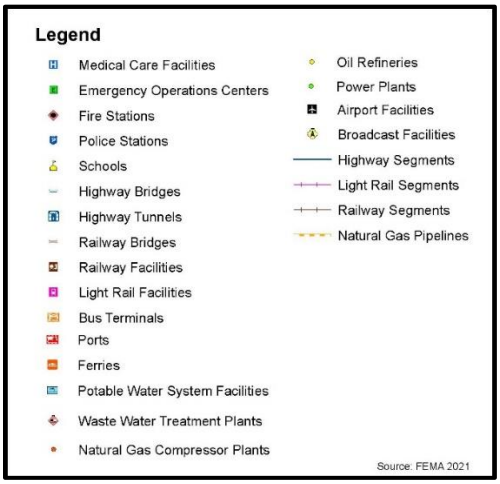

Figure 7: Map Legend for Figure 6 – Town of Round Hill Critical Assets Located in a Flood Zone

5.4. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

5.5. Economy

Information related to economic vulnerability is presented in the hazard sections of the **Base Plan**.

5.6. Cultural/Historical

Information related to cultural and historical structures is presented in the hazard sections of the **Base Plan**.

6. Capability Assessment

The Town of Round Hill reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

6.1. Capabilities Assessment Summary, Ranking, and Gap Analysis

The Town ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the Town's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction has limited capabilities within this category and is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities within this category and can implement few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities within this category, but improvement is needed in order to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities within this category as demonstrated by its authorities, programs, plans and/or resources, and can implement most mitigation actions.

Table 16: Capability Assessment Summary Ranking

Capability	Ranking
Planning and Regulatory	Low
Administrative and Technical	Moderate
Safe Growth	Moderate
Financial	Low
Education and Outreach	Low

6.1.1. Planning and Regulatory Capabilities Summary

The Town currently does not incorporate natural hazards into most plans or ordinances, except for stormwater management. The greatest issue facing the Town is stormwater management due to its older infrastructure and the increasing incidence of flooding. Goal 2, Objective C in the Town's Comprehensive Plan states that "community stormwater solutions should remain a critical capital improvement project need." Building codes are enforced at the county level, while the Town has a Zoning Administrator who enforces the Zoning Ordinance and the Subdivision/Land Development Ordinance. These two ordinances provide the regulations/requirements for site plans. Zoning, subdivision, and floodplain ordinances are in place.

The following plans and studies have been newly developed or updated since the previous HMP:

- Town of Round Hill Capital Improvement Plan
- Town of Round Hill 2017-2037 Comprehensive Plan
- Town of Round Hill Emergency Response Plan (Water & Sewer)

Capability Analysis: Low

The Town's plans and ordinances could be improved by adopting an all-hazards approach. This holistic approach can be incorporated when new plans and ordinances are written and when current documents and regulations are updated. The Town could also consider either creating an emergency operation plan or partnering with the county. A formalized continuity of operations plan can be very beneficial for any government or organization, as was demonstrated by the COVID-19 pandemic. Ordinances are currently executed are not effective for reducing hazard impacts. These policies should be reviewed to determine how they could help to reduce hazard impacts in the future.

6.1.2. Administrative and Technical Capabilities Summary

- The Town Administrator has grant writing and emergency management capabilities.
- The Town Clerk can utilize a warning system to alert residents and visitors of a hazard event.
- The Town has access to GIS personnel and planners or engineers with an understanding of natural and/or manmade hazards through a partnership with Loudoun County.
- Staff in the Planning and Zoning Department include a planner or engineer with knowledge of land development and land management practices and a floodplain manager.
- Subcontractor firms provide surveying staff and engineers, or professionals trained in construction practices related to buildings and/or infrastructure.
- The Town has adequate staffing for current operations.

Capability Analysis: Moderate

The Town has adequate staffing for current operations; however, this capability could be enhanced by ensuring all staff are integrated into mitigation planning efforts. In addition, coordinating more training about hazards is important for increasing staff awareness. The Town can fulfill basic hazard mitigation planning tasks by using internal staff, partnering with the county, or using outside contractors. Annual meetings with county staff to review hazard mitigation strategies and annual meetings with subcontractors to oversee hazard mitigation strategies also can increase this capability. Lastly, adding subcontractors or broadening the duties of staff to increase mitigation planning and implementation abilities could enhance this capability.

6.1.3. Safe Growth Capabilities Summary

- Land use policies discourage development or redevelopment in the natural hazard areas of the Town and policies provide adequate space for expected future growth in areas located outside natural hazard areas.
- The transportation plan does not limit access to hazard areas nor is it used to guide growth to safe locations; however, the transportation systems in the Town are designed to function under disaster conditions, specifically evacuations.
- The Town's environmental management policy specifically identifies areas in the Town that are protected and at risk. The policies were made to ensure the ecosystems of the Town stay protected and maintained, as well as to restore any ecosystems that have degraded over time.
- Zoning ordinances limit the rezoning of natural hazard areas and restrict the development and use of these areas. They also prohibit development in wetlands, floodways, and floodplains.
- The subdivision regulations of the Town restrict the subdivision of land within or adjacent to the hazard areas.
- The Capital Improvement Plan and infrastructure policies limit expenditures on projects that would encourage development in areas vulnerable to natural hazards and limit the extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards.
- Building codes contain provision to strengthen or elevate construction to withstand hazard forces.

Capability Analysis: Moderate

The Town of Round Hill has moderate safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and to protect the natural environment. These capabilities could be enhanced by offering incentives to develop outside protected ecosystems, incorporating NHMP projects into the Town's Comprehensive Plan, and the creation of safe growth transportation policies. The expansion of this capability is especially important if the Town's population continues to grow.

6.1.4. Financial Capabilities Summary

- The Town could use capital improvement funds, water and sewer user fees, general obligation bonds and/or special tax bonds, and federal and state funding programs to fund future mitigation actions.
- Currently, water and sewer user fees are used for utility maintenance and operations, while water and sewer availability fees are used for capital improvement projects.
- The Town is repaying a bond for building a wastewater treatment plant.

- The Town has used partial federal funding and a partnership with the Virginia Department of Transportation (VDOT) to pay for the construction of a new downtown stormwater system.

Capability Analysis: Low

The Town of Round Hill can use its financial sources for hazard mitigation. This capability could be enhanced by increasing the amount of money available through utilizing fees for stormwater capital projects and grant programs that can assist the Town in reducing risk in the future.

6.1.5. Education and Outreach Capabilities Summary

- The Town publicized the Public Survey for the NOVA HMP update process by posting information on its website and on its Facebook page.
- The Round Hill Outdoors Committee is focused on environmental protection and may be able assist with the implementation of future mitigation activities through the promotion of environmental protection and emergency preparedness.
- The Round Hill Volunteer Fire Department could help with emergency preparedness programs and activities.
- The Town of Round Hill promotes responsible water use and environmental education.
- The Town of Round Hill mails utility bills 6 times a year to 1,800 households. The Town uses this mailing for communicating with the public about relevant issues in the Town Newsletter. The Town could include an annual article to educate the public about the benefits of hazard mitigation.

Capability Analysis: Low

Jurisdictions have multiple opportunities to promote hazard mitigation and increase the involvement of stakeholders and the public. There is a critical need to inform additional stakeholders and the public about the benefits of hazard mitigation planning and implementation. This capability can be enhanced by partnering with Round Hill Elementary School for natural disaster or safety-related programs, obtaining a StormReady and Firewise Communities certification, and partnering with Loudoun County, the Volunteer Fire Department, and neighboring towns to increase access to educational and outreach tools and thereby reduce risk collaboratively.

7. Resilience to Hazards

7.1.1. National Risk Index

The National Risk Index (NRI) is a dataset and online tool developed by FEMA and other partners to identify communities in the United States at risk for 18 natural hazards. Hazard risk is calculated based on data for a single hazard type and reflects the relative risk for that hazard type and should be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently from the hazards in this plan, meaning that a direct hazard-to-hazard comparison of risk is not possible. The NRI is a county-level risk ranking, which includes the owns and is presented in **Annex 8, Loudoun County, Section 7.4**.

The NRI provides an overview of hazard risk, vulnerability, and resilience. The designation of “low risk” is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience. The Town of Round Hillis included in the Loudoun County NRI in **Annex 8, Loudoun County**.

7.2. Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household-level risk factors. The CRE was also conducted at the county level and is presented in **Annex 8: Loudoun County**.

7.3. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

The Town of Round Hill identified challenges and/or obstacles that need to be monitored in the next planning cycle:

- Climate change

8. Mitigation Actions

8.1. Goals and Objectives

The Town of Round Hill Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

The Town of Round Hill reviewed the mitigation actions in the 2017 NOVA HMP to identify the current status. Some projects that contribute to risk reduction may have been completed or are currently in progress, but they have not been included in this update for one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and resulting risk reduction.

8.3. New Mitigation Actions

In addition to the actions carried forward from previous plans, the Town of Round Hill identified five new mitigation actions that will be implemented in the next planning cycle. Proposed actions address risks consistent with the jurisdiction's highest risk hazards, severe winter weather, high wind/severe storm, and flood/flash flood, in addition to actions that address hazard mitigation education programs for all hazards. **Attachment 3** of this annex includes a table that lists the new mitigation actions for the Town of Round Hill.

8.4. Action Plan for Implementation and Integration

The Town of Round Hill Town Administrator is responsible for coordinating the implementation of the hazard mitigation activities. They will monitor the implementation of the jurisdiction's actions and participate in the implementation of the multi-jurisdictional regional plan, as related to the Town. Tasks to ensure that the Town's actions are implemented are integrated into the *Action Plan for Implementation and Integration* (which includes the prioritized list of Mitigation Actions) and plan maintenance procedures described in the next section. The Action Plan for Implementation and Integration describes how the Town's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 17: Action Plan for Implementation and Integration, Town of Round Hill

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plan.	When Round Hill's Comprehensive Plan undergoes its 5-year update, add mitigation action goals and action items into the plan, as applicable.
Review/update land development regulations for consistency with mitigation goals.	Review Town Subdivision & Land Development Ordinance and amend as applicable to meet mitigation goals.

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Review/update building/zoning codes for consistency with mitigation goals.	Review Town Zoning Ordinance and amend as applicable to meet mitigation goals. (The town falls under County Building & Development jurisdiction).
Maintain regulatory requirements of floodplain management program (NFIP).	Continue to maintain membership with the NFIP, enforce the Floodplain Ordinance, and follow NFIP best practices.
Continue public engagement in mitigation planning.	Continue holding events to educate public about mitigation planning efforts during National Preparedness Month.
Identify opportunities for mitigation education and outreach.	Reach out to local NGOs to learn about community outreach opportunities that may exist that we can join.
Review/update stormwater plans and procedures for consistency with mitigation goals.	Update Round Hill Stormwater Plan by 2025 to ensure consistent mitigation best practices and to reduce overall hazard risks.
Review/update emergency plans to address evacuation and sheltering.	Update Round Hill Emergency Plans by 2022 to address plans for evacuation and sheltering in the event of an emergency.
Maintain ongoing enforcement of existing policies.	Continue to enforce existing policies.
Monitor funding opportunities.	Continue to monitor for funding opportunities.
Incorporate goals and objectives into day-to-day government functions.	Increase frequency of tree trimming operations to minimize or eliminate the impacts of ice weighing down tree limbs and downing power lines. Meet with staff once a year to create annual checklist of other routine/simple mitigation strategies.
Incorporate goals into day-to-day development policies, reviews, and priorities.	Include a review of mitigation goals in the Annual Town Council Strategic Planning Meeting.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 18: Town of Round Hill Plan Maintenance Responsibilities for the *Northern Virginia Hazard Mitigation Plan*, Base Plan

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA HMP Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA HMP Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional plan reviews and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP, Base Plan**, the Town of Round Hill Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**. The Town's maintenance method and schedule may coincide with that of Loudoun County and be conducted simultaneously.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in fifth year

Table 19: Annex Maintenance Procedures

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with jurisdiction planning team. 2. Review the status of all mitigation actions, using the *Mitigation Action Implementation Worksheet* (**Section 3, Attachment A, NOVA HMP Base Plan**).	• Produce an annual report that includes the following: ▪ Status update of all mitigation actions ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities ▪ Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	1. Schedule the annual plan evaluation with jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities, as well as the hazard mitigation capabilities using the *Planning Considerations Worksheet* (**Section 3, Attachment C, NOVA HMP Base Plan**).	• Submit the annual report to the NOVA HMP Planning Team Point of Contact
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

Mitigation actions presented in the Town of Round Hill Jurisdiction Annex may be reviewed, revised, and updated at any time. The Town of Round Hill will continue to be a planning partner with Loudoun County and other county jurisdictions and regional entities to identify hazard mitigation opportunities that reduce the risks of the hazards identified in this plan.

10. Annex Adoption

The Town of Round Hill Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation Plan.*

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Action Worksheets

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Documentation of Public Participation

The Town of Round Hill promoted the Community Survey by posting it on its Facebook page and the town website, as well as by sending an email with a link to the survey. Screen shots of all three communications channels are included here.

Figure 8: Town of Round Hill Facebook Page

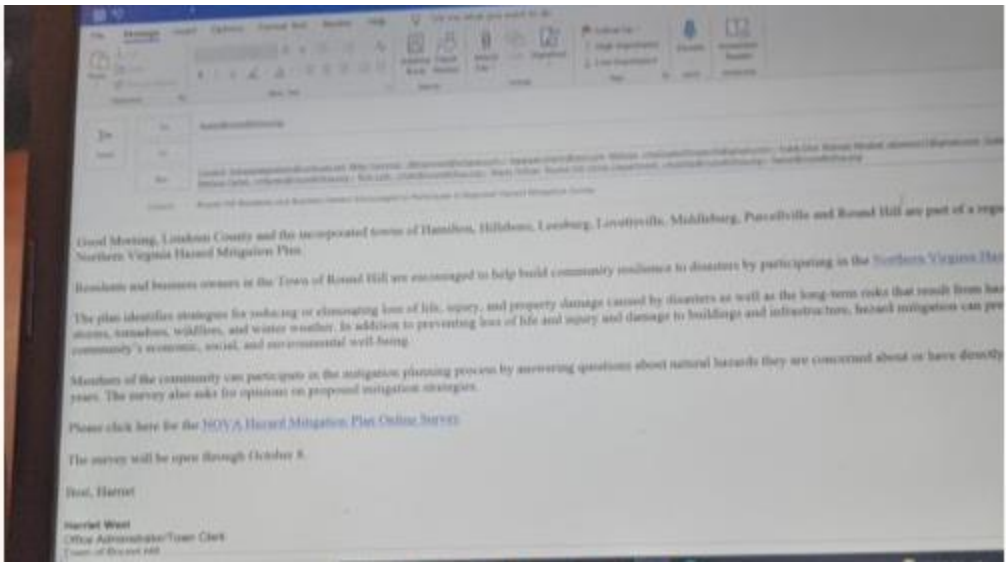

Figure 9: Town of Round Hill Email to Residents

Figure 10: Town of Round Hill Posting on the Town Website

11.3. Attachment 3: Mitigation Action

Table 20: Previous Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
2010-1	Identify the Town's Critical Infrastructure and develop a GIS layer.	Loudoun County Office of Emergency Management/Town of Round Hill Planning	• All Hazards	Local funding, DHS funding, Hazard Mitigation Grant Programs	In Progress	Secure funding	High	In progress. Hired a subcontractor to develop a complete Asset Management Plan, GIS System, and Tracking System that is available on mobile devices. Completion targeted for July 2022.	This is the first time a town-wide asset management plan/ database has been created. In the future, it will take less time to update/maintain.
2010-2	Implement drainage improvements in low-lying roadways.	Virginia Department of Transportation	• Dam Failure • Flood • High Wind • Severe Weather • Severe Winter Weather	DHS funding, Hazard Mitigation Grant Programs	In Progress	Secure funding	High	In progress. This has five phases. Phase 1 will be completed in January 2022. Phase 2 will begin in July 2023 (funding acquired, design begins soon). The other phases will each take three years to complete. The estimate total time to complete all phases is 15 years—2038 unless funding for a town-wide design becomes available.	Each phase costs about $3 million. This is why we broke it into phases.
2010-4	Establish and test emergency notification procedures and protocols for Town personnel.	Town of Round Hill	• All Hazards	Local Funding	In Progress	Allocate Funding	High	In progress. A basic plan was created in 2018. The town has hired a contractor to complete a new Emergency Plan with notification procedures/protocols by Dec 2021. This modern plan will establish full test emergency notification procedures and protocols for key government personnel, including emergency	This plan costs $30,000 and was built into our six-year CIP Plan. The basic plan was an internal document that did not cost anything beyond staff time.

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
								email groups, text-based alerts, and emergency call trees.	
2010-5	Develop and test a Continuity of Operations Plan (COOP).	Town of Round Hill/ Loudoun County Office of Emergency Management	• All Hazards	Local funding, DHS funding, Hazard Mitigation Grant Programs	Dec-18	Secure funding	High	In progress. A basic plan was put into place in 2020 for the Pandemic. The town is working to create a comprehensive COOP by December 2021, in parallel with the new Emergency Plan.	The town did not put the COOP into the FY2018 budget. A basic plan was put into place as the Town faced the pandemic. Staff have learned more about COOP planning since June 2020, and it plans to create a full plan in FY2021.
2010-6	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance mitigation measures, flood insurance information) that can assist them in reducing their flood risk.	Planning Commission	• Flood • High Wind • Severe Weather	FEMA Unified Hazard Mitigation Assistance Funding for qualified structures	Ongoing	Develop outreach materials or identify appropriate outreach materials for dissemination by June 2011.	Medium	Retain. This has not been worked on. It will be added to the FY2022 Work Plan. Preliminary work can commence in FY2021.	There are fewer than 10 properties in the floodplain, so this has not been a top priority. However, with more staff in the last three years, the Town has more capacity to complete low- to medium-priority projects.
2010-7	Support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation, flood proofing, minor localized flood control	Planning Commission	• Flood • High Wind • Severe Weather	FEMA Unified Hazard Mitigation Assistance Funding for qualified structures	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	Retain. This has not been worked on. It will be added to the FY2022 Work Plan. Preliminary work can commence in FY2021.	As mentioned in the previous action item. With less than 10 properties in the Floodplain or Flood Prone Areas, it has not been a top priority.

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
	projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.								Administration will pull any "flood" related action items listed in this chart into one workplan for FY2022.
2010-8	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	Planning Commission	• All Hazards	FEMA Unified Hazard Mitigation Assistance Funding for qualified structures	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review	Medium	In progress. In 2019, Virginia Risk Assessment Association preformed a risk assessment on critical town facilities and provided a report back on urgent items in need of improvement. These items have been incorporated into the Town CIP Plan, and several have been completed. The new Town Asset Management Plan & Database will help us find any additional items that require improvements.	
2010-9	Review locality's compliance with the National Flood Insurance Program (NFIP) with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Also, conduct an annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will verify the location of each	Planning Commission	• Flood • High Wind • Severe Weather	General Funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	Completed and ongoing. The Town of Round Hill adopted a new Floodplain Ordinance in late 2016, and it was declared to be in good standing with the NFIP as of February 2017. Prior to this the Town was not eligible for the NFIP.	

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Current Status	Comments to Justify Current Status
	repetitive loss property and determine whether that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.								
2010-9	Determine feasibility of developing a drought preparedness and response plan.	Town of Round Hill/ Loudoun County Office of Emergency Management	• Drought	General Funds, FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Research and identify applicable funding mechanisms to develop the plan.	Medium	Retain. This action item has been overlooked by previous administrators. The town hired a contractor to complete a risk assessment of the Town Water & Wastewater System in January 2021. It was completed in June 2021. Recommendations from this risk assessment include planning for droughts which will be included in the Emergency Response Plan that will be completed by December 2021.	

Table 21: New Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard(s)	Funding Source	Target Completion Date	Priority	Comments
2022-01	Town of Round Hill – Route 7 Bypass Pedestrian Tunnel.	Public Works	•	Capital Improvement Projects NVTA 30% local	7/1/2022	Medium	
2022-02	Provide back-up power (generators, where needed) for critical facilities (i.e., fire stations, police stations, water facilities, etc.).	Utility Department	• All Hazards	Utility Capital Improvement Projects Budget	7/1/2023	High	
2022-03	Variable Traffic Message Signs. The Town does not own any of these signs. For projects with advanced planning capabilities, the Town can borrow one from a neighboring jurisdiction. At least two variable message boards will be needed in a real emergency. This project will add several traffic message boards to the town's inventory. These boards are effective in the dissemination of information in the event of an emergency.	Public Works Department	• All Hazards	Split Town General Fund and Town Utility Fund Budgets	7/1/2023	Medium	Town Administration will recommend this purchase in the FY2023 Budget. It will be useful for both natural emergencies and utility emergencies.
2022-04	Practical Emergency Operations Training Exercise on a town wide basis for a natural disaster.	Town Administration	• All Hazards	Split Town General Fund and Town Utility Fund Budgets	7/1/2023	Medium	Town Administration will recommend this training in the FY2023 Budget. It will be useful for both natural emergencies and utility emergencies. If funding becomes available (or free training) Staff could complete this in FY2022. This could also include non-natural hazard training. Town Administration will recommend this document creation/printing in the FY2023 Budget. It will be useful for both natural emergencies and utility emergencies. If funding

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard(s)	Funding Source	Target Completion Date	Priority	Comments
							becomes available (or free materials) Staff could complete this in FY2022. This could also include non-natural hazard scenarios.
2022-05	Create a Town of Round Hill Citizen Guide to Emergency Preparedness. Mail to residents and post on the Web. Available to both in-town and out-of-town residents (total 1700 homes).	Town Administration	• All Hazards	Split Town General Fund and Town Utility Fund Budgets. For out-of-town residents (might ask for funding assistance from County)	7/1/2023	Medium	

Northern Virginia Hazard Mitigation Plan

Annex 17: Prince William County

November 2022

Prince William County Overview

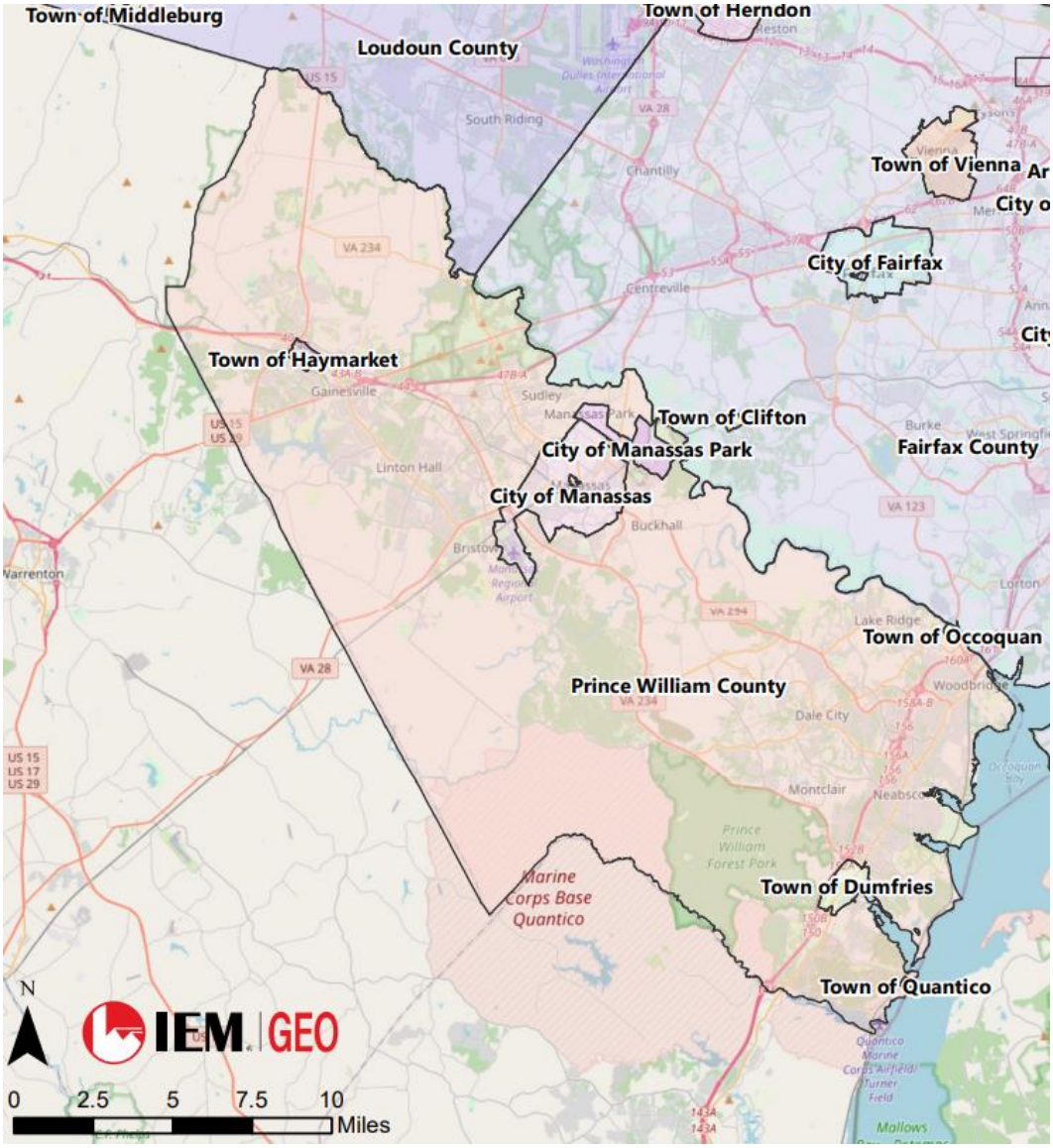

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1730	348 sq. mi.	482,204	1 County Complex Court, Prince William, VA 22192	158,525	Severe Storms, Flooding, and Winter Weather

Prince William County's Risk Environment

This overview is the basis for the details in this annex.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

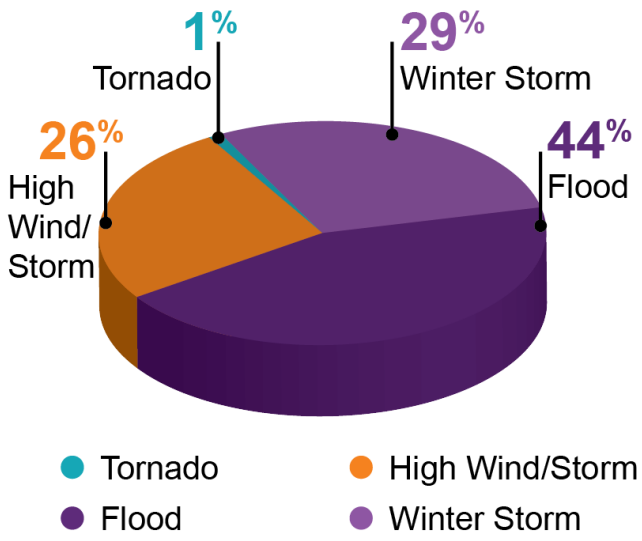

Figure 1: Percentage of Hazard Events

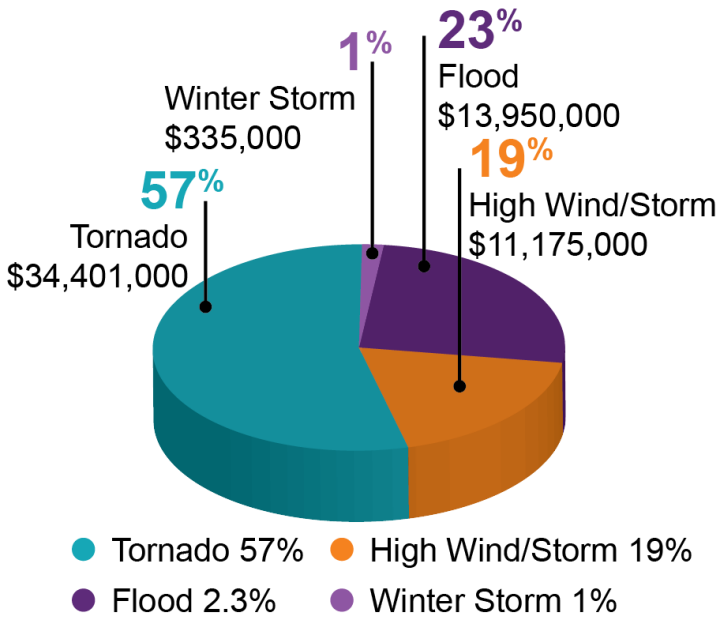

Figure 2: Property Damage Costs from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Ranking of Natural Hazards by Risk

Hazard	Hazard Ranking
High wind/severe storm	**High**
Winter weather	**High**
Flood/flash flood	**High**
Dam failure	**High**
Tornado	**Medium**
Earthquake	**Medium**
Drought	**Medium**
Extreme temperatures	**Medium**
Wildfire	**Low**
Landslide	**Low**
Karst/sinkhole/land subsidence	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	164
Food, Water, Shelter	96
Health and Medical	156
Energy	57
Communications	104
Transportation	732
Hazardous Materials	11
Education	147
Cultural/Historical	455
High and Significant Hazard Dams	19

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for Prince William County

Capability	Ranking
Planning and Regulatory	Moderate
Administrative and Technical	Moderate
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Katie Kitzmiller, Deputy Emergency Management Coordinator Office of Emergency Management 703-792-7047 KKitzmiller@pwcgov.org 3 County Complex Court Prince William, VA 22192
Secondary Point of Contact	Brian Misner, Emergency Management Coordinator Office of Emergency Management 703-792-5828 BMisner@pwcgov.org 3 County Complex Court Prince William, VA 22192

Prince William County

This annex presents the following jurisdiction-specific information provided by Prince William County for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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1. Jurisdiction Profile

Established	1730
Incorporated Towns	4
County Population	482,204
Total Land Area	348 square miles (336 on land, 12 on water)
Geographic Region	Piedmont/Coastal Plain
Persons Per Household	3.04
Persons Per Square Mile	1,435.13
Median Age	35.4 (as of 2020)

1.1. Location

Prince William County (PWC) is situated along the Potomac River approximately 25 miles southwest of the Washington, D.C., metropolitan area. It is the second most populous county in Virginia, just behind Fairfax County, with a population of 482,204.[1] Of its 347.33 square miles, PWC encompasses 11 square miles of water, including Lake Manassas to the north and Lake Montclair in the south, nine watershed areas, and 19 high and significant hazard dams. The entire county is considered a resource management area consisting of floodplains, highly eroded soils, and other sensitive areas adjacent to resource protection areas that comprise certain tidal and non-tidal wetlands and other lands considered necessary to protect the quality of Virginia waters.

1.2. History

In 1608, Captain John Smith and other English explorers arrive in what is now Prince William County on an expedition up the Potomac River. They found the region inhabited by Iroquois, Piscataway, Anacostans, and Doeg (an Algonquian-speaking sub-group of the Powhatan Tribal confederation). The documented name of the village that the Doeg Indians inhabited is *Pemacocack*, which means “plenty of fish” in the Algonquian language. This village was located on the west bank of the Potomac River, approximately 30 miles south of present-day Alexandria.

The first known colonial settlement was founded in 1722, and in 1730, the Virginia General Assembly allocated approximately 2,000 square miles of land from Stafford County and named it Prince William County in honor of the third son of King George II, Prince William Augustus, Duke of Cumberland. Prince William County originally included what later became Fairfax County (1742), Loudoun County (1757), Fauquier County (1759), and Arlington County (1801) and the cities of Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park.

[1] U.S. Census. (2020). QuickFacts. (https://www.census.gov/quickfacts/fact/table/princewilliamcountyvirginia,US/POP010220)

1.3. Demographics, Economy, and Governance

Prince William County's population is 482,204, according to the 2020 U.S. Census, which is an increase of 19.95% since 2010. The County is densely populated, with 1,435.13 residents per square mile. The following tables and figures help summarize PWC's demographic, economic, and governance characteristics, and provides details about the County's economy.

Table 6: Population and Growth Rate[2]

Year	Population	Percent Increase over Previous Census
1970	111,102	
1980	144,703	30.24%
1990	215,686	49.05%
2000	280,813	30.20%
2010	402,002	43.16%
2020	482,204*	19.95%

Note: *Institutionalized population: 1,437

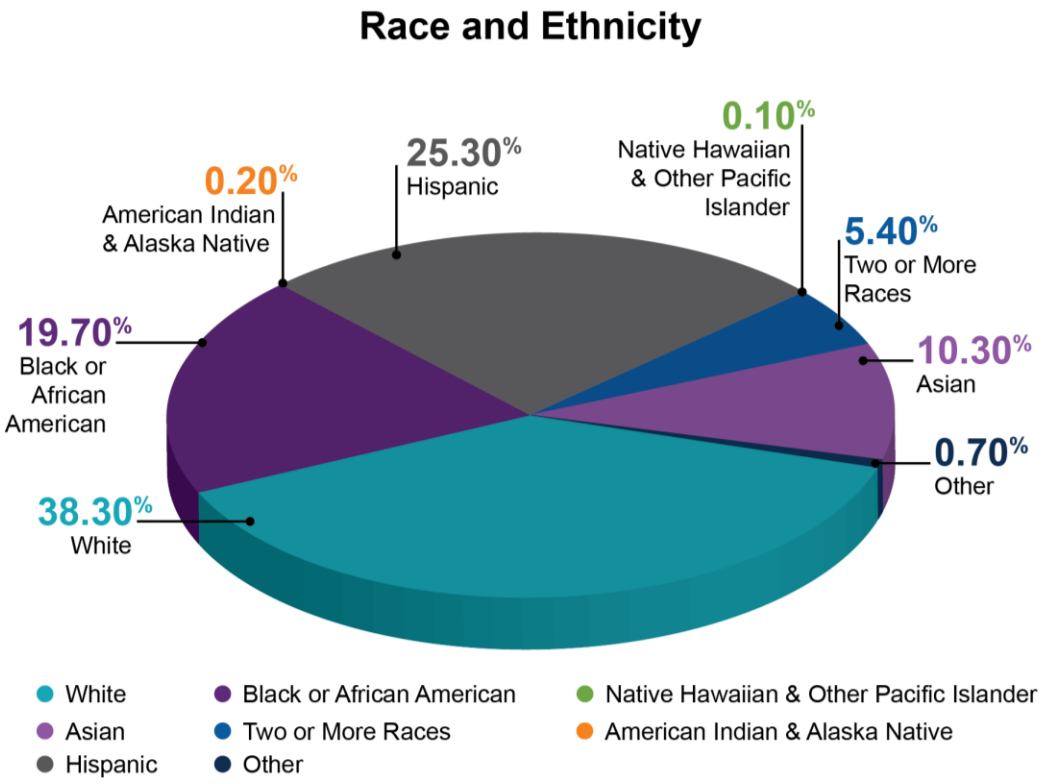


Figure 4: Race and Ethnicity Demographics from US Census

[2] U.S. Census (1970–2020), City-Data (www.city-data.com), U.S. Census Bureau (www.census.gov), and Prince William County (https://www.pwcva.gov/department/gis/2020-census)

Table 7: Economic Data[3][4]

Economy	Data
Median Household Income (in 2020 dollars) 2016–2020	$107,707
Unemployment Rate (June 2020)	9.2%
Per Capita Income (in 2020 dollars) 2016–2020	$42,298
Median House or Condo Market Value 2016-2020	$390,500
Percentage Below Poverty (2020)	4.9%
Number of Businesses (2019)	8,726

Prince William County is governed by the Board of County Supervisors (BOCS), which consists of representatives from seven magisterial districts and one at large representative who also serves at the Chair of the Board. The BOCS directly supervises the County Executive, who is responsible for managing the day-to-day operations of county government.

The County consistently ranks among the top 20 wealthiest counties in the country. Far fewer PWC residents and households have incomes below the poverty level than the national average (the percentage of PWC households below poverty is 6.1%; the national average is 11.4%). While trends indicate that the population as a whole experiences less poverty than the national average, several communities in PWC have significantly higher percentages than the national average.

Similarly, while far fewer residents obtain direct cash assistance, such as Temporary Assistance for Needy Families or Supplemental Nutrition Assistance Program (SNAP) benefits, than the national average, 7.8% of households in the County receive some form of SNAP benefits.[5]

Nearly 8% of County residents reported having a disability. While this is lower than the national average, it equates to more than 35,000 individuals. Nearly 30% of people 65 and older report having a disability. Older adults are also more likely to have chronic health conditions, thus increasing their disaster-related susceptibility. Aging may also correlate with difficulty in completing activities of daily living that include eating, bathing, dressing, toileting, transferring, walking, and continence. Understanding the overlapping and disparate needs of each generational group and the demographic subgroup in each group is vital to effective planning.

Eight of the top 25 employers are local, state, or federal government agencies, including schools and institutions of higher education. According to the Virginia Employment Commission, the following list are the top 11 largest employers in PWC:

1. Prince William County Schools – 10,000 – 15,000
2. US Marine Corps – 3,000-4,000
3. Prince William County Government – 5,000-6,000
4. Wal Mart – 1,000 – 2,000
5. Sentara Healthcare – 1,000-2,000

[3] https://www.census.gov/quickfacts/princewilliamcountyvirginia
[4] https://www.bls.gov/regions/mid-atlantic/news-release/unemployment_washingtondc.htm
[5] Virginia Department of Social Services (2021). SNAP Participation Reports. (https://www.dss.virginia.gov/geninfo/reports/financial_assistance/snap_participation.cgi)

6. The Fishel Co. – 500-1,000
7. Temporary Solutions Inc. – 500-1,000
8. Target Corp – 500-1,000
9. Northern Virginia Community College – 500-1,000
10. Ruppert Landscape 500-1000
11. Wegmans Food Markets – 500-1000

1.4. Built Environment and Community Lifelines

The information on PWC's community lifelines and critical assets has been collected from multiple sources, including Prince William County Emergency Management, ArcGIS datasets, Hazus-MH® software (Version 4.2), and county government websites. The Hazus Level 1 assessment data indicate that the County has an estimated 206 critical and historic assets. Because of the time lag in collecting and verifying data, and the method in Hazus of documenting location and jurisdiction, this might not reflect the current inventory maintained by the County.

FEMA developed the concept of community lifelines to increase the effectiveness of disaster operations and to better position jurisdictions to respond to incidents. Table 8 lists the numbers of assets in the seven types of community lifelines. They are discussed in the sections that follow.

Table 8: Number of Assets per Community Lifeline[6]

Lifeline/Sector	Number of Assets
Safety and Security	164
Food, Water, Shelter	96
Health and Medical	156
Energy	57
Communications	104
Transportation	732
Hazardous Materials	11
Education*	147
Cultural/Historical	455
High Hazard Dams	19

*See the Education section for more information.

1.4.1. Safety and Security

As of July 2022, the County had one emergency operations center, 22 fire stations, three county police stations, and one police station in each of the four incorporated towns.

1.4.2. Food, Water, Shelter

Food commodities are available throughout Prince William County from public retailers, wholesalers, and contracted services for specific institutions and facilities. Should the need arise, PWC may enter into

[6] Hazus

memorandums of understanding or mutual agreements with viable entities in the region to assist with post-disaster needs.

Water and wastewater services are provided to county residents through two utility providers, Prince William County Service Authority and Virginia American Water. Both receive their water supply from Fairfax Water. There are three wastewater treatment facilities within the County. There are a total of eight separately permitted water systems within the County.

According to the 2020 Census, the County has 158,525 total housing units with a 3% vacancy rate[7]. Most housing units in the County are owner-occupied (73.1%[8]), while renter-occupied housing makes up 25.5%.

Table 9: Housing Demographics Trends, Occupied and Vacant[9][10]

Category	2016	2020	2020 Percent
Total Housing Units	144,314	150,283	—
Total Occupied Units	138,102	144,159	95.9%
Total Vacant Units	6,212	6,124	4.1%

Table 10: Housing Demographics, Owner Occupied vs. Renter Occupied[11][12]

Category	2016	2020	2020 Percent
Owner-Occupied	98,292	105,332	70.1%
Renter-Occupied	39,810	38,827	25.8%
Total Vacant Units	6,212	6,124	4.1%

1.4.3. Health and Medical

Four hospitals offer patient care, urgent care, emergency rooms, and other healthcare services in PWC:

- Sentara Lake Ridge – Woodbridge, VA
- Sentara Northern Virginia Medical Center – Woodbridge, VA
- UVA Haymarket Medical Center – Haymarket, VA
- UVA Prince William Medical Center – located in the City of Manassas, but provides services PWC

[7] https://www.pwcva.gov/department/gis/2020-census
[8] https://www.census.gov/quickfacts/princewilliamcountyvirginia
[9]https://data.census.gov/cedsci/table?q=Prince%20William%20County,%20Virginia%20housing&g=0500000US51153&tid=DECENNIALPL2020.H1
[10] https://data.census.gov/cedsci/table?g=0500000US51153&d=ACS%205-Year%20Estimates%20Detailed%20Tables&tid=ACSDT5Y2016.B25002
[11]https://data.census.gov/cedsci/table?tid=ACSDP5Y2020.DP04&g=0400000US51_0500000US51153&hidePreview=true
[12] https://data.census.gov/cedsci/table?g=0500000US51153&d=ACS%205-Year%20Estimates%20Detailed%20Tables&tid=ACSDT5Y2016.B25003

In addition, Kaiser Permanente is another large healthcare in the County that have three large outpatient facilities that provide advanced medical services for their patients.

1.4.4. Energy

Power providers in the County include Dominion Energy Virginia, and the Northern Virginia Electric Cooperative (NOVEC). Washington Gas and Columbia Gas operate within PWC with pipelines running throughout the County. There is also one natural gas compressor plant and one power plant located in the County.

1.4.5. Communications

There are two broadcast facilities in the County. The transmitter for WNVT Channel 53 is located in PWC, and WPWC is a broadcast radio station with a Spanish Christian format licensed to Dumfries Triangle.

Most communications and information system infrastructure in the United States is privately owned. However, the County maintains authority and control over public safety communications for fire, police, and other responding agencies. In recent years, the federal government has taken a stronger role in protecting information and communications infrastructure, which may present a challenge in relation to the impacts of disasters. Increasing reliance on this infrastructure by individuals, businesses, and the government could cause vulnerabilities that emergency managers should consider in pre- and post-incident planning and operations.

1.4.6. Transportation

The County is served by the following major highways:

- Interstate highways: I-66 and I-95
- U.S. routes: U.S. 1, 15, and 29
- State routes: 28, 123, 234, and 294 (Prince William Parkway)

The County is served by the following Bus and Passenger Rail providers:

- Potomac and Rappahannock Transportation Commission (PRTC) OnmiRide (Bus Service)
- Virginia Railway Express (VRE)
- Amtrak

The County also has two major freight rail lines: CSX and Norfolk Southern.

According to the 2020 American Community Survey, the average commute time to work in PWC is 39.8 minutes, which is well above the national average of 27.6 minutes. Seven percent of the County workforce commutes for over 90 minutes. According to the 2020 Census, 39.9% of the population worked in the County of residence, 48.2% worked outside the County of residence, and 11.9% worked outside the state of residence.

Only 2.5% of residents do not have access to a vehicle. Although there are robust public transit resources, the high number of individuals with access to a private vehicle should be considered in evacuation planning. PWC has six commuter rail stops on two rail lines. PRTC operates OmniRide buses and paratransit resources for PWC. OmniRide provides commuter service to Northern Virginia and downtown Washington DC as well as connecting bus services to Metro stations, allowing service from the community to the greater Washington D.C. metropolitan area.

Most workers commute by automobile, either alone or in a carpool. The County partners with the Virginia Department of Transportation to provide 17 commuter lots with space for 8,631 vehicles.[13]

1.4.7. Hazardous Materials

There is one natural gas compressor plant, one power plant, and four natural gas pipelines located in the County.

Natural gas service in the County is provided by Columbia Gas of Virginia and Washington Gas Light Company. Both companies maintain a significant network of distribution lines within the County.

The County is transited by four natural gas pipelines, one of which originates from a port on the Potomac River within the County.

The County is also transited by both major east coast liquid petroleum pipelines. The Colonial Pipeline runs through the west central portion of the County and the Kinder Morgan Pipeline runs along the eastern edge of the County, parallel to the CSX rail line.

1.4.8. Education

Prince William County Public Schools is the second largest school system in Virginia and the 34 largest in the nation. The system consists of 62 elementary, 17 middle, and 18 high schools, three (3) K-8 & Traditional schools as well as a virtual high school, and two non-traditional schools. There were 89,076 students in the district in 2021. Forty-seven percent of full-time students are considered economically disadvantaged, 26% of full-time students are non-native English speakers, and 13% of full-time students have a disability.[14][15] There are also faith-based, pre-school, special education, and alternative day care schools within the County. [16]

There are four higher education facilities in the County:

- George Mason University - Science and Technology Campus
- Northern Virginia Community College (NVCC) – Manassas Campus
- NVCC – Woodbridge Campus
- Strayer University Woodbridge Campus

Prince William County Libraries operates eleven library branches located throughout the County as well one branch located within the City of Manassas. In Fiscal year 2021 there were over 365,000 visits to the library system.

1.4.9. Recreational, Cultural, and Historic Sites and Assets

The Prince William County Department of Parks, Recreation, and Tourism operates a park system comprising 81 properties and over 60 miles of trails on over 4,400 acres. The staff operates a large portfolio of recreational facilities, services, and programs, hosting over 2 million visitors annually and providing unique leisure experiences for residents of all ages, abilities, and recreational interests. In additional to the County's recreational assets, the County is home to Leesylvania State Park, Prince William Forest Park (National Park Service), and the Manassas Battlefield Park (National Park Service).

[14] https://www.pwcs.edu/cms/One.aspx?portalId=340225&pageId=769123
[15] PWCS Student and Staff Demographics
[16] FEMA Hazus Inventory Data

The Area Agency on Aging operations two senior centers, one in Woodbridge and one in Manassas, that provide recreational and cultural opportunities to the County's senior citizen population.

The Prince William County Office of Historic Preservation, located with the Department of Parks, Recreation, and Tourism, serves as steward of county-owned historic structures, interiors, archaeological resources, natural resources, historic landscapes, artifacts, and collections. In addition to the properties and land that the office oversees, there are many landmarks on the National Historic Register of Places, part of the National Park Service.

1.4.10. High & Significant Hazard Dams

PWC has 21 high and significant hazard dams used for various purposes, including flood control, stormwater management (SWM), and recreation. Of these dams, 16 are classified as high-hazard dams and 5 are classified as significant hazard.

1.5. Growth and Development Trends

Over the past two decades, Prince William County has experienced significant growth pressures and while population continues to grow, the supply of land capable of supporting development continues to decrease. PWC is a diverse, growing county with demographic and population features that pose unique disaster- and emergency-related challenges and resilience opportunities.[17] The County population has grown substantially since the 1960s, increasing by approximately 20% between 2010 and 2020, or an annual rate of 1.85%. As of the 2020 U.S. Census, the County had 482,204 residents.

Land development in PWC is monitored and controlled at the County level and is a key focus area on the PWC Comprehensive Plan update. The County's land use plan incorporates best planning practices that encourage the provision of diverse housing choices, mixed land uses, while protecting the established character of existing urban, suburban, and rural neighborhoods. The County will continue to be a planning partner with local jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk.

The Prince William County Comprehensive Plan from 2021[18] details growth and development trends and is regularly updated. The following is a summary of the Comprehensive Plan:

- Since 1980, Prince William County's population has increased from 144,703 to 467,900, for an increase of 323,197 population or an average annual rate of 5.6%. This rapid growth makes Prince William County one of the fastest growing counties in the Commonwealth of Virginia over this period.
- The Northwest submarket has experienced the fastest and most significant nominal growth (82,437 people) since 2000, increasing from a population of 24,896 in 2000 to 107,333 in 2020. This has resulted in 16.6% annual growth, driven largely by development moving west from the DC Metropolitan Area along Interstate 66.
- Over the next 20 years, the Washington DC Metropolitan Council of Governments projects that the greatest population gains will occur in the I-95 submarket, with the addition of 74,500 new residents, followed by over 40,500 in the Northwest submarket. The Central PWC submarket is considerably smaller with a 2020 population of 58,714.

[17] Where available, this assessment uses data from the 2020 Census. The remaining data are from the 2019 5-year American Community Survey.
[18] PWC Demographic and Housing August 2021

- While viewed as a Washington, DC suburb, Prince William County is becoming more diverse in terms of its population. This is less so in the Northwest and Central PWC submarkets which have majority white populations greater than 70% in 2019. However, the County is fairly representative of the MSA's diversity. It has a slightly larger white population but is comparable in terms of other non-white racial groups and has a larger Hispanic population (20.6%), even when you remove the Greater Manassas submarket.
- The Hispanic population, which is an ethnic category including all people of Hispanic ancestry, is much higher in some areas. For example, 27.1% of the I-95 submarket population is classified as Hispanic or Latino and it's the first submarket that has a majority non-white population.

Any trends in growth and development should be monitored and documented in the next planning cycle with the intent of providing a more detailed statistical analysis of vulnerable populations and how this could affect the analysis of hazards and opportunities for mitigating risks.

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, PWC followed the planning process described in **Section 2 of the Base Plan**. Besides providing representation to the Northern Virginia Hazard Mitigation Planning Team, the County supported the local planning process by coordinating with representatives from other departments and agencies in its jurisdiction primarily through the PWC Hazard Mitigation Workgroup.

Table 11: PWC Hazard Mitigation Workgroup Participants

Name	Position/Title	Department/Agency
Katie Kitzmiller	Deputy Emergency Management Coordinator	Prince William County Office of Emergency Management
Matt Smolsky	Assistant Fire Chief/Fire Marshal	Prince William County Department of Fire and Rescue
Madan Mohan	Floodplain Manager	Prince William County Department of Public Works Environmental Services Division
Raj Bidari	CRS Coordinator	Prince William County Department of Public Works Environmental Services Division
Eric Mays	Building Official	Prince William County Department of Development Services
Tom Smith	Director	PWC Department of Public Works
Brian Misner	Emergency Management Coordinator	PWC Office of Emergency Management

PWC Emergency Management (PWC EM) is the lead coordinating agency for all hazard mitigation program activities. PWC EM coordinated planning updated with the PWC Hazard Mitigation Workgroup and coordinated with identified town points of contact throughout this planning process. In addition, PWC EM provided oversight and representation for the regional planning process at the Northern Virginia Emergency Manager's Group and the Northern Virginia Emergency Manager's Planning Group. The County also identified the following among its mitigation planning responsibilities:

- Providing management support for the planning effort
- Serving as planning group resources/subject matter experts
- Assessing hazard risk and vulnerability
- Providing technical data and hazard information
- Conducting a capabilities assessment
- Developing mitigation strategies
- Sponsoring mitigation actions
- Reviewing plans and providing input
- Furthering public outreach
- Implementing the plan
- Maintaining the plan
- Ensuring adequate project administration

PWC planning participants coordinated primarily by means of virtual meetings during the planning process, and as needed, they worked independently on planning activities, completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. In addition, the Draft Plan documents were sent to all PWC department directors, the PWC Office of Executive Management, and key PWC EM program stakeholders for review and comment. Additional documentation of the NOVA Planning Group's process and meetings is included in **Appendix A of the Base Plan.**

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a public hazard survey and access to the Draft Plan for review and input. These opportunities were placed on the Prince William County Emergency management Facebook, Twitter, and website, and email notification systems to maximize public visibility. Documentation of the public survey advertisement and Draft Plan review is in **Attachment 2** of this annex.

3. Jurisdiction-Specific Hazard Event History

PWC's comprehensive hazard history is described in **Section 5 of the Base Plan**. The diversity of the County's landscape increases its vulnerability to a variety of hazards, most notably flooding, severe storms, and winter weather. PWC experiences all five types of flooding. In addition to inland flooding and flash flooding related to snowmelt and rain, low-lying areas along the Potomac River are subject to tidal, coastal and storm surge flooding. As sea levels rise, permanent inundation of low-lying areas along and near the river also is a threat.

The National Oceanic and Atmospheric Administration National Center for Environmental Information (NCEI) Storm Events Database includes 873 recorded natural meteorological events in the County between January 1, 1950, and May 2021. The County was included in three Federal Disaster Declarations and emergencies between 2017 and May 2021 (see Table 12).

Table 12: Federal Disaster and Emergency Declarations (2017–2021), Prince William County[19]

Declaration	Date	Hazard	Assistance Type
DR-4512-VA	4/2/2020 (continuing)	COVID-19 Pandemic	Individual Assistance, Public Assistance
EM-3448-VA	3/13/2020 (continuing)	COVID-19 Pandemic	Public Assistance (Category B)
EM-3403-VA	9/11/2018	Hurricane Florence	Public Assistance (Category B)

The PWC Hazard Mitigation Workgroup has submitted additional details related to significant hazard events since the 2017 plan. They are noted in Table 13.

Table 13: Significant Hazard Events Identified by Prince William County (2017–2021)

Date	Hazard	Event and Description
March 2018	Severe Storm and High Wind	The entire county was impacted by high wind between March 2 and March 4, 2018. There were approximately 42,000 power outages, and all southbound lanes on Interstate 95 were closed after high winds caused a 140-foot Potomac Mills sign to lean. In addition, Telegraph Road was closed between Prince William Parkway and Opitz Boulevard because of the damaged sign.
May 2018	Severe Storm	The entire county experienced severe thunderstorms and hail on May 15, 2018. Moreover, there was concentrated storm activity in the towns of Haymarket and the unincorporated area of Antioch. There was minor property damage, approximately 15,500 power outages, and roads closed because of downed trees and power lines.
June 2018	Severe Storm and Flooding	On June 9, 2018, in the Gainesville area, approximately 60 vehicles in the Jiffy Lube Live parking lot were partially submerged in water when a clogged drain in a stormwater management pond caused flooding. The stormwater issue that led to this event has been rectified.

[19] FEMA

Date	Hazard	Event and Description
June 2018	Severe Storm and Flooding	Between June 21 and June 24, 2018, the entire county was impacted by severe storms and flooding. Numerous roads were closed because of high water, and three injuries occurred. Based on this event, the County was able to identify and solidify the top 10 road closure areas on which to focus mitigation activities.
January 2019	Winter Weather	The entire county experienced moderate snow, with accumulation up to 4.5 inches. This caused numerous minor vehicle accidents. Snowfall rates and low temperatures caused hazardous conditions on untreated roads.
February 2019	Winter Weather	The entire county experienced snow accumulation from 3 to 6 inches and ice accumulations ranging from less than 0.10 inch to 0.25 inch. This caused two rollover vehicle accidents and numerous minor vehicle accidents. Snowfall rates, ice accumulation, and low temperatures caused hazardous conditions on untreated roads.
March 2019	Flooding	Western PWC and the town of Haymarket were impacted by flooding on March 22, 2019. Several homes were damaged, roads were closed because of high water, swift water rescue calls were received, and canoers went missing temporarily.
May 2019	Severe Storm	The eastern portion of the County, including the towns of Dumfries, Occoquan, and Quantico, were impacted by severe storms on May 30, 2019. Multiple houses were damaged by fallen trees, and one house had to be evacuated. There were approximately 5,000 power outages during the event.
June 2019	Severe Storm and High Wind	On June 2, 2019, the County experienced localized, moderate straight-line wind damage in the vicinity of Yates Ford Road and Occoquan Forest. Numerous trees and power lines were down, including trees on vehicles on Yates Ford Road, which was closed. Dominion Energy reported 3,246 customer outages. One house was placarded unsafe by the Building Inspector because of moderate damage from tree impact.
June 2019	Severe Storm and Flooding	On June 17, 2019, the entire county experienced severe storms and flooding. Numerous houses were damaged by fallen trees, and numerous roads were blocked by trees or debris.
May 2020	Civil Unrest	On May 30, 2020, a planned protest in the city of Manassas became an unlawful assembly because of several unruly protesters in the area of Sudley Road and Sudley Manor Drive. County Police coordinated the response with the Virginia State Police; mutual aid from the Prince William Sheriff, Manassas City Police Department, and Fairfax County Police Department was activated. All vehicle traffic between Interstate 66 and Lomond Drive was unable to approach or cross Sudley Drive until the situation was resolved. In addition, a second planned protest on May 31, 2020 was also declared an unlawful assembly occurring on Liberia Avenue impacting both PWC and the City of Manassas.

4. Hazard Risk Ranking

After developing hazard profiles, the Prince William County Hazard Mitigation Workgroup conducted a two-step quantitative risk assessment for each hazard. The assessments considered population vulnerability, geographic extent/location, probability of future occurrence, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an overall risk score, which was summarized according to these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4.2 of the Base Plan**.

The overall risk score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented in the hazard sub-sections in **Section 5 of the Base Plan**, and local detail is provided in the jurisdiction annexes. Non-natural hazard profiles are presented in **Volume II of the Base Plan**.

Table 14: Hazard Risk Ranking Summary, Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
High wind/severe storm	3.3	5.4	8.7	**High**
Winter weather	3.7	4.8	8.5	**High**
Flood/flash flood	2.3	5.7	8.0	**High**
Dam failure	1.3	5.2	6.5	**High**
Tornado	1.3	4.8	6.1	**Medium**
Earthquake	2.3	3.7	6.0	**Medium**
Drought	2.3	3.4	5.7	**Medium**
Extreme temperatures	3.0	2.5	5.5	**Medium**
Wildfire	1.0	3.0	4.0	**Low**
Landslide	1.0	2.7	3.7	**Low**
Karst/sinkhole/land subsidence	1.0	2.5	3.5	**Low**

Table 15: Hazard Risk Ranking Summary, Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious disease/public health	3.0	6.3	9.3	**High**
Terrorism	1.0	6.4	7.4	**High**
Cyberattack	2.3	5.0	7.3	**High**
Hazardous materials	1.3	5.4	6.7	**Medium**
Communication disruption	2.0	4.3	6.3	**Medium**
Active violence	1.0	3.6	4.6	**Medium**
Civil unrest	1.3	4.9	6.2	**Low**

Based on the hazard risk scores, PWC evaluated the level of risk for 18 hazards—11 natural and 7 non-natural.

Eight natural hazards were identified as high- or medium-risk hazards to which the jurisdiction is vulnerable:

- **High:** High Wind/Severe Storm, winter weather, flood/flash flood, and dam failure
- **Medium:** Tornado, earthquake, drought, and extreme temperatures

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious disease/public health, terrorism, and cyber attack
- **Medium:** communications disruption, hazardous materials, and active violence

Active violence was moved to Medium from Low after discussions within the County. All other hazards were ranked as "low," signifying a minimal risk to PWC.

4.1. Additional Hazard Risk Considerations

Based on the Hazard Risk Ranking, four hazards were identified as High Risk for Prince William County. Additional considerations for those hazards are provided below. More information can be found for all hazards in **Section 5 of the Base Plan.**

4.1.1. Dam/Levee Failure

PWC has 21 high and significant hazard dams, which are used for various purposes, including flood control, stormwater management, and recreation. Of these dams, 16 are classified as high-hazard dams and 5 are classified as significant hazard.[20] Appendix C includes a description of the location and extent of risk for each dam. The following assets were determined to be vulnerable to this hazard in PWC:

- 4520 Homes
- 106 Businesses
- 2 Schools
- 5 Critical Infrastructure

[20] High hazard: dams that upon failure would cause probably loss of life or serious economic damage. Significant: dams that upon failure might cause loss of life or appreciable economic damage. economic damage.

- 3 Railroads
- 4 Utilities
- 2 Parks
- 2 Golf Courses
- 38 Roadways
- 1 Dam Downstream

4.1.2. Flood/Flash Flood

The PWC Hazard Mitigation Workgroup noted that the frequency of flash flooding has increased in recent years, which is attributed to more frequent excessive rainfall events combined with increases in impermeable surfaces, aging drainage systems, and inadequate stormwater infrastructure which reduces capacity for handling storm runoff. See the summary in Table 16. The County is addressing this issue through increased public education, buying out as many severe repetitive loss (SRL) properties as feasible, installing gauges and warning systems, creating a Community Energy and Sustainability Master Plan, and completing studies of frequently flooded areas and roads to determine the mitigation actions that would be the most beneficial.

Table 16: Flood/Flash Flood Events, 1950–May 31, 2021[21]

Impact	Data
Flood/Flash flood event	227
Direct deaths	0
Direct injuries	0
Property damage	$15,591,000
Crop damage	$100,000
Total property and crop damage	$15,691,000

Note: *The impact in Prince William County, including the towns of Dumfries, Haymarket, Occoquan, and Quantico

4.1.3. High Wind/Severe Storm

Table 17 presents the number of severe storm events documented in the NCEI Storm Events Database, including high wind and impacts on people, property, and crops.

Table 17: Severe Storm/High Wind Events*, 1950–May 31, 2021[22]

Impact	Data
Severe storm and high wind events	134
Direct deaths	0
Direct injuries	3
Property damage	$19,627,950

[21] NCEI Storm Events Database
[22] NCEI Storm Events Database

Impact	Data
Crop damage	$81,750
Total property and crop damage	$19,709,700

Note: *Including the towns of Dumfries, Haymarket, Occoquan, and Quantico

4.1.4. Winter Storm

Table 18 presents the number of severe winter storm events documented in the NCEI Storm Events Database, including blizzard, heavy snow, winter storms, and winter weather.

Table 18: Severe Winter Storm Events, 1950–May 31, 2021[23]

Impact	Data
Severe winter storm events	148
Direct deaths	0
Direct injuries	0
Property damage	$35,001
Crop damage	$0
Total property and crop damage	$35,001

Note: *Including the towns of Dumfries, Haymarket, Occoquan, and Quantico.

Additional hazard information for PWC is presented in the **Base Plan**.

[23] NCEI Storm Events Database

5. Vulnerability Assessment

The method for calculating loss estimates presented in this annex is the same as that described in **Section 4 of the Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including potential impacts and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potentially vulnerable to one or more hazards.

5.1. National Flood Insurance Program and Community Rating System

PWC is a participant in the National Flood Insurance Program (NFIP; see FEMA NFIP Community Status Report). It also participates in the voluntary Community Rating System (CRS) program under the NFIP. It has a CRS Class of 7, which is associated with a 15 percent flood insurance discount for policyholders.

Table 19: Prince William County NFIP Participation

NFIP Data	Date
Initial flood hazard boundary map (FHBM) identified	1/10/1975
Initial flood insurance rate map (FIRM) identified	12/1/1981
Date of the current effective map	8/3/2015
Regular-Emergency date	12/1/1981
Digital flood insurance rate map (DFIRM)/Q3	DFIRM

Table 20: NFIP Status, October 27, 2021[24]

Category	NFIP Topic	Source of Information	Comments
Insurance	• How many NFIP policies are in the community? • What is the total premium and coverage?	• State NFIP Coordinator or FEMA NFIP Specialist • Community Information System Database	• 1,248 policies • $848,332 premiums • $349,291,100 in force
Insurance	• How many claims have been paid in the community? • How many claims were for substantial damage? • What is the total amount of paid claims?	• FEMA NFIP or Insurance Specialist • Community Information System Database	• 431 claims paid • 25 claims for substantial damage • Total amount of claims paid is $5,327,804

[24] Prince Williams County

Category	NFIP Topic	Source of Information	Comments
Insurance	How many structures are exposed to flood risk in the community?	• Community Floodplain Administrator (FPA) • Estimate from FEMA	4,582 structures are exposed to flooding, repetitive loss, and dam inundation
Insurance	Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	Specific repetitive loss areas and certain dam inundation areas
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	Yes
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	No
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	Special Flood Hazard Area (SFHA) review, engineering compliance with floodplain ordinance, permit review/issuance, education, and outreach, building compliance, and post-disaster damage inspections
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	Purchase conversion by residents in potential flood-prone areas
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Compliance History	Are there any outstanding compliance issues (i.e., current violations)?		No
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		CAV: 02/23/2011 CAC: 03/19/2015

5.2. Population

Estimates of the number of residents in PWC vulnerable to each hazard are presented in the various hazard sections of the **Base Plan**.

In the 2010 Census, PWC became a major-minority County, with more individuals reporting being of a “race other than white” versus “white alone” as broken down in the U.S. Census. More than 30% of PWC’s population speaks a language other than English at home, and 59,204 (12.3%) indicate they speak English “less than very well.” It is important that all mitigation and preparedness information is translated into the languages most spoken within Prince William County, including English, Spanish, Arabic, Korean, and Vietnamese.

The Centers for Disease Control and Prevention’s (CDC) Social Vulnerability Index (SVI) is a tool that helps identify specific vulnerable populations. The CDC SVI depicts the vulnerability of communities at

the census tract level, by county, into fifteen census-derived factors grouped into four themes: socioeconomic status, household composition/disability, race/ethnicity/language, and housing type/transportation. Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills.

According to the overall CDC SVI, the locations with the highest overall vulnerability are in the central and eastern portions of the County. Several census tracts in the County, including the Yorkshire and Woodbridge areas and within the Town of Dumfries have an SVI percentile ranking of .72–.94 percent, identifying them as the highest areas of social vulnerability.

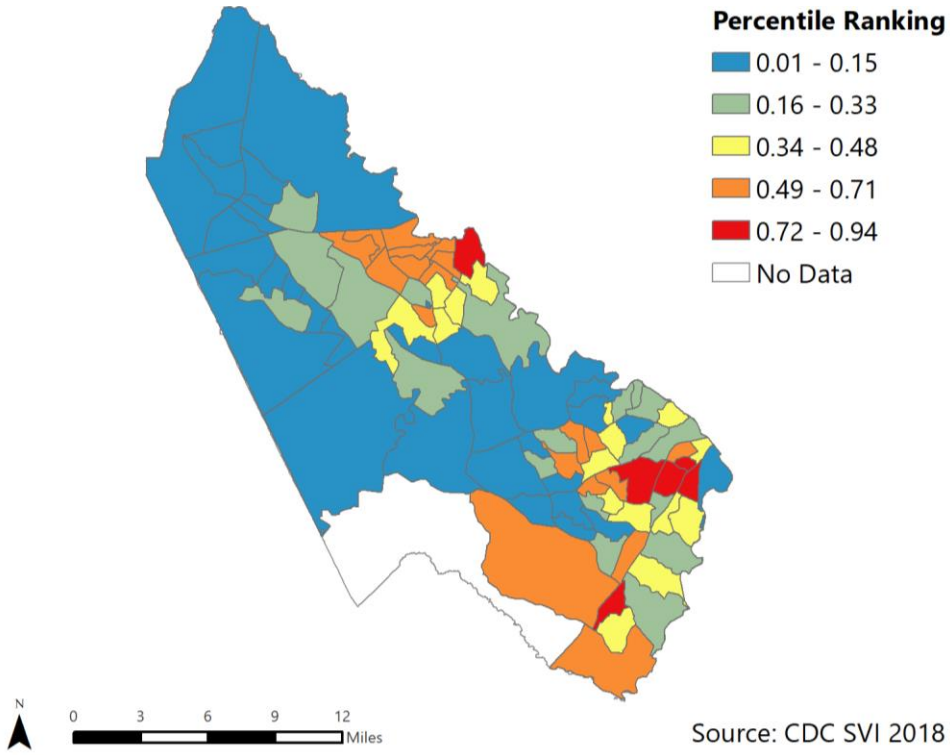
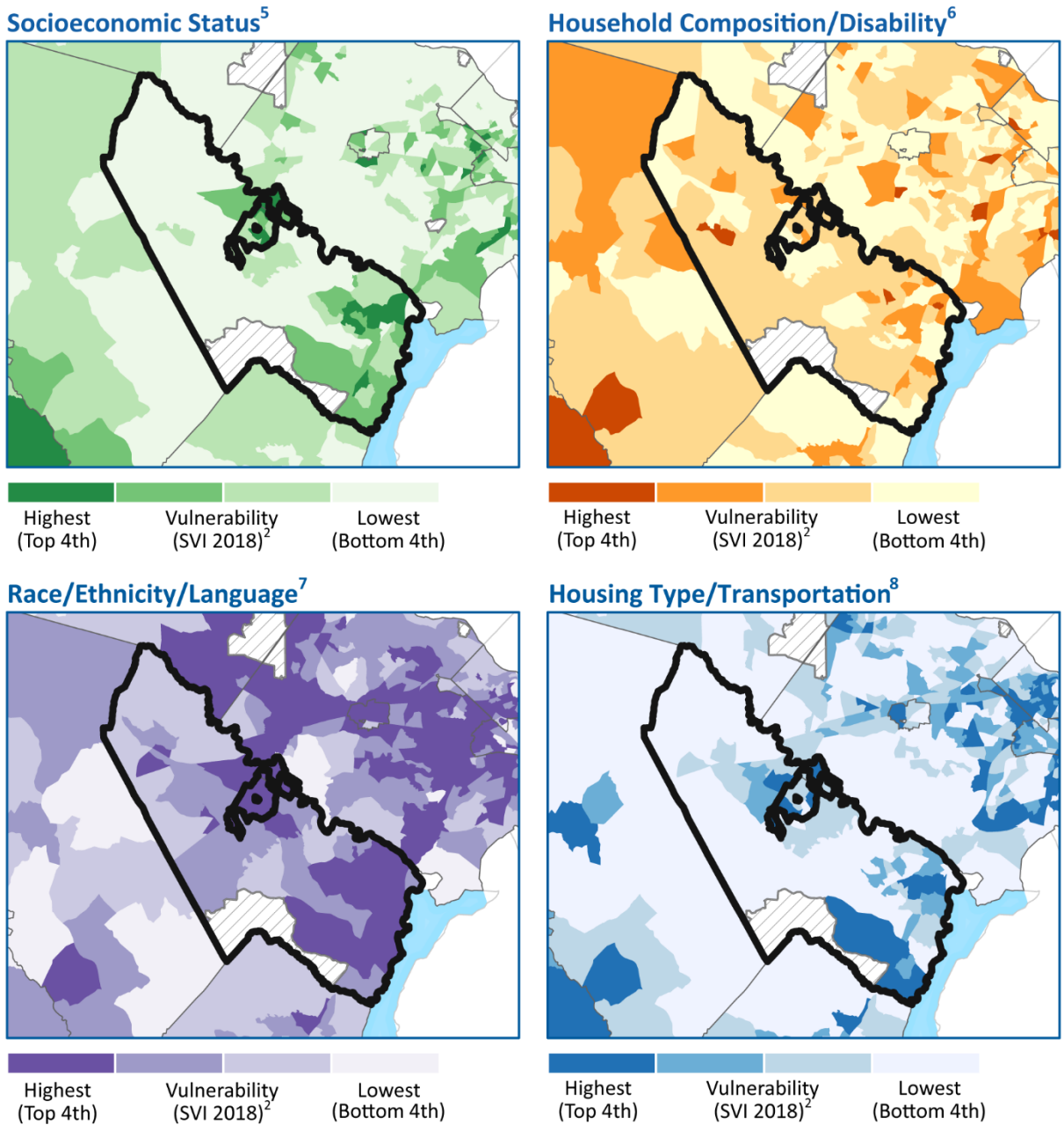


Figure 5: Overall Social Vulnerability (2018), Prince William County[25]

[25] Centers for Disease Control and Prevention (https://svi.cdc.gov/map.html)



Data Sources: [2]CDC/ATSDR/GRASP, U.S. Census Bureau, Esri® StreetMapTM Premium.
Notes: [1]Overall Social Vulnerability: All 15 variables. [3]Census tracts with 0 population. [4]The CDC SVI combines percentile rankings of US Census American Community Survey (ACS) 2014-2018 variables, for the state, at the census tract level. [5]Socioeconomic Status: Poverty, Unemployed, Per Capita Income, No High School Diploma. [6]Household Composition/ Disability: Aged 65 and Over, Aged 17 and Younger, Single-parent Household, Aged 5 and over with a Disability. [7]Race/Ethnicity/Language: Minority, English Language Ability. [8]Housing Type/Transportation: Multi-unit, Mobile Homes, Crowding, No Vehicle, Group Quarters.
Projection: NAD 1983 Virginia Lambert.
References: Flanagan, B.E., et al., A Social Vulnerability Index for Disaster Management. *Journal of Homeland Security and Emergency Management*, 2011. 8(1).
CDC SVI web page: http://svi.cdc.gov.

Figure 6: Social Vulnerability, by Theme, Prince William County[26]

The maps in Figure 7 illustrate the County's higher levels of vulnerability in the race/ethnicity/language theme, demonstrating the importance of communicating essential hazard mitigation, preparedness, response, and recovery information to the public in alternate formats and multiple languages.

[26] Centers for Disease Control and Prevention. SVI Interactive Map. (https://svi.cdc.gov/map.html)

5.3. Built Environment

Based on data currently available through Hazus, the tables in this section provide the numbers of exposed facilities and properties in relation to earthquakes, floods, and hurricane winds. They include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events. The vulnerability of critical infrastructure is presented according to the lifeline sector categories identified by FEMA.

Table 21: Community Lifeline Facilities and Critical Assets

Lifeline/Sector	Number of Assets
Safety and Security	164
Food, Water, Shelter	96
Health and Medical	156
Energy	57
Communications	104
Transportation	732
Hazardous Materials	11
Education*	147
Cultural/Historical	455
High Hazard Dams	19

Table 22: Prince William County Building Stock Exposure by General Occupancy[27]

Type	Amount
Residential	$48,430,503,000
Commercial	$4,155,696,000
Industrial	$758,100,000
Agricultural	$171,771,000
Religion	$396,989,000
Government	$123,270,000
Education	$330,279,000
TOTAL	**$54,366,608,000**

Note: Building stock exposure totals reflect data for those census tracts/blocks included in the study region.

PWC has more than $54 billion in buildings exposure to flood and earthquake according to the Hazus flood scenario and the Hazus earthquake scenario.

Hazus identified 570 structures that would be damaged, with 69 being at least 50% damaged, and 208 having substantial damage from a 6.5 magnitude earthquake.

[27] Hazus

5.4. Community Lifelines and Assets

PWC reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events.[28] The vulnerability of critical infrastructure is presented in the lifeline sector categories identified by FEMA.

Table 23: Vulnerable Community Lifeline Assets[29]

Sector	Dollar Exposure
Safety and Security	$5,189,980
Food, Water, Shelter	Undetermined
Health and Medical	Undetermined
Energy	$2,145,060,000
Communications	Undetermined
Transportation	$2,286,081,000
Hazardous Materials	Undetermined

Note: Building Stock Exposure totals reflect data for those census tracts/blocks included in the study region.

5.5. Natural Environment

Information related to environmental vulnerability is presented in the hazard-specific sections in **Section 5 of the Base Plan**.

Additional environmental community assets in PWC include Neabsco Boardwalk on the Potomac Heritage National Scenic Trail and several public parks that have the potential for flooding, severe weather, and hurricanes. Leesylvania State Park is susceptible to hazardous material incidents because of the presence of a natural gas pipeline, in addition to impacts from flooding, severe weather, and hurricanes.

The County identified the Featherstone National Wildlife Refuge and Occoquan Bay National Wildlife Refuge as critical habitats because of their forests, meadows, marshes, grasslands, and the presence of many bird species.

5.6. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2500-year, 6.5 magnitude earthquake event, 100-year flood event, and probabilistic hurricane wind event are identified by Hazus for specific assets.

Table 24: Direct Economic Losses (in Thousands of Dollars)[30]

[28] Information used in this analysis is extracted from Hazus. Prince William County maintains a separate critical facilities inventory which is inconsistent with Hazus and numbers vary. Hazus data was used here to maintain consistency with other jurisdictions.
[29] Hazus
[30] Hazus 2500-year, 6.5 magnitude scenario, 100-year flood event, and probabilistic hurricane wind event

Hazard	Buildings (Capital Stock and Income)	Transportation	Utilities
Earthquake	$724,815	$10,717	$36,923
Flood	$574,803	$0	$37,162.80
Hurricane wind	$46,603	[Not available]	[Not available]

Additional economic concerns for PWC are related to the area's economic base, which relies on government, information technology, and finance. Major employers include Fortune 500 companies, the federal government, and the military.

5.7. Cultural/Historical

Information related to the vulnerability of cultural and historical assets is presented in the hazard-specific sections of the **Base Plan**.

PWC has significant historical and cultural landmarks linked to the founding and development of the United States, including battlefields, historic districts, and historic buildings. The entire town of Occoquan is listed on the National Register of Historic Places along with many other sites within the County.

6. Capability Assessment

PWC reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a capabilities assessment worksheet, PWC documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, PWC completed a jurisdictional needs identification questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the levels of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans, and/or resources, and it can implement most mitigation actions.

Table 25: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	Moderate
Administrative and Technical	Moderate
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary[31]

The County utilizes the all-hazards approach when developing any jurisdictional plans, including the Comprehensive Plan, a Capital Improvement Plan, and an Emergency Operations Plan, in addition to the Hazard Mitigation Plan (HMP). The County has also set planning goals related to climate change.

The following plans and goals have been newly developed or updated since the 2017 HMP:

- Prince William County Comprehensive Plan, updated 2019
- Prince William County Capital Improvement Plan FY2022–FY2027, adopted by the Board of County Supervisors in April 2021
- Prince William County Emergency Operations Plan, adopted by the Board of County Supervisors in December 2020
- Prince William County 2021–2024 Strategic Plan, adopted by the Board of County Supervisors in July 2021
- Regional Climate Mitigation and Resiliency Goals, endorsed by the Board of Supervisors on November 21, 2020. They include:
  - Achieving 100% renewable electricity for county government operations by 2030
  - For county government operations to be 100% carbon neutral by 2050
  - 100% of the County's electricity to be from renewable sources by 2035
  - Creating a public advisory body to direct the County in reaching those goals

The resolution that endorsed these goals does not commit to any specific initiatives or policy changes. However, a Community Energy and Sustainability Master Plan will be created for 2023.

Capability Analysis: Moderate

Moderate planning and regulatory tools are in place in PWC, and they demonstrate initial successes in integrating hazard mitigation planning with existing planning mechanisms. Although the County has several plans that could incorporate hazard mitigation goals and strategies, they have not traditionally included relevant components of hazard mitigation. The County's 2021-2024 Strategic Plan was adopted on July 20, 2021 and includes several hazard mitigation-related items across multiple goal areas. The PWC Hazard Mitigation Workgroup is committed to ensuring the addition of relevant hazard mitigation strategies when various agency and county plans are updated in order to increase planning and regulatory capabilities and resiliency.

[31] Prince William County jurisdictional capabilities assessment.

There are many planning and regulatory tools in place to address flooding, which is one of the top hazards in the County. These tools include stormwater projects in the capital improvement plan, a stormwater management (SWM) Plan that could be enhanced to include mitigation actions, an active SWM program, enforced building codes and zoning, subdivision, and flood plain ordinances, and FEMA-updated flood insurance rate maps that take effect in 2022. In addition, the 2021-2024 PWC Strategic Plan contains several objectives that address various aspects of flooding, in particular Objective EC-5 to "reduce and mitigate the impacts of flooding in communities" with several action strategies and key performance indicators to meet this objective. PWC is also a participant in the Community Rating System, committed to continually increasing planning and program areas to address flooding.

The PWC Hazard Mitigation Workgroup was established in 2017 to implement the PWC-specific mitigation strategies outlined in the NOVA HMP. The Workgroup is facilitated by PWC EM and includes representatives from the Departments of Public Works, Development Services, Transportation, Information Technology, Parks, Recreation, and Tourism (DPRT), Public Safety Communications, Police (PD), the Fire and Rescue System (FRS), and the Virginia Department of Transportation (VDOT). Additional agencies and partners, such as utility or transportation providers, the School Division, town representatives and others are consulted on hazard-specific and project-specific strategies, as they are identified. To date, the Workgroup has utilized a project management framework to coordinate efforts around specific grant programs and individual mitigation strategies.

While the workgroup has been successful in identifying small projects for specific grant opportunities, the County need to develop a local mitigation framework that coordinates mitigation strategy implementation for all hazards – particularly flooding – in a cohesive and holistic way.

6.1.2. Administrative and Technical Capabilities Summary[32]

- Staff in the Planning Office, Department of Public Works, and Department of Development Services include planners, engineers, and a floodplain manager with an understanding of natural and non-natural hazards. They are integrated into mitigation planning.
- The County has personnel skilled in GIS in the Fire and Rescue System, the Department of Information Technology, the Police Department, and the Department of Public Works.
- Staff in the Office of Emergency Management, Fire and Rescue System, Police Department, Department of Public Works, Department of Public Safety Communications and elsewhere are familiar with the community's hazards.
- The County partners with scientists at Virginia Tech's Occoquan Watershed Monitoring Laboratory to monitor flooding and with the Virginia Department of Conservation and Recreation to review dam safety. The County has installed an Automated Flood Warning System (AFWS) at several known flooding locations and is continuing to build out the AFWS network.
- The Office of Emergency Management has emergency management personnel, operates county-wide warning systems for internal and external notifications and warnings, and it has a grant writer who coordinates with the hazard mitigation program.
- The County has created an Office of Environmental and Energy Sustainability, which will create a Community Energy and Sustainability Master Plan and focus on flooding because of several high-profile routine problem areas.
- The County has created an Office of Equity and Inclusion, which serves the PWC government in partnership with the Board of County Supervisors, the Office of Executive Management, departments, and the community. It provides leadership, guidance, and coordination for the organization's continuing efforts toward building an equitable and inclusive culture, where

[32] Prince William County jurisdictional capabilities assessment

diversity is leveraged as a strength of our workforce and how we deliver services to residents, businesses, and visitors. This includes language-support services and demographic data dashboards to help increase the impact of community outreach on hazard mitigation.

- The County has identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and implementation of the plan:
  - Development Services
  - Emergency Management
  - Fire and Rescue System
  - Planning Office
  - Police Department
  - Public Works
    - Environmental Services Division
    - Construction and Operations Division
  - Parks, Recreation, and Tourism
  - Virginia Department of Transportation
  - Department of Information Technology
  - Department of Public Safety Communications
  - Office of Environmental and Energy Sustainability
  - Transportation Department
  - Town representatives

Capability Analysis: Moderate

To strengthen the administrative and technical capabilities of the County, all agencies with a role in hazard mitigation should continue to be incorporated into the PWC Hazard Mitigation Workgroup to effectively coordinate issues that cross agencies, with participation, at minimum, in the annual review of the HMP. This integration will provide a high level of coordination for the purpose of mitigation planning and action implementation. Additional agencies and partners, such as utility or transportation providers, the School Division, town representatives and others should continue to be consulted on hazard-specific and project-specific strategies, as they are identified.

6.1.3. Safe Growth Capabilities Summary[33]

- Growth guidance instruments such as future land-use policies, regulations, and maps identify natural hazard areas such as floodplains, and they discourage or prohibit development or redevelopment in these areas.
- The Comprehensive Plan includes a transportation element that addresses the appropriate placement and use of transportation systems.
- Environmental policies encourage appropriate development to protect ecosystems.

[33] Prince William County jurisdictional capabilities assessment

- Public safety plans and procedures address emergency evacuation and other emergency measures associated with safe growth.
- The building code and floodplain regulations provide for a Base Flood Elevation (BFE) sufficient to protect property from 100-year flood events.

6.1.3.1. Capability Analysis: Moderate

PWC has established a moderate level of safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment. Additional enhancements to these capabilities include limiting transportation access to identified hazard areas in the County's transportation plan, creating environmental policies that provide incentives for development outside protective ecosystems, including provisions for mitigation of natural hazards in economic development or redevelopment strategies, and including projects in the mitigation Plan in the County's Capital Improvement Plan (CIP).

The current CIP does not provide funding for projects identified in the 2017 HMP. However, PWC's CIP program has funded a few projects based on countywide prioritization of service delivery to meet growth, such as constructing police and fire stations, roadways, and mass transit facilities. Relevant projects identified by the PWC hazard mitigation program are submitted in the CIP process when they are identified.

6.1.4. Financial Capabilities Summary[34]

- The County has the authority to incur debt through general obligation bonds, private activities, and/or special tax bonds. It collects fees for utility services and stormwater and impact fees for new development.
- The County participates in multiple federal funding programs, such as Community Development Block Grants, the Urban Areas Security Initiative program (UASI), the State Homeland Security Program (SHSP), and Emergency Management Performance Grant (LEMPG) to support PWC emergency management program components for all hazards.
- FEMA's Flood Mitigation Assistance program (FMA) provided funding in 2019 for acquiring and demolishing a severe repetitive loss (SRL) property in the County.
- Applications have been submitted to the Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Program, and the Building Resilient Infrastructure and Communities (BRIC) to enhance the County's automated flood warning system.
- The County's automated flood warning system was funded through the Virginia Department of Conservation and Recreation Dam and Flood Safety Grant program.
- The County participates in several state funding programs and has submitted applications to the Virginia Community Flood Preparedness Fund grant and the Virginia Emergency Shelter grant and continues to monitor all state and federal grant programs for grant opportunities for eligible projects identified to support PWC's mitigation actions.

Capability Analysis: Moderate

The Office of Emergency Management continues to identify funding opportunities for mitigation activities. The past focus was on federal and state grant programs as the primary sources of funding for any mitigation activity. There has been a recent shift to utilizing other county funding sources for mitigation projects. For example, the Department of Parks, Recreation, and Tourism has used general funds to buy

[34] Prince William County jurisdictional capabilities assessment

automated gauges for two of their high-hazard dams. In addition, as part of the environmental review for a project to construct a roadway bypass, the Department of Transportation has funded automated flood and rain gauges in an area with a history of flooding. Cross-agency mitigation conversations will continue to be strengthened to leverage non-grant funds to support mitigation projects. Most agencies do not know the options available or understand the need to include mitigation actions as an element of their projects. PWC should look for opportunities to integrate Emergency Management into existing county processes and procedures for strategic and comprehensive planning implementation and capitol project initiation to assess proposed projects for potential mitigation actions.

6.1.5. Education and Outreach Capabilities Summary[35]

- PWC is designated as a StormReady community, which includes components of public education and training.
- The County partners with local schools in the Safe Alone, Safe at Home program, which incorporates hazard and safety information for schools.
- PWC is a participant in the Community Rating System and routinely implements community outreach and engagement efforts focused on general preparedness, flood safety awareness, dam safety awareness. This includes the County's flood safety information webpage (https://www.pwcva.gov/flooding) which has information about dam safety, flood control and safety, flood risk mapping, real-time stream gauges, and information about flood insurance.

Emergency preparedness and mitigation outreach is implemented by the Ready Prince William Outreach Program, especially as it relates to flooding and dam safety. This program is currently expanding to incorporate more community groups and councils and to develop enhanced materials to provide additional hazard information. In addition, the Office of Emergency Management website (https://www.pwcva.gov/department/office-emergency-management) highlights key information on a variety of hazards. Ready Prince William integrates multiple mediums for dissemination of preparedness information including printed materials at County libraries, dissemination of materials at public outreach and community events, targeted social media campaigns, detailed hazard-specific information on the County website, and conducting community presentations.

Capability Analysis: Moderate

Jurisdictions have multiple opportunities to promote hazard mitigation and increase the involvement of stakeholders and the public. There is a critical need to inform additional stakeholders and the public about the benefits of hazard mitigation planning and implementation.

The Office of Emergency Management will continue to focus on and expand public–private partnership initiatives that address key preparedness topics. These initiatives were leveraged during the COVID-19 response and recovery operations to address the key economic recovery needs of the PWC business community. Expanding these initiatives would provide an opportunity to increase preparedness and mitigation efforts in the County.

The Office of Emergency Management is continuing to enhance it's Ready Prince William outreach and community engagement program to ensure increased participation by community leaders and organizations and will continue to enhance the distribution of preparedness materials and programs into the community, as specific areas of need and enhancement are identified.

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6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, PWC identified activities related to each natural hazard that support risk reduction. They are listed in 26.

Table 26: Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts[36]

Hazard	Capability
Dam failure	• All high and significant hazard dams in the County have emergency action plans for potential incidents and are reviewed by the Office of Emergency Management • Public education and operational plans address preparedness and response to reduce risk.
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and International building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme temperature	• Public education and operational plans address preparedness and response to reduce risk.
Flood/Flash flood	• Floodplain administration and regulations ensure that inappropriate activities and development in the floodplain are prohibited. • A stormwater management program and projects address flood prevention and risk reduction.
High wind/severe storm	• State and International building codes provide minimum design requirements for a structure to resist the loads which they are likely to encounter such as including windborne debris.
Karst/Sinkhole/Land subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Winter storm	• Public education and operational plans address preparedness and response to reduce risk.
Non-natural hazards	• Public education and operational plans address preparedness and response to reduce risk. • Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.

[36] Prince William County jurisdictional capabilities assessment

Hazard	Capability
Climate change	• Resilience planning and achieving the Regional Climate Mitigation and Resiliency Goals endorsed by the Board of Supervisors will allow for the identification and mitigation of climate change-related issues in future planning cycles.

7. Resilience to Hazards

7.1. National Risk Index

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. It is a dataset and online tool developed by the Federal Emergency Management Agency (FEMA) and other partners to help illustrate communities in the United States that are potentially at risk to 18 natural hazards. Hazard risk is calculated from data of a single hazard type and reflects the relative risk for that hazard type. This data is presented for general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. The NRI defines some hazards differently from the hazards in this plan, so a direct hazard-to-hazard comparison of risk cannot be determined.

The designation of “low risk” is driven by lower loss because of natural hazards, lower social vulnerability, and higher community resilience. The levels of risk are described in Figure 7.

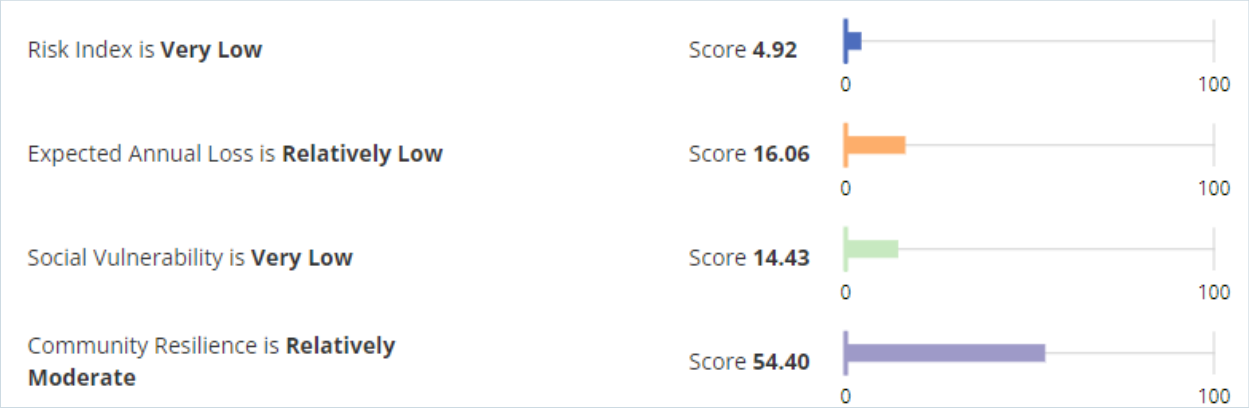

Figure 7: Summary of National Risk Index Findings, Prince William County[37]

Table 27: Comparison of Prince William County Scores with Virginia and National Average[38]

Index	Prince William County	Virginia Average	National Average
Risk	4.92	6.50	10.60
Expected Annual Loss	16.06	9.22	13.33
Social Vulnerability	14.43	35.32	38.35
Community Resilience	54.40	54.92	54.59

[37] National Risk Index, FEMA; Community Report - Prince William County, Virginia | National Risk Index (fema.gov) (https://hazards.fema.gov/nri/report/viewer?dataLOD=Counties&dataIDs=C51153)
[38] National Risk Index, FEMA; Community Report - Prince William County, Virginia | National Risk Index (fema.gov) (https://hazards.fema.gov/nri/report/viewer?dataLOD=Counties&dataIDs=C51153)

Table 28: Prince William County Risk Ranking Summary[39]

Index	Rank
Risk	Very Low
Expected Annual Loss	Relatively Low
Social Vulnerability	Very Low
Community Resilience	Relatively Moderate

PWC's NRI for community resilience is 54.40, indicating a moderate ability, compared to the rest of the United States, to prepare for natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions.

7.2. Community Resilience Estimates

Community Resilience Estimates (CREs) are produced by the U.S. Census Bureau, beginning August 10, 2021. They combine data from several sources to analyze individual and household-level risk factors for areas like a census tract, county, or state. They can be used to determine the potential of the community to respond to disasters.[40]

CREs can help determine the vulnerability to disasters of specific neighborhoods because of characteristics that may make segments of the population more susceptible to their impacts and consequences. CREs aggregate the following 10 risk factors:

12. Income-to-poverty ratio
13. Single or zero caregiver household
14. Unit-level crowding
15. Communication barriers
16. Aged 65 years or older
17. Lack of full-time or year-round employment (household)
18. Disability
19. No health insurance coverage
20. No vehicle access (household)
21. No broadband internet access (household)

[39] National Risk Index
[40] The methodology is described at the U.S. Census Bureau Community Resilience Methodology page (https://www.census.gov/programs-surveys/community-resilience-estimates/technical-documentation/methodology.html).

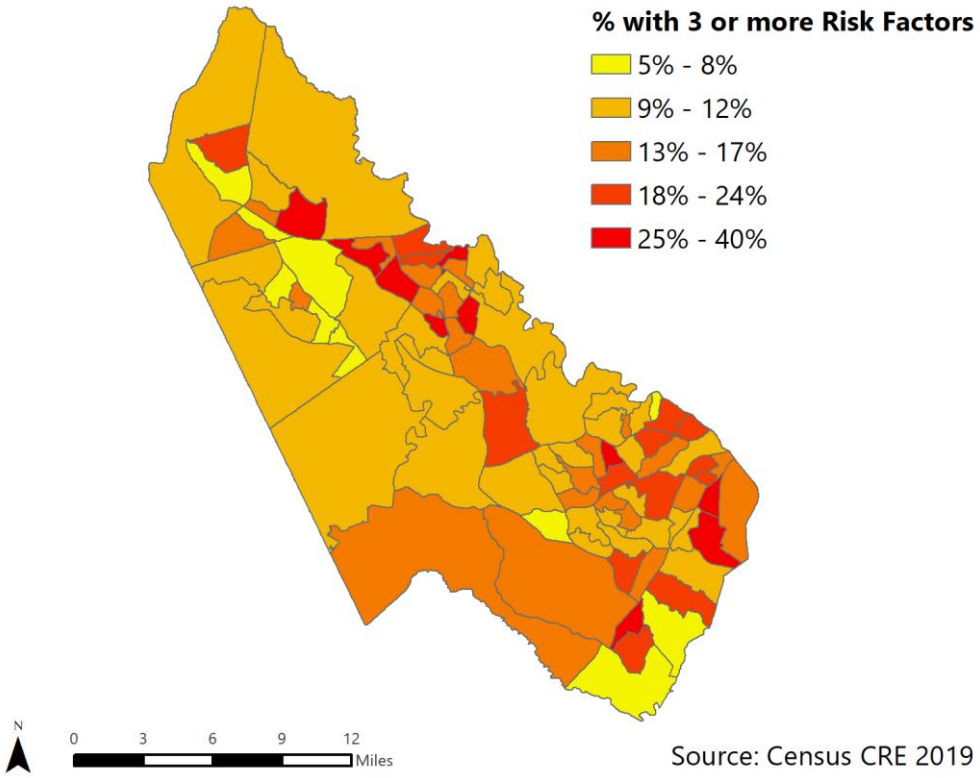

Figure 8: Community Resilience Estimates, Prince William County[41]

7.3. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

The Prince William County Hazard Mitigation Workgroup identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- The risk of cyber-related incidents on critical infrastructure and key resource sites
- Impacts of climate change
- Increases in the number of excessive rainfall events that impact new areas with flooding
- Increase in potential for stormwater infrastructure failure due to aging infrastructure which will exacerbate flooding issues in older, already developed areas of the County
- Continued development will aggravate flooding conditions
- Increase of special events with soft targets and crowded places through the County
- Increase in the frequency and severity of severe weather, extreme heat and extreme cold events
- Increasing age of critical infrastructure, including road and dam infrastructure will increase the risk for potential failure

[41] U.S. Census Bureau, Community Resilience Estimates

8. Mitigation Actions

8.1. Goals and Objectives

The Prince William County Hazard Mitigation Workgroup adopted the regional goal statement presented in **Section 8 of the Base Plan**. In addition, the PWC Emergency Operations Plan (EOP), dated December 2020, defines mitigation as "activities providing a critical foundation in the effort to reduce the loss of life and property from natural and/or human-caused disasters by avoiding or lessening the impact of a disaster and providing value to the public by creating safer communities". Mitigation seeks to fix the cycle of disaster damage, reconstruction, and repeated damage. These activities or actions, in most cases, will have a long-term sustained effect (*Prince William County EOP,* p. F-3).

The Plan also identifies mitigation as one of the five mission areas of the County's emergency management program and part of an integrated operational process that also involves prevention, preparedness, response, and recovery. (*Prince William County EOP,* p. 8) The County's emergency management approach is driven by a focus on equity to support the whole community with a commitment to promoting justice and fairness across all emergency management phases (*Prince William County EOP,* p. 1). The link between the goals of the *NOVA HMP* and the *EOP* increases the likelihood of success in implementing mitigating actions.

8.2. Status of Previous Actions

PWC monitors actions and tracks progress through the periodic review, evaluation, revision, and updating of the NOVA HMP. Some projects that contribute to risk reduction have been completed or are currently in progress but have not been included in this Plan for one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and the resulting risk reduction.

Table 29: Status of Previously Identified Mitigation Actions, Prince William County

Previous Action Item #	Agency/Department Mitigation Action	Status
2006-7	Promotion of structural mitigation	Ongoing
2010-3	Public outreach and education	Ongoing
2010-7	Parent notification	Ongoing
2010-9	Stormwater inventory framework/monitoring system	**Completed**
2010-13	NFIP compliance	Ongoing
2010-14	County Debris Management Plan	**Completed**
2017-1	Continuity of Operations Plan and Agency Continuity of Operations Plans	Ongoing
2017-2	Disaster recovery program	Ongoing
2017-3	Flood Mitigation Assistance Pilot Grant Program	**Completed**
2017-4	Mitigation of flood-prone structures	Ongoing

Three of the County's previous action items are completed, and seven are ongoing. Previous action items are from the 2006, 2010, and 2017 HMPs. They include planning efforts, structural projects, alert systems, training, and maintaining compliance with the National Flood Insurance Program.

8.3. New Mitigation Actions

The Prince William County Hazard Mitigation Workgroup identified nine new natural hazard and three new non-natural hazard mitigation actions to include in this plan. **Attachment 3** of this annex includes a table that summarizes each new and continued mitigation action for natural hazards, describing the proposed activity, priority level, estimated cost, interim measures of success, and lead agency. PWC's non-natural hazard actions are identified in **Section 10** of the **NOVA HMP Base Plan**.

Table 30: New Mitigation Actions, Prince William County Summary

2022 Action Item #	Agency/Department Mitigation Action
2022-1	Automated flood warning system
2022-2	Climate Resiliency Planning
2022-3	Emergency Operations Plan annexes
2022-4	Mitigate flood prone areas
2022-5	Lake Jackson Dam flooding issues
2022-6	Generators at identified mass care facilities
2022-7	Flood Mitigation study on Old Church Road
2022-8	Enhance and optimize alert and warning capabilities to improve public information and warning, situational awareness, and operational coordination.
2022-9	Training and exercises to maintain operational readiness

8.4. Action Plan for Implementation and Integration

The Prince William County Office of Emergency Management (PWC EM) is responsible for coordinating with county departments and agencies that participate in hazard mitigation activities. The PWC EM-designated mitigation coordinator is responsible for implementing the HMP on two levels: executing the jurisdiction's actions and facilitating the implementation of the multi-jurisdictional regional plan. Tasks to ensure that the jurisdiction's actions are implemented are integrated into the Action Plan for Implementation and Integration (which includes the prioritized list of mitigation actions) and Plan maintenance procedures described in the next section.

The Action Plan describes how the County's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 31: Action Plan for Implementation and Integration of Mitigation into Existing Plans and Procedures

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plans.	The goal of "providing a safe and secure community through prevention, readiness, and service excellence" was adopted in 2019 in the Comprehensive Plan. The newly adopted 2021–2024 Strategic Plan includes an objective to ensure "continued and enhanced preparation for and response to public health and other emergencies," and to "reduce and mitigation the impacts of flooding in communities." The Prince William County Office of Emergency Management (PWC EM) will continue to coordinate additional integration in all relevant plans as they come due for updates.
Review/update land development regulations for consistency with mitigation goals.	The PWC Hazard Mitigation Workgroup will be expanded to include agencies involved in land use planning and building code enforcement to ensure that all policies and procedures are reviewed annually and updated to address any identified mitigation projects, actions, or impacts to such plans.
Review/update building/zoning codes for consistency with mitigation goals.	The PWC Hazard Mitigation Workgroup will incorporate building and zoning codes into a review process. However, some components of building and zoning codes cannot be changed as they are adopted at the Commonwealth level.
Maintain regulatory requirements of the National Flood Insurance Program (NFIP).	The PWC Public Works Environmental Services Division in coordination with PWC EM will continue to maintain regulatory requirements for floodplain management in accordance with NFIP.
Enhance floodplain management through the Community Rating System (CRS).	PWC just completed its 5-year review cycle, and it anticipates increasing at least one CRS class. The PWC Hazard Mitigation Work group is developing a strategic plan for ongoing maintenance and implementation of CRS programs with the goal of becoming at least a class 5 community.
Review/update Economic Development Plan and policies for consistency with mitigation goals.	PWC EM will coordinate with PWC Economic Development to continue to develop the business and industry function for response and recovery operations and explore avenues for integration with mitigation goals, as applicable.
Continue public engagement in mitigation planning.	PWC EM will continue to coordinate community outreach and engagement efforts through the "Ready Prince William" program. These efforts will focus on expanding reach to multiple areas of the community, creating focused information and engagement programs for specific community needs or the hazards they face, and continuing to promote general preparedness and mitigation efforts to increase community resiliency.
Identify opportunities for mitigation education and outreach.	The PWC Hazard Mitigation Workgroup will continue its efforts to provide mitigation information to the community as a whole and address community and individual-specific concerns, as they arise.
Review/update stormwater management (SWM) plans and procedures for consistency with mitigation goals.	PWC Department of Public Works will continue its SWM program. All SWM plans and procedures will be incorporated into the PWC Hazard Mitigation Workgroup review of plans, policies, and procedures to ensure alignment with and enhancement of relevant mitigation goals.

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Review/update emergency plans to address evacuation and sheltering.	The PWC EOP was readopted in December 2020, and it will be readopted in 2024, per state requirements. PWC EM will continue to coordinate the development, updating, maintenance, and training and exercising of all emergency operations plans, policies, and procedures. This includes functional annexes, hazard-specific annexes, and all documentation related to the emergency operations center.
Maintain ongoing enforcement of existing policies.	The PWC Hazard Mitigation Workgroup will continue to review all policies to ensure necessary enforcement is being completed.
Monitor funding opportunities.	PWC EM will continue to monitor all possible funding opportunities and coordinate with the PWC Hazard Mitigation Workgroup and other stakeholders to identify and expand previously untapped funding sources for mitigation projects as they are identified and for which PWC is eligible. PWC EM will also work with stakeholders to integrate mitigation actions and projects into other CIP projects to maximize use of all funding options.
Incorporate goals and objectives into day-to-day government functions.	PWC EM will continue to work with the PWC Mitigation Workgroup and the PWC Office of Executive Management to continue to identify ongoing integration of mitigation activities, where applicable, in day-to-day government functions.
Incorporate goals into day-to-day development policies, reviews, and priorities.	PWC EM will continue to work with the PWC Mitigation Workgroup and the PWC Office of Executive Management to continue to identify ongoing integration of mitigation activities, where applicable, in day-to-day development of policies, reviews, and priorities.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the Plan maintenance process, as outlined in **Section 3, Base Plan**. These responsibilities are summarized in Table 32.

Table 32: Prince William County Plan Maintenance Responsibilities for the NOVA Hazard Mitigation Plan (Base Plan)

Activity	Responsibilities
Monitoring the plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA Planning Group. • Maintain records and documentation of all jurisdictional monitoring activities. • Help disseminate reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA Planning Group. • Maintain records and documentation of all jurisdictional evaluation activities. • Help disseminate information and reports to stakeholders and the public.
Updating the plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and updating. • Collect and report data to the NOVA Planning Group. • Maintain records and documentation of all reviews and revisions of the plan by the jurisdiction. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintaining the **NOVA HMP Base Plan**, the Prince William County Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following a major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in the fifth year

Table 33: Prince William County Annex Maintenance Procedures

Activity	Procedure and Schedule	Outcome
Monitoring the annex	1. Schedule the annual plan review with the jurisdiction planning team. 2. Review the status of all mitigation actions, using the Mitigation Action Implementation Worksheet **(NOVA HMP Base Plan, Section 3, Attachment A)**.	• Produce an annual report that includes the following: ▪ Status update of all mitigation actions ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities ▪ Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the annex	1. Schedule the annual plan evaluation with the jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities and hazard mitigation capabilities using the Planning Considerations Worksheet **(NOVA HMP Base Plan, Section 3, Attachment C)**.	• Submit the annual report to the NOVA HMP Project Team Point of Contact.
Updating the annex	1. Coordinate with Northern Virginia jurisdictions to identify the process and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years helps maintain the jurisdiction's eligibility for federal post-disaster funding.

Mitigation actions presented in the PWC Jurisdiction Annex may be reviewed, revised, and updated at any time. PWC will continue to be a planning partner with multiple jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan.

10. Annex Adoption

The PWC Jurisdiction Annex will be adopted simultaneously with the adoption of the *NOVA HMP*.

11. Prince William County Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Documentation of Public Participation

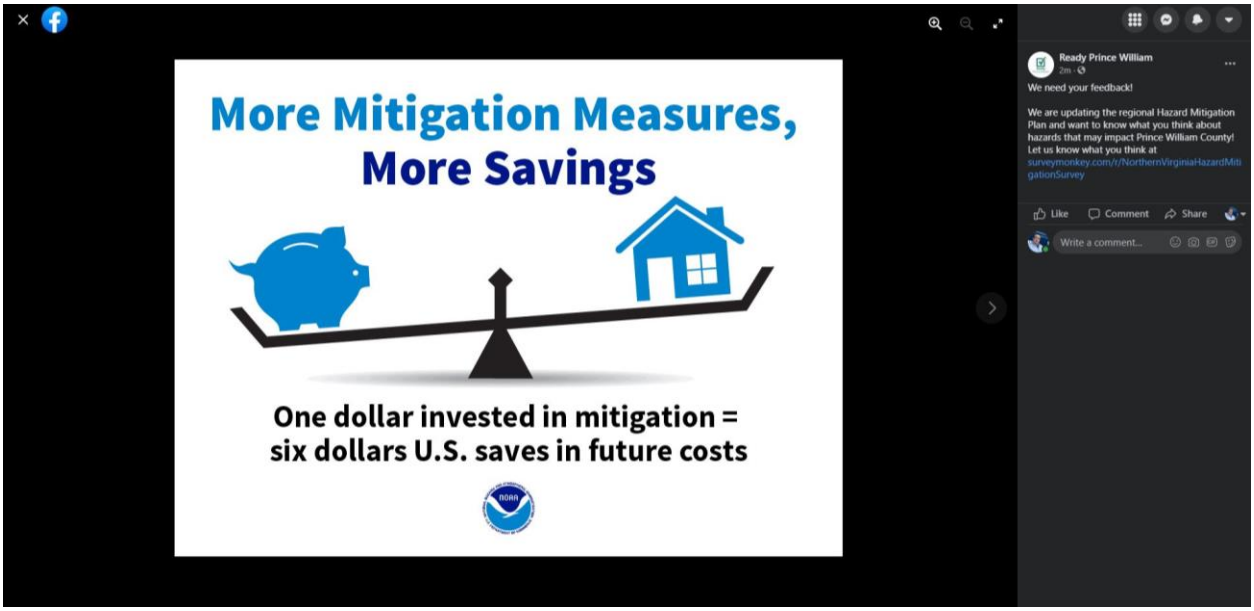

Figure 9: Public Participation Outreach through Facebook Screenshot[42]

Figure 10: Public Participation Outreach through Twitter Screenshot[43]

[42] www.facebook.com/ReadyPWC/photos/a.126388788690207/555621955766886
[43] www.twitter.com/ReadyPWC/status/1435966448564785155

Figure 11: Final Draft Public Comment Outreach through Twitter

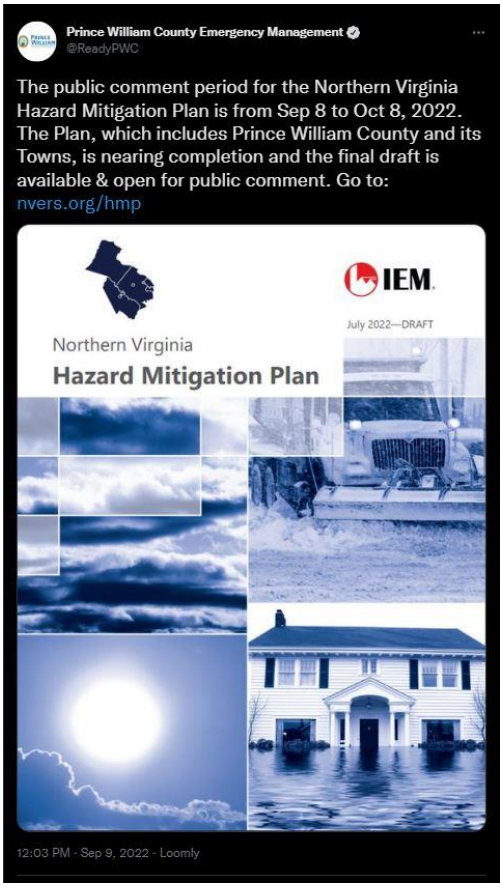

Figure 13: Final Draft Public Comment Outreach through Twitter

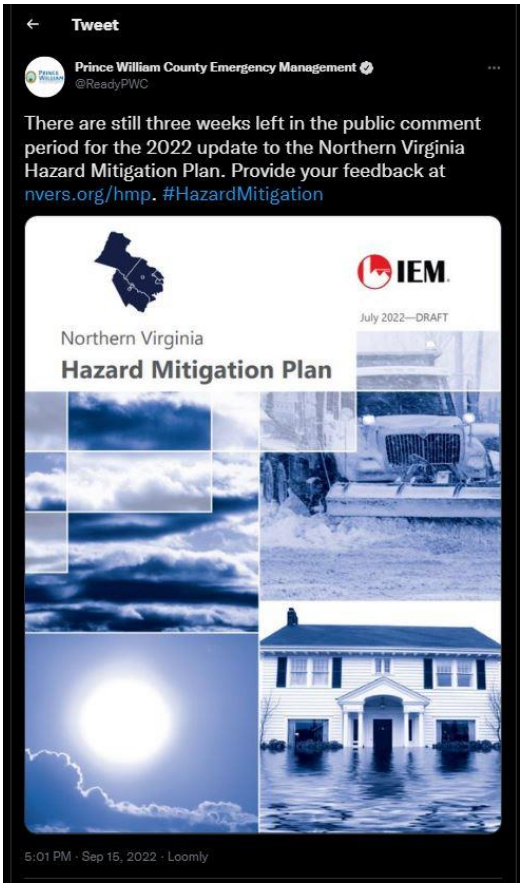

Figure 12:Final Draft Public Comment Outreach through Twitter

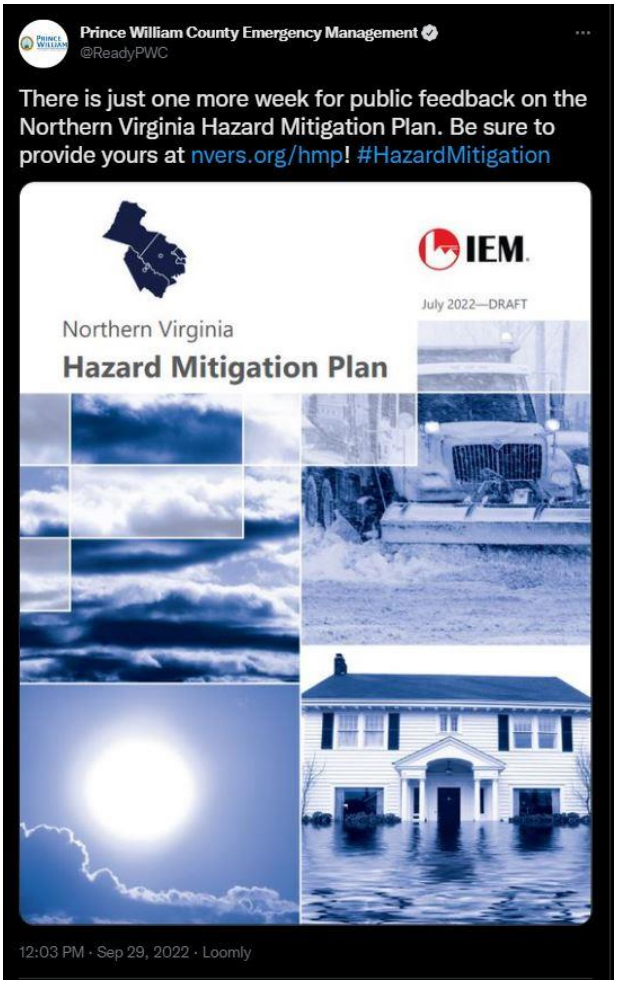

Figure 14: Final Draft Public Comment Outreach through Twitter

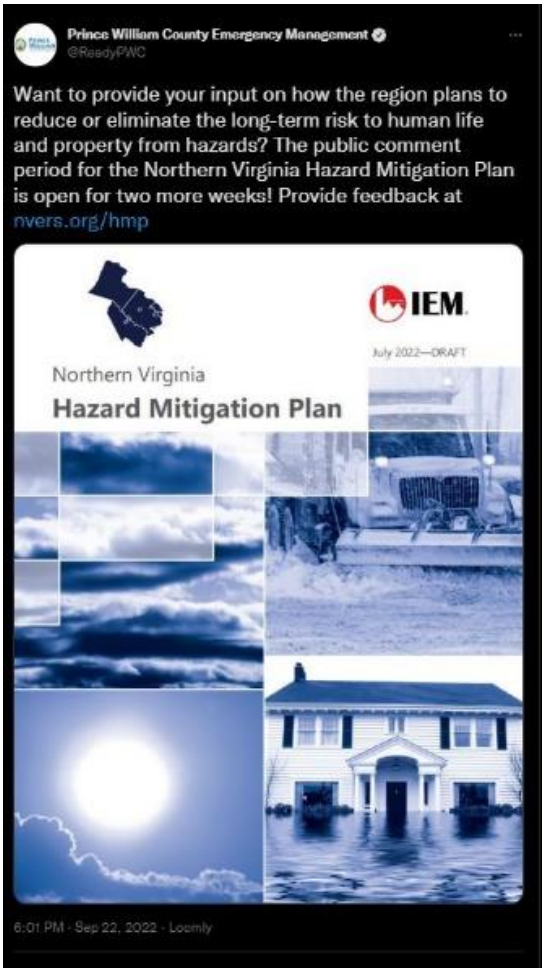

Figure 15: Final Draft Public Comment Outreach through Twitter

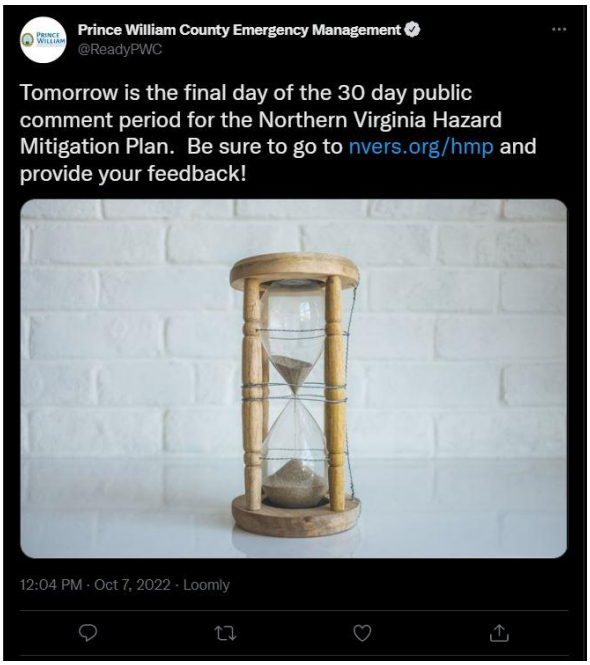

Figure 17:Final Draft Public Comment Outreach through Twitter

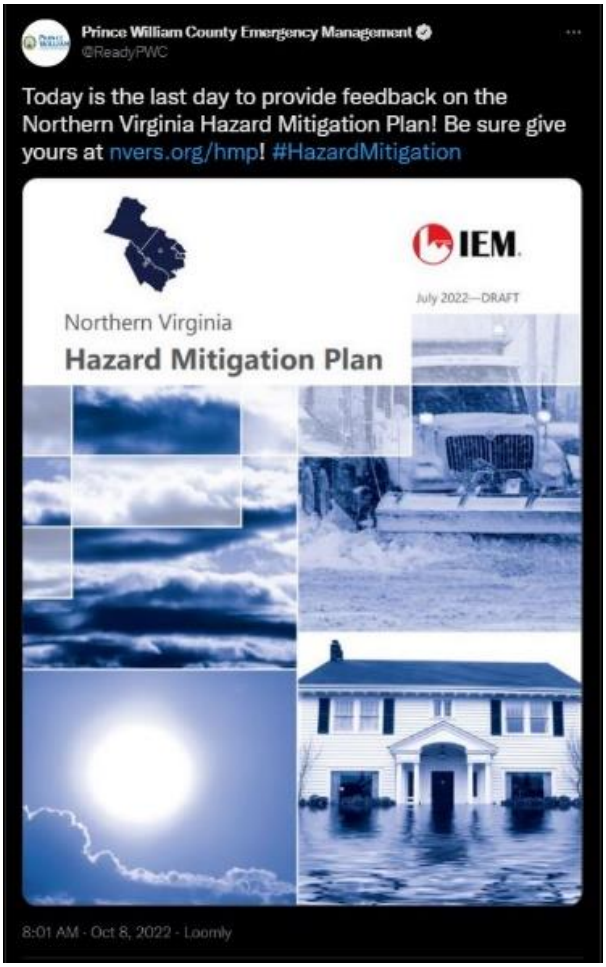

Figure 16: Final Draft Public Comment Outreach through Twitter

11.3. Attachment 3: Mitigation Actions

Table 34: Previous Mitigation Action

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment	Current Status	Justification of Current Status
2006-7	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	Department of Development Services, Department of Fire and Rescue, Department of Public Works	• Earthquake • Flood • High wind/ severe storm • Tornado • Winter storm	FEMA Unified Hazard Mitigation Assistance Funding	Ongoing	Continue to adhere to building code and flood plain ordinance.	Medium	Action carried over from previous plan; Still relevant and necessary	Ongoing	Through the PWC Hazard Mitigation Working Group, agencies worked to ensure that all building code and flood plain ordinances were adhered to through all building permitting processes. In addition, the Working Group reviewed and updated several processes and procedures in 2021 to ensure continued compliance and that all members of the public had information related to structural mitigation options, where applicable.
2010-3	Provide outreach and educate to those citizens who are at risk of flooding	Office of Emergency Management, Department of Public Works and Virginia Cooperative Extension	• Flood • High wind/ severe storm	FEMA Unified Hazard Mitigation Assistance Grants, Hazard Mitigation Grant Program-5% initiative funds	Ongoing	N/A	High	No	Ongoing	As part of PWC's Ready Prince William whole community outreach campaign, several initiatives were ongoing during 2021 focusing on All-hazard preparedness and, more specific flood preparedness and awareness information, as flooding is the highest natural hazard risk impacting PWC. Outreach materials including PWC Emergency Preparedness Handbook, Flood Preparedness brochure and other hazard-specific information were developed, updated, and maintained and made available online and available during all Community Outreach activities and events conducted by PWC. Materials were also made available to community partners, on a requested basis. PWC Emergency Management also maintained and updated the general Ready Prince William website (pwcva.gov/ready) and also enhanced the pwcva.gov/flooding webpages to provide members of the public additional in-depth information about flooding.

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment	Current Status	Justification of Current Status
										Targeted outreach campaigns in 2021 relating to flooding include: - Mailing of letters to all properties located in area that has a history of repeated flooding with key information about protecting their property from flooding. -Highlighting flooding hazards during the first ever Flood Awareness Week in PWC and Virginia. -Highlighting flooding hazards relating to dams in PWC during Dam Safety Day and mailing a post card to all properties located downstream of a high or significant hazard dam in PWC. -Flood preparedness and flood insurance brochures information distributed at the Prince William County Fair and the PWC Public Safety Day. Several publications have been made available online and at several PWC libraries for public access including Bull Run Library, Central Library, Chinn Park Library, Haymarket Gainesville Library, Montclair Library, Potomac Library, and Dumfries Neighborhood Library. These publications include: 1. Prince William County Flood Insurance Rate Map (FIRM) – January 5, 1995/August 3, 2. 2015 Prince William County Flood Insurance Study (FIS) January 5, 1995 3. Prince William County Flood Preparedness Brochure 4. Prince William County Northern Virginia Hazard Mitigation Plan
2010-05	Review and update Emergency Action Plans (EAP) for Dams owned by the County and work with private dam owners on	Department of Public Works, Office of Emergency Management	• Extreme Temperature • Flood	Hazard Mitigation Grant Program-5% initiative funds, Virginia	Ongoing	Continue to evaluate as required	High	Lake Jackson and Silver Lake Dams have been rehabilitated and meet all currents	Ongoing	PWC Emergency Management continued to review Dam Emergency Action Plans for all High and Significant Hazard Dams in PWC and participated in two dam exercises, as requested by private dam owners. In addition,

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment	Current Status	Justification of Current Status
	inspections, maps and updates		• High wind/ severe storm	Floodplain Management Fund (administered by DCR Division of Dam Safety and Floodplain Management), County Funding				standards. Non-County owned dam EAP are reviewed when received from the dam owner and recommendations are made to the owner of the dam		PWC EM staff reviewed the Dam inventory in PWC to ensure all updated EAPs are on file digitally, available in the Emergency Operations Center in hard copy format, included in a publicly viewable Dam-inundation mapper. PWC EM also developed the Dam Emergency Response Hazard-Specific Annex as part of the PWC Emergency Operations Plan update that also includes Quick Response Guides for all high and significant hazard Dams in PWC to ensure all first responders have quick response information during a potential or actual dam incident.
2010-7	Evaluate parent notification process at schools in include language evaluation	Prince William County Schools	• All Hazards	No cost-internal County School Staff support	Ongoing	Continue to increase language evaluation capability	Medium	Numerous methods of communications with parents and guardians. Will continue to evaluate and address language evaluation.	Completed	This mitigation action has been completed and is no longer relevant as PWC Schools have a program they continuously implement.
2010-9	Development of a storm water inventory framework/monitoring system	Department of Public Works	• Dam failure • Flood • High wind/ severe storm	PWC Storm water management fee funds this ongoing initiative	Ongoing	Update and maintain inventory database	Medium	Utilize current manual system to provide flood checks before major storm events as well as County maintained facilities	Completed	PWC Department of Public Works developed and maintains a stormwater inventory.
2010-13	Review locality's compliance with the National Flood Insurance Program to include an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Additionally,	Department of Public Works, Office of Emergency Management	• Dam failure • Flood • High wind/ severe storm	Hazard Mitigation Grant Program, County floodplain management program	Ongoing	Annual Review	Medium	No	Ongoing	PWC Emergency Management and Public Works reviews the repetitive loss and severe repetitive loss properties within PWC on an annual basis. Due to a backlog with FEMA, the 2021 list is still pending, however, a review has been conducted including all problem areas and past known areas with repetitive loss properties. In addition, PWC EM and Public Works has also reviewed all

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment	Current Status	Justification of Current Status
	conduct annual review of repetitive loss and severe repetitive loss property list requested from VDEM to ensure accuracy and conduct outreach as appropriate. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501									CRS/NFIP and Flood Insurance guidance and changes to ensure that all impacts are addressed in the PWC Hazard Mitigation Program. The PWC Hazard Mitigation Working Group also continued to address any homeowner questions relating to problem site flooding and financial questions about assistance available to support flooding concerns, even if they are not noted as RL or SRL properties. In addition, PWC developed the 2021 *Substantial Damage Management Plan.*
2010-14	Review and update County Debris Management Plan as required	Department of Public Works	• Earthquake • Flood • High wind/ severe storm • Karst/Sinkholes/ Land subsidence • Landslides • Tornado • Winter storm	Internal Staff; PWC Contracted services	Ongoing	Annual training and exercise on Debris Management Plan	Low	Update sent to FEMA for formal review and approval by December 2016	Completed	The Department of Public Works continued to maintain the PWC *Debris Management Plan.* The Plan was last adopted in 2017 in accordance with FEMA requirements. Public Works conducted the annual plan familiarization seminar in 2019. The seminar was put on hold in 2020 and 2021 due to COVID. This mitigation strategy will be replaced with a broad action for all Emergency Plans.
2017-1	Develop, test and exercise County Continuity of Operations Plan and Agency Continuity of Operations (COOP) Plans	Office of Emergency Management	• All Hazards	PWC funding	Ongoing	Annual review of County and Agency COOP Plans, and completion of annual training and exercise matrix	High	N/A	Ongoing	PWC Emergency Management coordinated and maintains the County Continuity of Operations Program. All County agency COOP annexes were reviewed and significantly updated in 2020-2021 due to operational changes during COVID-19 to ensure all agencies-maintained mission essential functions, particularly as it relates to virtual service provision and widespread telework implementation. PWC EM will conduct the annual agency plan reviews through the end of 2021. In addition, PWC is conducting a significant revision of the

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment	Current Status	Justification of Current Status
										Countywide Continuity of Operations and Continuity of Governance plan to include several job aids and decision-making tools identified as an area of improvement during the COVID-19 Interim Action Review. This planning process is expected to be completed in 2022.
2017-2	Create a Disaster Recovery program for information technology systems	Department of Information Technology	• All Hazards	County Funding	Ongoing	Conduct annual contingency test on mission critical systems	Medium	N/A	Ongoing	PWC Department of Information Technology continues to conduct testing, updates, and maintenance on all mission critical systems. These updates are conducted on a system-specific basis to ensure optimum usability and ensure system redundancy during disaster.
2017-3	Prince William County Flood Mitigation Assistance Pilot Grant Program to Acquire Severe Repetitive Loss properties and create green space	Office of Emergency Management	• Flood	Flood Mitigation Assistance (FMA) Grant	Grant Period of Performance ends October 2018	FEMA Grant awarded May 26, 2016	Medium	Pending evaluation of pilot program and homeowner participation	Completed	PWC Emergency Management coordinated the implementation of the first Acquisition and Demolition of a Severe Repetitive Loss property in PWC. This project was completed in accordance with all FEMA Flood Mitigation Assistance Grant requirements and was successfully closed out in 2019. PWC Emergency Management continues to provide advice to County agencies and homeowners who have an RL or SRL designation to ensure all relevant program information is readily and easily accessible.
2017-04	Support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate	Department of Public Works	• Flood • High wind/severe storm	FEMA Unified Hazard Mitigation Assistance Funding	Ongoing	Identify all priority flood-prone structures by December 2019	Medium	Action carried over from previous plan; Still relevant and necessary	Ongoing; would like to remove wording in red	The PWC Hazard Mitigation Working Group formally meets at least twice a year to review all problem areas to review impacts to identify existing opportunities to increase, enhance, and implement new and meaningful mitigation strategies. As part of this process, all flooded areas and road closures are reviewed by PWC EM and any new areas or reoccurring problem areas identifying the cause of flooding (if possible), and any short-term or long-term mitigation actions. Most new problem areas identified during flooding events are a result to construction or the

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment	Current Status	Justification of Current Status
										failure or exceedance of temporary erosion and stormwater control measures. The Working Group review will also include, but are not limited to, other potential causes including potential failure of existing stormwater control measures and equipment, environmental or ecological impacts like a new beaver dam, coastal erosion, or water level changes. Once mitigation actions are determined, the Working Group will assign a lead agency and track the implementation and impacts in future flooding events. This analysis also contributes to identification of opportunities for outreach and PWC EM's ongoing enhancements to the Program for Public Information, which provides the public with information needed to increase flood-hazard awareness and to motivate actions to reduce flood damage, encourage flood insurance coverage, and protect the natural functions of floodplains. Where funding is required to implement a project, the Working Group will review all local, state, and Federal opportunities to determine the best course of action and PWC EM tracks the development of all eligible project applications in accordance with funding guidelines.

Table 35: New Mitigation Actions

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment
2022-01	Implement PWC Automated Flood Warning System in areas of frequent flooding and dams	Office of Emergency Management	• Dam failure • Flood • High wind/ severe storm	Various funding sources	Ongoing	Continue to add locations, as funding is identified	High	
2022-02	Develop a Community Energy and Sustainability Master Plan, and implement it, where applicable, across County programs.	Department of Public Works	• All Hazards	Various funding sources	2023	Develop Plan	High	
2022-03	Continue to Develop and Enhance hazard-specific and functional annexes of the PWC Emergency Operations Plan	Office of Emergency Management	• All Hazards	Various funding sources	2024	Develop draft annexes	High	All first draft annexes should be completed no later than 2024.
2022-04	Continue to address frequent flooding problem areas and evaluate for specific mitigation actions	Office of Emergency Management/PWC Hazard Mitigation Workgroup	• Dam failure • Flood • High wind/ severe storm	Various funding sources	Ongoing	Quarterly review of all problem sites by Work group	Medium	
2022-05	Address reoccurring flooding issues on Lake Jackson and Dam components that have reached the end of their service life	Department of Public Works	• Dam failure • Flood	Various funding sources	Ongoing	Approval by BOCS or approval of funding to move forward	Medium	
2022-06	Coordinate the purchase and installation of emergency generators or mobile generator docking stations for pre-identified facilities that could be used as emergency mass care facilities	Department of Facilities and Fleet; Department of Parks, Recreation and Tourism; Libraries, Office of Emergency Management	• All Hazards	Various funding sources	Ongoing	Develop a prioritized list of facilities and needs for potential grant programs	High	

Project No.	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment
2022-07	Conduct a study to determine mitigation options for recurring flooding on Old Church Road	Office of Emergency Management/ Department of Public Works	• Dam failure • Flood • High wind/ Severe storm	Federal HMA grant	2023	Secure funding for a study to determine long-term mitigation action	Medium	
2022-08	Enhance and optimize alert and warning capabilities to improve public information and warning, situational awareness, and operational coordination	Office of Emergency Management	• All Hazards	Various Funding Sources	Ongoing	Complete capability buildout and increase opt-in users	High	
2022-09	Continue to train and exercise field/EOC coordination and integration	Office of Emergency Management, PWC Fire and Rescue System, Police Department	• All Hazards	Various Funding Sources	Ongoing	Develop and conduct PWC-Specific Field/EOC Coordination Course for Command Staff	Medium	

Northern Virginia Hazard Mitigation Plan

Annex 17-A: Town of Dumfries

November 2022

Town of Dumfries Overview

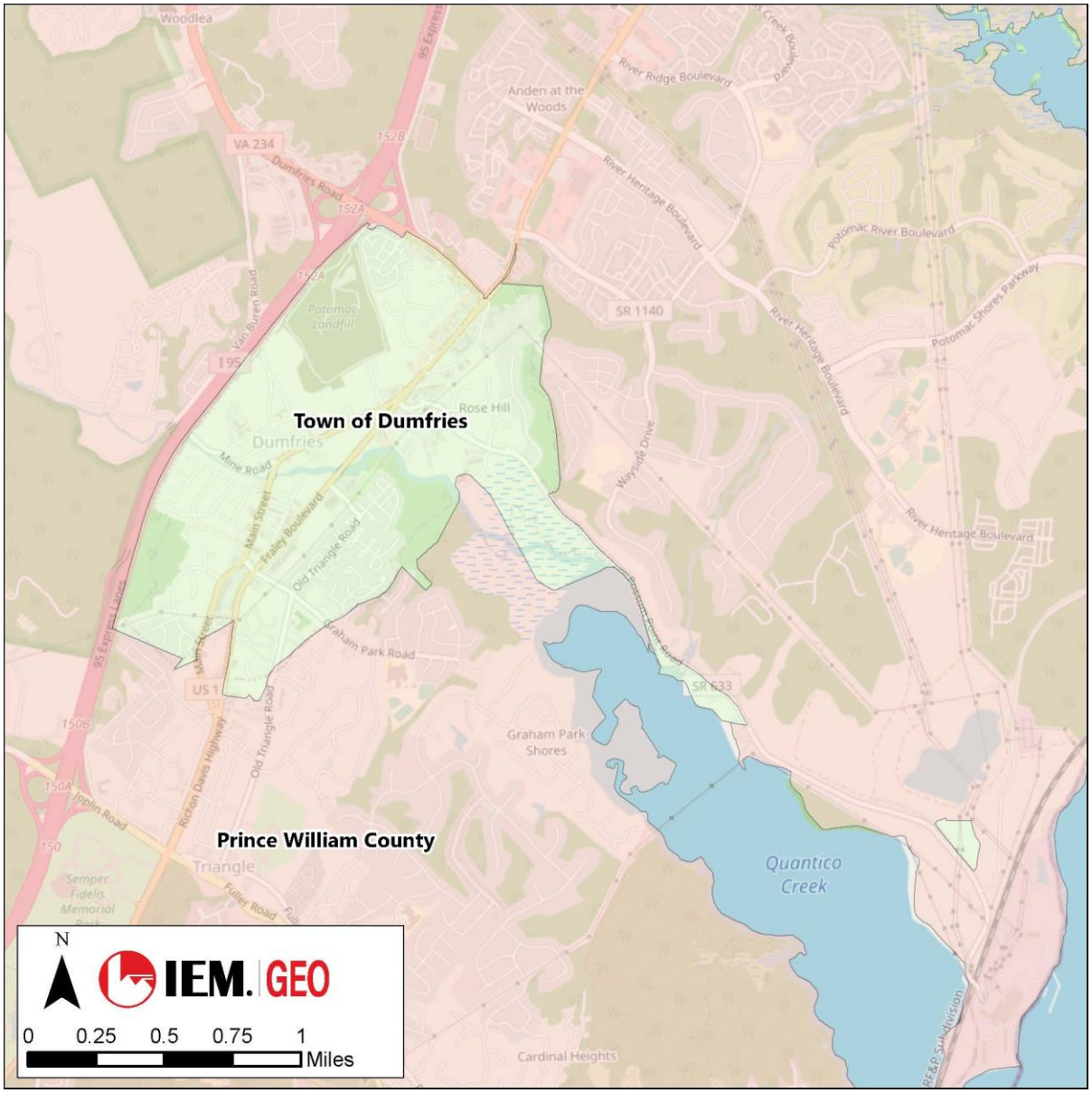

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1749	1.55 sq. mi.	5,679	17739 Main St, Suite 200, Dumfries, VA 22026	1,531	Flood/Flash Flood

Town of Dumfries Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

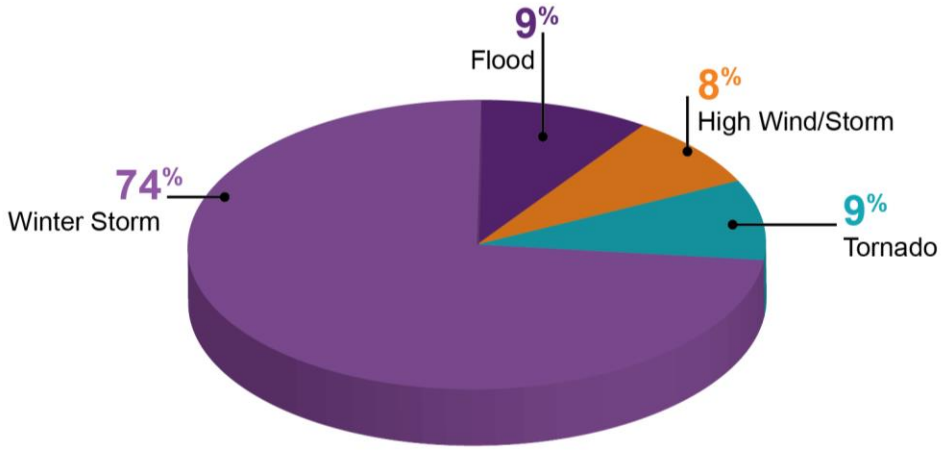

Figure 1: Percentage of Hazards

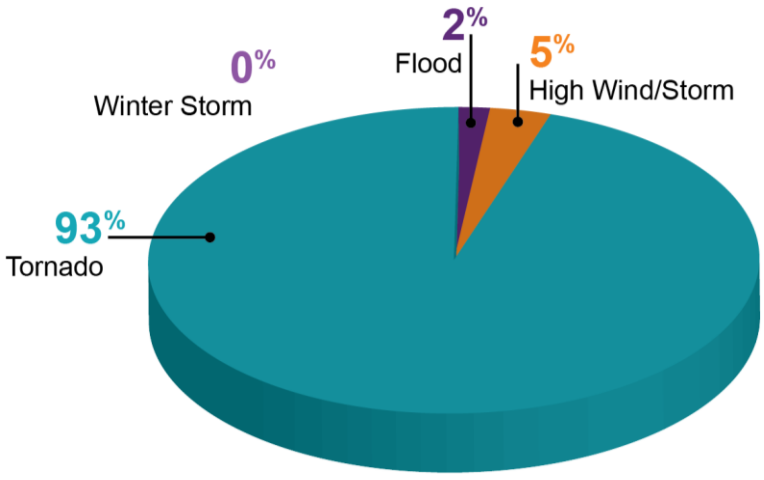

Figure 2: Property Damage Percentages from Natural Hazards

Natural Hazard Risk Ranking

Table 2: Ranking of Natural Hazards by Risk

Hazard	Hazard Ranking
Winter Weather	**High**
Flood	**High**
High Wind/Severe Storm	**High**
Tornado	**Medium**
Earthquake	**Medium**
Drought	**Medium**
Extreme Temperatures	**Medium**
Dam Failure	**Medium**
Wildfire	**Low**
Landslide	**Low**
Karst/Sinkhole	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifelines/Sectors	Number of Assets
Safety and Security	1
Food, Water and Shelter	0
Health and Medical	0
Energy	1
Communications	1
Transportation	5
Hazardous Materials	0
Education	10
Cultural/Historical	2
High Hazard Dams	2

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for Town of Dumfries

Capability	Ranking
Planning and Regulatory	High
Safe Growth	High
Administrative and Technical	Moderate
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Jonét Prévost-White, Director of Public Works Department of Public Works 703-221-3400 jwhite@dumfriesva.gov 17739 Main Street, Suite 200 Dumfries, VA 22026
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Town of Dumfries

This annex presents the following jurisdiction-specific information provided by the Town of Dumfries for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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1. Jurisdiction Profile

Established	1749
Total Land Area	1.55 square miles
Geographic Region	Piedmont
Persons Per Household	3.47
Persons Per Square Mile	3,664
Median Age	24.7
Elevations	36 feet

1.1. Location

The Town of Dumfries is in Prince William County. The town is situated 70 miles north of the Commonwealth capital of Richmond. It is 30 miles south of central Washington, D.C. The eastern part of the town is along the Quantico River, which feeds into the Potomac River. This location results in the town being at a lower elevation than most jurisdictions in the planning area.

1.2. History

The Town of Dumfries began as early as 1690 when a gristmill on Quantico Creek was erected. The Town was formally established on 60 acres and named after the birthplace of founder John Graham, Dumfriesshire, Scotland. The Town received its charter on May 11, 1749, making it the oldest continuously chartered town in Virginia. Dumfries was the second leading port in Colonial America, receiving tobacco from the upland and rivaling New York, Philadelphia, and Boston. Due to numerous factors, Dumfries peaked in size and importance in 1763.[1]

1.3. Demographics, Economy, and Governance

Table 6: Population and Growth Rate[2]

Year	Population
1970	1,890
1980	3,214
1990	4,282
2000	4,934
2010	4,961
2020	5,679

[1] https://www.dumfriesva.gov/residents/about_the_town/index.php
[2] U.S. Census Bureau QuickFacts: Dumfries town, Virginia

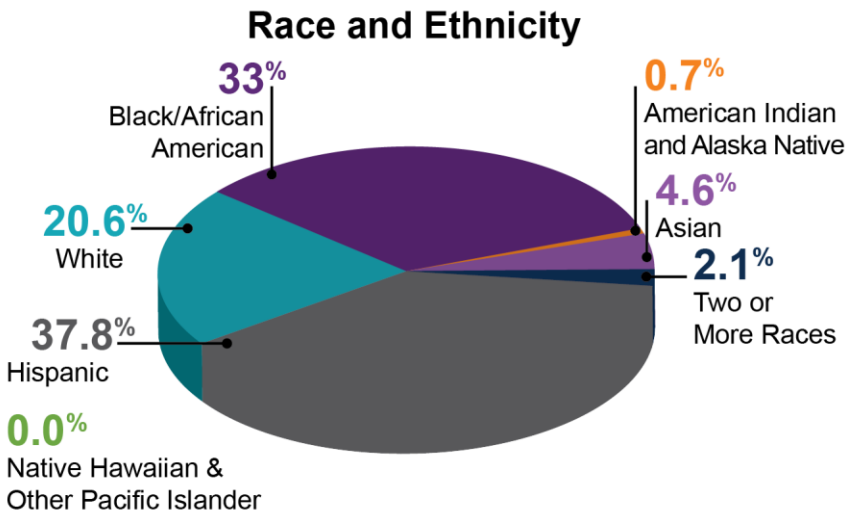

Figure 4: Race and Ethnicity Demographics

Table 7: Economic Data

Economy	Data
Median Household Income (2020)	$68,438
Unemployment Rate (September 2021)	3.2%
Per Capital Income (2020)	$25,892
Median House or Condo Market Value (2019)	$214,800
Percentage Below Poverty (2020)	15.5%

The Town of Dumfries has a Council-Manager form of government with a seven-member Council, including the Mayor and Vice Mayor. The day-to-day management of the town is overseen by a Town Manager whose duty it is to implement the policies of the Mayor and Council.

1.4. Built Environment and Community Lifelines

The information related to Community Lifelines and critical assets in the Town of Dumfries presented in this section has been collected from multiple sources, including Hazus (Version 4.2) and government websites. Data extracted from the Hazus Level 1 assessment indicates that the town has an estimated 21 critical and historic assets. Due to the delay in collecting and verifying data and the method of documenting location and jurisdiction used in Hazus, this may not reflect the current inventory maintained by the Town of Dumfries.

The Town of Dumfries maintains a detailed list of community lifeline facilities, sites, and critical assets.

Table 8: Number of Assets per Community Lifeline/Sector

Sector	Number of Assets
Safety and Security	2

Sector	Number of Assets
Food, Water, Shelter	0
Health and Medical	0
Energy	1
Communications	1
Transportation	5
Hazardous Materials	0
Education	10
Cultural/ Historical	2
High Hazard Dams	0

1.4.1. Safety and Security

There is one police station serving the Town of Dumfries. The fire and medical assistance comes from the county. One volunteer fire department is located in the town.

1.4.2. Food, Water, Shelter

Food commodities are available throughout the town from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

1.4.3. Health and Medical

There are no medical facilities in the Town of Dumfries according to the Hazus information.

1.4.4. Energy

The Dominion Possum Point power plant is located outside of the Town of Dumfries, although it has a Dumfries address, and it is a critical lifeline in the area. Due to the Dumfries address for the plant, Hazus believes it is in the town.

1.4.5. Communications

There is one town-level broadcast facility listed in the Town of Dumfries, WPWC 1480. It is a Spanish Christian formatted broadcast radio station licensed to Dumfries-Triangle, Virginia. It serves southern Prince William County and western Charles County, Maryland. It is owned by JMK Communications.

Most communications and information systems and infrastructure in the United States are privately owned. In recent years, the federal government has taken a stronger role in protecting information and communications infrastructure, which may also present a challenge in relation to disaster impacts. Increasing reliance on this infrastructure by individuals, businesses, and government could cause vulnerabilities that emergency managers should take into consideration in pre- and post-incident planning and operations.

1.4.6. Transportation

There are three highway bridges along the U.S. 1 in town: two over Quantico Creek and one over Cannonball Branch stream. The Town's western boarder runs along Interstate 95 (I-95) and there are two ports in the town at Possum Point and Atlantic Richfield. Highways are maintained by the Commonwealth.

1.4.7. Hazardous Materials

There are no hazardous materials facilities/storage sites listed for the Town of Dumfries

1.4.8. Education

The only public school within the Town limits is one elementary school.

1.4.9. Recreational, Cultural and Historic Sites, and Assets

There are two historical buildings in the town, the Old Hotel and Weems-Botts House.

1.5. Growth and Development Trends

According to the Dumfries Comprehensive Plan 2014 and Housing Analysis of 2020, population change is tied to the greater growth patterns of Prince Williams County and Northern Virginia.[3] The population rate of Dumfries has remained steady and slow over the last decade with an increase of growth and development predicted in the coming decade to match the surrounding communities. The increase in development is due partly to the housing affordability in Dumfries compared to the surrounding Northern Virginia communities. Most of the growth will continue to be in multi-family units.

[3]https://www.dumfriesva.gov/government/departments/planning_and_community_development/comprehensive_plan.php

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the Town of Dumfries followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Group, the town supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction.

Table 9: Local Planning Participants

Name	Position/Title	Department/Agency
Jonét Prévost-White	Director of Public Works	Department of Public Works
Keith Rogers	Town Manager	Town Manager's Office

The jurisdiction identified its chief hazard mitigation planning responsibility as representing the town in coordination with the Prince William representative to the Emergency Manager's Planning Group. The town also identified the following tasks as part of its mitigation planning responsibilities:

- Jurisdictional planning committee
- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review plan drafts and provide input
- Public outreach activities
- Implementation of the plan
- Maintaining the plan

Town of Dumfries planning participants coordinated primarily by means of virtual meetings during the planning process, and as needed, independently to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A.**

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a Public Hazard Survey, which was posted and advertised on the town's website: Town of Dumfries, VA (dumfriesva.gov).

In addition to the survey, the public was offered the opportunity to review and provide input to the draft 2022 plan update. Notification of the Draft Plan release was made through the same town web link. Documentation of the public survey and draft plan review is included in **Attachment 3** of this annex.

3. Jurisdiction-Specific Hazard Event History

The Town of Dumfries' comprehensive hazard history is generally combined with Prince William County's and described in **Sections 4 and 5, Base Plan**.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,019 recorded natural meteorological events that took place in Prince William County between January 1, 1950, and May 2021. The county and its municipalities have been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 10: Federal Disaster and Emergency Declarations (2017–2021), Prince William County

Declaration	Date	Hazard	Assistance Type
DR-4512-VA	4/2/2020 (continuing)	COVD-19 Pandemic	Individual Assistance, Public Assistance
EM-3448-VA	3/13/2020 (continuing)	COVID-19 Pandemic	Public Assistance (Category B)
EM-3403-VA	9/11/2018	Hurricane Florence	Public Assistance (Category B)

Tables 18 and 19 in Annex 17 provide a summary of all high wind/severe storm and severe winter weather events that have occurred in Prince William County between 1950 and May 31, 2021.

The Town of Dumfries Planning Team highlighted two flooding events as significant hazards that have occurred since the 2017 plan.

Table 11: Significant Hazard Events, Town of Dumfries (2017–2021)

Date	Hazard	Event and Description
2018 (Estimated date)	Flooding	Flooding occurred on Main Street, impacting buildings and cars. It is likely that a similar event will occur in the future. No one on staff knows the exact date; however, they remember it occurring.
August 12, 2020	Flooding	Flooding occurred on Main Street, impacting town property and cars. Batestown Road was closed due to water. The flood inundated the parking lot of the town offices, but all cars were moved out of the lot before the flood. It is likely that a similar event will occur in the future.

4. Hazard Risk Ranking

After developing hazard profiles, the Town of Dumfries conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan**. The Hazard Risk Ranking scores for the town are provided in **Attachment 2** of this annex.

The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5, Base Plan**, and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II of the Base Plan**.

Table 12: Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.7	3.5	7.2	**High**
Flood	1.7	4.2	5.9	**High**
High Wind/Severe Storm	2.7	3.2	5.8	**High**
Tornado	1.3	4.3	5.6	**Medium**
Earthquake	2.3	3.2	5.5	**Medium**
Drought	2.3	3.2	5.5	**Medium**
Extreme Temperatures	3.0	2.5	5.5	**Medium**
Dam Failure	1.0	4.1	5.1	**Medium**
Wildfire	1.0	3.0	4.0	**Low**
Landslide	1.0	2.7	3.7	**Low**
Karst/Sinkhole	1.0	2.5	3.5	**Low**

Table 13: Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	3.0	5.8	8.8	**High**
Terrorism	1.0	6.4	7.4	**High**
Civil Unrest	1.3	5.2	6.5	**High**
Cyber Attack	2.0	4.7	6.7	**Medium**
Hazardous Materials	1.3	3.9	5.3	**Medium**
Communication Disruption	1.3	3.7	5.0	**Low**
Active Violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, the Town of Dumfries evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter weather, flood/flash flood, and high wind/severe storm
- **Medium:** Tornado, earthquake, drought, extreme temperatures, and dam failure

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious disease/public health, terrorism, and civil unrest
- **Medium:** Cyberattack and hazardous materials

All other hazards are ranked as “low,” signifying a minimal risk to the Town of Dumfries.

4.1. Additional Hazard Risk Considerations

4.1.1. National Risk Index

The National Risk Index (NRI) is a dataset and online tool developed by FEMA and other partners to help illustrate communities in the United States at risk for 18 natural hazards.

Hazard risk is calculated on data for a single hazard type and reflects the relative risk for that hazard type and should be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex.

In addition, some hazards are defined differently from the hazards in this plan, so a direct hazard-to-hazard comparison of risk is not able to be determined. The NRI is a county-level risk ranking, which includes the towns and is presented in **Annex 17: Prince William County, Section 4.1**.

4.1.2. Non-Natural Hazards

Volume II of the *2022 Northern Virginia Hazard Mitigation Plan* addresses non-natural hazards identified by the Town of Dumfries.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

The Town of Dumfries is a participant in the National Flood Insurance Program (NFIP).

Table 14: NFIP Status[4]

Init FHBM Identified	6/18/1976
Init FIRM Identified	5/15/1980
Current Effective Map Date	8/3/2015
Reg-Emer Date	5/15/1980
Digital Flood Insurance Rate Map (DFIRM)/(Q3)	DFIRM

Table 15: NFIP Policy and Claims Status

Policies In-Force	11
Premiums Paid	Unknown
Total Claims	
Total Payment	

Other hazard information for the Town of Dumfries is presented in the **Base Plan**.

5.2. Population

Estimates of the number of residents in the Town of Dumfries vulnerable to each hazard are presented in the various hazard sections in the **Base Plan**.

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations.

The Overall CDC SVI for Prince William County, including the Town of Dumfries is presented in **Annex 17: Prince William County**.

[4] FEMA NFIP Community Status Report, September 9, 2021

5.3. Built Environment and Community Lifelines and Assets

Using the best Hazus data available, scenarios were run at the county level for earthquake, flood, and hurricane wind to determine potential exposure of buildings, infrastructure, and economy. Information presented in **Annex 17: Prince William County** includes the Town of Dumfries.

Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events. The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA. In addition to the assets identified by Hazus, the Town Hall of Dumfries also lies partially within the floodplain.

Table 16: Community Lifelines/Critical Facilities Exposed to FEMA Floodplains, Town of Dumfries

Facility Type	Total Number	In 100-Year Floodplain	In 500-Year Floodplain
Highway Bridges	3	3	0

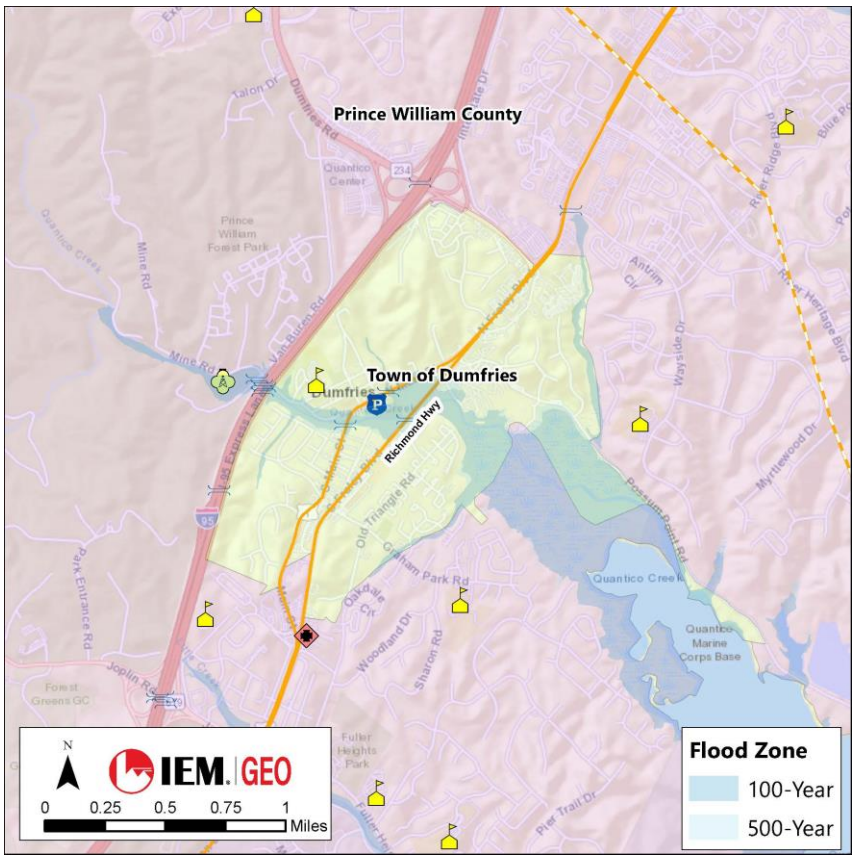

Figure 5: Critical Facilities Exposed to FEMA Floodplain, Town of Dumfries

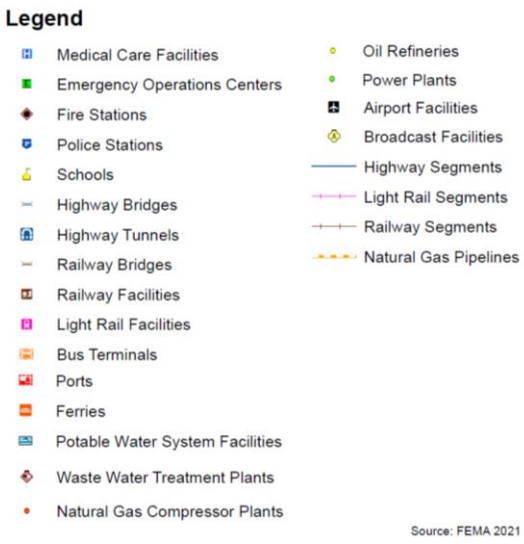

Figure 6: Map Legend of Figure 5 -- Critical Facilities Exposed to FEMA Floodplains, Town of Dumfries

Overlaying the critical facilities in Dumfries on the mapped flood zones illustrate that the only facilities within the 100- or 500-year floodplains are highway bridges.

5.4. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

Garrison Park in the Town of Dumfries is within a FEMA mapped floodplain. Additional environmental community assets in the surrounding area of Prince William County include Neabsco Boardwalk on the Potomac Heritage National Scenic Trail and several public parks, which have the potential for flooding, severe weather, and hurricane impacts. Leesylvania State Park is susceptible to hazardous material incidents due to the presence of a natural gas pipeline in addition to natural impacts from flooding, severe weather, and hurricanes.

The county identified Featherstone National Wildlife Refuge and Occoquan Bay National Wildlife Refuge as a critical habitat due to their forests, meadows, marshes, and grasslands and the presence of many bird species.

5.5. Economy

Information related to economic vulnerability are presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2,500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets and presented in **Annex 17: Prince William County**.

5.6. Cultural/Historical

Information related to vulnerability of cultural and historical assets are presented in the hazard-specific sections of the **Base Plan**. There are two historical buildings in the town, the Old Hotel and Weems-Botts House.

Historic structures and sites are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites.

6. Capability Assessment

The Town of Dumfries reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the town completed a Jurisdiction Needs Identification Questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed in order to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans and/or resources, and it can implement most mitigation actions.

Table 17: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	Low
Administrative and Technical	Moderate
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Low

6.1.1. Planning and Regulatory Capabilities Summary

The town is working toward utilizing an all-hazards approach when developing any jurisdictional plans and land use planning ordinances and building codes are an effective measure for reducing hazard impacts and are adequately administered and enforced.

Capability Analysis: Low

The town maintains a comprehensive plan and capital improvement plan. The comprehensive plan does not reference hazards and cannot currently be used to implement mitigation actions. The capital improvement plan has identified sustainability and infrastructure as a designated area of focus. Active projects in this plan include a Quantico Creek Stream Restoration project, widening of Route 1, and stormwater dry pond maintenance.

Town hall has been identified as a critical structure. The Town is planning to install a whole building generator so the Town can operate as an emergency command center if needed.

The town is in the process of creating a continuity of operations plan. They are also a member of the Prince William County local emergency operations plan.

Building codes and site plan review requirements are enforced and the town has a Building Code Effectiveness Grading Schedule of 4. Fire stations are managed by Prince William County.

Strong zoning, subdivision, floodplain, stormwater management, and erosion and sediment control ordinances reduce hazard impacts by protecting people and property.

To strengthen these capabilities, the town plans to update the floodplain ordinance and ensure all plans (comprehensive plans, codes and ordinances, etc.) are up to date and current according to local, state, and federal guidelines and regulations.

6.1.2. Administrative and Technical Capabilities Summary

The town has a small staff, who are new to their positions. Staffing and personnel resources can be strengthened by increasing the number of staff available and provide hazard training for all staff on a regular basis.

Current town staff have effective coordination and are integrated into mitigation planning, including planners, public works leadership, and the town manager.

Capability Analysis: Moderate

The Town of Dumfries has the staffing capability to provide for coordination for the purpose of mitigation planning and action implementation. The need for continuing funding for positions through general budget and grant opportunities and the need for ongoing education, training, and exercises offer areas for improvement.

6.1.3. Safe Growth Capabilities Summary

- Growth guidance instruments such as future land-use policies, regulations, and maps identify natural hazard areas such as floodplains and discourage or prohibit development or redevelopment within these areas.
- Environmental policies encourage appropriate development to protect ecosystems.
- Public safety plans and procedures address emergency evacuation and other safety measures associated with safe growth.
- The building code contains provisions to strengthen or elevate construction to withstand hazard forces.
- The zoning ordinance conform to the comprehensive plan in terms of discouraging development or redevelopment within natural hazard areas.

Capability Analysis: Moderate

The Town of Dumfries has safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment.

6.1.4. Financial Capabilities Summary

- The capital improvement plan could provide funding for mitigation project in the future but does not currently.
- The town has the authority to incur debt through general obligation bonds and/or special tax bonds, as well as fees for utility services and impact fees for new development.
- The town participates in multiple federal and state funding programs through various disciplines.

Capability Analysis: Moderate

The town has access to and eligibility for multiple funding resources, including state and federal funding. These external funding sources have been used in the past for stream restoration, roadway project funding, and road improvements. More money can be used to improve traffic flow to get people out during emergencies. Additional funding streams could be used for a flood warning system and broadband to improve access to the internet and emergency information.

6.1.5. Education and Outreach Capabilities Summary

- Prince William County is designated as a StormReady community, which includes the town in components of public education and training. The town can also use the county emergency operations center for centralized information and equipment when needed.
- The town works with the Soil and Water Conservation District to help clean up streams and reduce flooding.

- The Department of Public Works distributes floodplain awareness information.

Capability Analysis: Low

The town would like to increase public awareness through newsletters and local nonprofit organizations in reoccurring programs and outreach efforts. They would also like to increase collaboration with Prince William County Emergency Management in local outreach programs.

6.2. National Flood Insurance Program and Community Rating System

An additional component of the Capabilities Assessment was a survey of the jurisdiction's National Flood Insurance Program (NFIP) status.

Table 18: NFIP Status, as of October 18, 2021[5]

Category	NFIP Topic	Source of Information	Comments
Insurance	How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist	
Insurance	Community Information System Database	11	
Insurance	How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist	
Insurance	Community Information System Database	Unknown	
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	Yes
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	Unknown
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability).	Community FPA	Map assistance, permit review, public outreach, map revision records, and inspections.

[5] Source: Town of Dumfries Director of Public Works

Category	NFIP Topic	Source of Information	Comments
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	No in-house GIS
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Compliance History	Are there any outstanding compliance issues (i.e., current violations)?		No
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		Unknown

6.3. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, the Town of Dumfries identified activities related to each natural hazard that support risk reduction.

Table 19: Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Dam failure (including levees)	• Public education and operational plans address preparedness and response to reduce risk.
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and international building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme temperature	• Public education and operational plans address preparedness and response to reduce risk.
Flood/Flash flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. • Stormwater management program and projects address flood prevention and risk reduction.

Hazard	Activity
High wind/severe storm	• State and international building codes provide for wind load design regulations.
Karst/Sinkhole/Land subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Winter Weather	• Public education and operational plans address preparedness and response to reduce risk.
Non-natural hazards	• Public education and operational plans address preparedness and response to reduce risk. • Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate change	• Ongoing resilience planning will allow for the identification and mitigation of climate change-related issues in future planning cycles.

7. Resilience to Hazards

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of “low risk” is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience. The Town of Dumfries is included in the Prince William County NRI in **Annex 17: Prince William County**.

7.1. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

The Town of Dumfries identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- The risk of cyber-related incidents on critical infrastructure and key resource sites
- Climate change

8. Mitigation Actions

8.1. Goals and Objectives

The Town of Dumfries Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

The Town of Dumfries monitors actions and tracks progress through the periodic review, evaluation, revision, and update of the NOVA HMP. Some projects that contribute to risk reduction have been completed or are currently in progress, but have not been included in this plan for one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and resulting risk reduction.

Table 20: Status of Previous Mitigation Actions, Town of Dumfries

2017 Action Item #	Agency/Department Mitigation Action	Status
2017-1	Police Radios	Completed
2017-2	Public Safety Vehicle Replacement	Ongoing
2017-3	Possum Point Drainage Improvement	Unknown
2017-4	Dewey's Creek Stream Restoration	Unknown/ PWC Project
2017-5	Prince William Estates Drainage	Completed
2017-6	Orange Street Drainage	Unknown
2017-7	Quantico Creek Steam Restoration	Completed
2017-8	Tripoli Boulevard Stormwater Management	Partially completed

Three of the town's previous action items are completed, and one is partially completed. One action is ongoing. The status of three action items is unknown. Most of the town staff are new to their positions and the history of these projects is not fully known. It is possible that one action item, the Dewey's Creek Stream restoration, is a Prince William County item that was mistakenly placed on the town's action list in the 2017 HMP.

8.3. New Mitigation Actions

The Town of Dumfries Planning Team identified eight new mitigation actions to include in this plan. Proposed actions address risks consistent with the jurisdiction's highest risk hazards, flood/flash flood, and winter weather, in addition to actions that address hazard mitigation education programs for all hazards.

Table 21: New Mitigation Actions, Town of Dumfries Summary

2022 Action Item #	Agency/Department Mitigation Action
2022-1	Public outreach
2022-2	Community rating visit (CAV)
2022-3	Vehicle replacement
2022-4	Training
2022-5	Backup power to a critical facility
2022-6	Quantico Creek stream restoration phase 2
2022-7	Dry pond maintenance
2022-8	Provide broadband and free Wi-Fi to Dumfries residents

8.4. Action Plan for Implementation and Integration

The Town of Dumfries Public Works Department is responsible for coordinating municipal departments and agencies participating in hazard mitigation activities. The Public Works-designated Mitigation Coordinator is responsible for implementing the mitigation plan on two levels: implementation of the jurisdiction's actions and facilitating the implementation of the multi-jurisdictional regional plan. Tasks to ensure the town's actions are implemented are integrated into the *Action Plan for Implementation and Integration* (which includes the prioritized list of Mitigation Actions) and plan maintenance procedures are described in the next section. The *Action Plan for Implementation and Integration* describes how the town's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 22: Action Plan for Implementation and Integration, Town of Dumfries

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Maintain regulatory requirements of the floodplain management program (NFIP).	Revise town ordinance to help maintain NFIP requirements.
Enhance floodplain management through Community Rating System (CRS)	Staff training on CRS and floodplains.
Continue public engagement in mitigation planning.	Public outreach within the town.
Identify opportunities for mitigation education and outreach.	Determine how the town's two newsletters, TV channel, and social media can be used for outreach.
Review/update emergency plans to address evacuation and sheltering.	Create a continuity of operations plan.

9. Annex Maintenance Procedures

The Point of Contact for the Northern Virginia Mitigation Planning Committee is the facilitator for the process to monitor, evaluate, and update the NOVA HMP and is responsible for initiating the annual activities, convening the Planning Committee, and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**. This process will involve representatives from all participating jurisdictions.

Table 23: Town of Dumfries Plan Maintenance Responsibilities for the NOVA Hazard Mitigation Plan (Base Plan)

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to Prince William County/NOVA Planning Group. • Maintain records and documentation of all jurisdictional monitoring activities. • Help disseminate reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the Prince William County/NOVA Planning Group. • Maintain records and documentation of all jurisdictional evaluation activities. • Help disseminate information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and updating. • Collect and report data to the Prince William County/NOVA Planning Group. • Maintain records and documentation of all reviews and revisions of the plan by the jurisdiction. • Help disseminate reports to stakeholders and the public.

9.1. Maintenance of the Jurisdiction Annex

In addition to maintenance of the NOVA HMP Base Plan, the Town of Dumfries Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the Jurisdiction Annex. The town's maintenance method and schedule may coincide with that of Prince William County and be conducted simultaneously.

9.1.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following a major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in the fifth year

Table 24: Town of Dumfries Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with the jurisdiction planning team. 2. Review the status of all mitigation actions, using the Mitigation Action Implementation Worksheet (**NOVA HMP Base Plan, Section 3, Attachment A**).	• Produce an annual report that includes the following: ▪ Status update of all mitigation actions. ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities. ▪ Summary of activities conducted for the Action Plan for Implementation and Integration.
Evaluating the Annex	1. Schedule the annual plan evaluation with the jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the Planning Considerations Worksheet (**NOVA HMP Base Plan, Section 3, Attachment A**).	• Submit the annual report to the Prince William County/NOVA HMP Planning Group Point of Contact.
Updating the Annex	1. Coordinate with Prince William County and the Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years will maintain the town's eligibility for federal post-disaster funding.

Mitigation actions presented in the Town of Dumfries Jurisdiction Annex may be reviewed, revised, and updated at any time.

The Town of Dumfries will continue to be a planning partner with multiple jurisdictions and regional entities, including Prince William County, to identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan.

10. Annex Adoption

The Town of Dumfries Jurisdiction Annex will be adopted simultaneously with the adoption of the *NOVA HMP* and the *Prince William County Annex*.

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Planning Worksheets and Documentation
- Attachment 3: Documentation of Public Participation
- Attachment 4: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Planning Worksheets and Documentation

Capability Assessment

Jurisdiction: Town of Dumfries
Date: 10/15/2021

Participants:

Name	Position/Title	Department/Agency
Jonét Prévost-White	Director of Public Works	Department of Public Works

Planning and Regulatory

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. Please indicate which of the following your jurisdiction has in place.

Plan	Yes or No? Year	Does the plan address natural and/or human-caused hazards?	Does the plan identify projects to include in the mitigation strategy?	Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan - Town of Dumfries Comprehensive Plan, https://cms5.revize.com/revize/dumfriesva/Final%20Draft-Comprehensive%20Plan%202020.pdf	Yes, 2014, Amended November 2020 Final Draft	• Town data portal - https://data.dumfriesva.gov/ • Quick Facts - https://www.dumfriesva.gov/government/departments/planning_and_community_development/quick_facts.php • Specific hazards not referenced	Floodplains referenced, p. 25	Plan cannot be used for mitigation action. Does not address natural or human-caused hazards

Plan	Yes or No? Year	Does the plan address natural and/or human-caused hazards?	Does the plan identify projects to include in the mitigation strategy?	Can the plan be used to implement mitigation actions?
Capital Improvements Plan Town of Dumfries, VA (revize.com)	Yes 2020–2024	• Designated area of focus: sustainability and infrastructure • Active projects: ▪ Quantico Creek Stream Restoration (p. 16) ▪ Route 1 Widening ▪ BMP Maintenance		
Economic Development Plan		Major employers listed https://www.dumfriesva.gov/government/departments/planning_and_community_development/employers.php		
Impact fees for new development	No			
Local Emergency Operations Plan	No	PWC includes the town in EOC Operations		
Continuity of Operations Plan	No	In progress		
Transportation Plan Dumfries approves plan to remake Main Street into urban village (potomaclocal.com) Prince William, Dumfries Projects Receive $110M In NVTA Funding | Woodbridge, VA Patch Capital Improvement Plan- Route 1 widening: MetaViewer.php (granicus.com); p. 7		No	No	No

Plan	Yes or No? Year	Does the plan address natural and/or human-caused hazards?	Does the plan identify projects to include in the mitigation strategy?	Can the plan be used to implement mitigation actions?
Stormwater Management Plan MetaViewer.php (granicus.com)	No			
Community Wildfire Protection Plan	No			
Other special plans (e.g., brownfields redevelopment, disaster recovery, Local Waterfront Redevelopment Plan, climate change adaptation, etc.) Waterfront Waterfront Area Part of Dumfries' Economic Development Plan - Potomac Local News Development Local Development Plan (LDP2) (dumgal.gov.uk)	No			

Building Code, Permitting, and Inspection	Yes or No?	Are codes adequately enforced?
Building Code Chapter 14 of Town Code: Chapter 14 - Buildings and Building Regulations | Code of Ordinances | Dumfries, VA | Municode Library	Yes	Yes, Section 14.3: Building inspection department, which shall administer and enforce within the town the building code as stated in the Virginia Uniform Statewide Building Code (USBC)
Building Code Effectiveness Grading Schedule (BCEGS) Score	Yes, 2018	4
Fire Department ISO rating		Fire Stations managed by PWC
Site Plan review requirements Chapter 70, Article IV: Article IV. - Site Plan | Code of Ordinances | Dumfries, VA | Municode Library	Yes	

Land Use Planning and Ordinances	Yes or No?	Is the ordinance an effective measure for reducing hazard impacts?	Is the ordinance adequately administered and enforced?
Zoning ordinance - Chapter 70, Mini TOC: Chapter 70 - Zoning | Code of Ordinances | Dumfries, VA | Municode Library	Yes	No	Yes
Subdivision ordinance - Chapter 54 Chapter 54 - Subdivisions | Code of Ordinances | Dumfries, VA | Municode Library	Yes	No	Yes
Floodplain ordinance - Chapter 54.6 Land Subject to Flooding, Chapter 54 - Subdivisions | Code of Ordinances | Dumfries, VA | Municode Library Chapter 70, Division 9 – Floodplain Districts, Division 9. - Floodplain Districts FP-1 | Code of Ordinances | Dumfries, VA | Municode Library	Yes	Yes	Yes
Natural hazard-specific ordinance (stormwater, steep slope, wildfire) Stormwater management: Chapter 26, Article V: Chapter 26 - Environment | Code of Ordinances | Dumfries, VA | Municode Library Erosion and sediment control: Chapter 26, Article IV: Article IV. - Erosion and Sediment Control | Code of Ordinances | Dumfries, VA | Municode Library	Yes	Yes	Yes
Flood Insurance Rate Maps Preliminary FIS/FIRMs, http://cityofmanassaspark.us/city-services/planning-a-zoning/general-information/flood-insurance-study-fis-flood-insurance-rate-maps-firms.html	Yes	Town of Dumfries – Panels 0304F, 0308F, 0312F, 0316F	
Acquisition of land for open space and public recreation uses	No		
Other	No		
How can these capabilities be expanded and improved to reduce risk?			
Plans to update the floodplain ordinance. Ensure that all plans (Comprehensive Plans, Codes and Ordinances, etc.) are up to date and current according to local, state, and federal guidelines and regulations.			

Administrative and Technical

Identify whether your community has the following administrative and technical capabilities. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. If your jurisdiction does not have local staff resources, please indicate if these are available through agreement with other entities or at the county level to provide the services or technical assistance.

Staff/Personnel Resources	Have Capability Y/N	Department/ Agency and Position	Effective Coordination?	Adequate Staffing?	Integrated into Mitigation Planning?
A. Planner(s) or engineer(s) with knowledge of land development and land management practices	Y	Community Development	Yes	No	Yes
B. Engineer/professionals trained in construction practices related to buildings and/or infrastructure	Y	Public Work Director	Yes	No	Yes
C. Planners/Engineer(s) with an understanding of natural and/or manmade hazards	Y	Public Work Director	Yes	No	Yes
D. Floodplain manager	Y	Public Works	Yes	Yes	Yes
E. Surveyor(s)					
F. Staff with education or expertise to assess the community's vulnerability to hazards	Y	Public Work Director	Yes	No	Yes
G. Personnel skilled in GIS and/or Hazus	Y	FPM at EMI training			
H. Scientist familiar with hazards of the community	N				
I. Emergency manager	Y	Town Manager			
J. Grant writer(s)	N				
K. Warning systems or services (automated callout, sirens, etc.)	Y	Public Work Director	Y	No	No
How can these capabilities be expanded and improved to reduce risk?					
Need to increase staff and training for staff.					

Safe Growth

This worksheet identifies potential gaps in your community's growth guidance instruments and improvements that could be made to reduce vulnerability to future development.

Comprehensive Plan	Yes	No
Land Use		
1. Does the future land-use map clearly identify natural hazard areas?		
2. Do the land-use policies discourage development or redevelopment within natural hazard areas?	X	
3. Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?	X	
Transportation		
1. Does the transportation plan limit access to hazard areas?	X	
2. Is transportation policy used to guide growth to safe locations?	X	
3. Are movement systems designed to function under disaster conditions (e.g., evacuation)?		X
Environmental Management		
1. Are environmental systems that protect development from hazards identified and mapped?		X
2. Do environmental policies maintain and restore protective ecosystems?	X	
3. Do environmental policies provide incentives to development that is located outside protective ecosystems?		
Public Safety		
1. Are the goals and policies of the comprehensive plan related to those of the FEMA-approved Local Hazard Mitigation Plan?	X	
2. Is safety explicitly included in the plan's growth and development policies?	X	
3. Does the monitoring and implementation section of the plan cover safe growth objectives?	X	

Comprehensive Plan	Yes	No
Zoning Ordinance		
1. Does the zoning ordinance conform to the comprehensive plan in terms of discouraging development or redevelopment within natural hazard areas?	X	
2. Does the ordinance contain natural hazard overlay zones that set conditions for land use within such zones?	X	
3. Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?	X	
4. Does the ordinance prohibit development within, or fining of, wetlands, floodways, and floodplains?		
Subdivision Regulations		
1. Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?		X
2. Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources?		X
3. Do the regulations allow density transfer where hazard areas exist?		X
Capital Improvement Program and Infrastructure Policies		
1. Does the capital improvement program limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?		X
2. Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?		X
3. Does the capital improvement program provide funding for hazard mitigation projects identified in the FEMA-approved Local Hazard Mitigation Plan?		X
Other		
1. Do small area or corridor plans recognize the need to avoid or mitigate natural hazards?		X
2. Does the building code contain provision to strengthen or elevate construction to withstand hazard forces?	X	
3. Do economic development or redevelopment strategies include provisions for mitigation of natural hazards?		X

Comprehensive Plan	Yes	No
4. Is there an adopted evacuation and shelter plan to deal with emergencies from natural hazards?		X

Financial

Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in the past and for what type of activities?	Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Stormwater pond maintenance; stream restoration	Yes
Authority to levy taxes for specific purposes	Y	Unsure	
Fees for water, sewer, gas or electric services	Y	No	Yes
Impact fees for new development	Y		
Stormwater utility fee	Y	Stormwater fees	Yes
Incur debt through general obligation bonds and/or special tax bonds	Y	New building	Yes
Incur debt through private activities	N		
Community Development Block Grant	Y	Unsure	
Other federal funding programs	Y	UCI – roadway funding, NVTA – road improvement, VADCR - litter	Yes
State funding programs	Y	SLAF – stream restoration	Yes
Public/Private partnership funding sources	Y	Unsure	
How can these capabilities be expanded and improved to reduce risk?			
More money can be used to improve traffic flow to get people out during emergencies. Flood warning system, broadband to improve access to internet and emergency information			

Education and Outreach

Identify education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Program/Organization	Yes/No	Describe program/organization and how it relates to disaster resilience and mitigation.	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	Soil and Water Conservation District – Stream cleanups reduce flooding. PWC EM – EOC for centralized information and equipment	
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education, household recycling, etc.)	Yes	Floodplain & Flooding Awareness – Department of Public Works, https://www.dumfriesva.gov/government/departments/public_works/flooding___floodplain_information.php	
Natural disaster or safety related school programs	No		
StormReady certification	No	Participate with PWC	
Firewise Communities certification	No		
Public–private partnership initiatives addressing disaster-related issues	No		
Other			
How can these capabilities be expanded and improved to reduce risk?			
Increase public awareness through newsletters and local NPOs in reoccurring programs and outreach efforts. Increase collaboration with PWC EM in local outreach programs.			

National Flood Insurance Program (NFIP) Survey Form

Jurisdiction: Town of Dumfries
Floodplain/NFIP Administrator:
Phone: 703-221-3400
Date: 10/18/2021
Email: jwhite@dumfriesva.gov
Jurisdiction Participants: Jonét Prévost-White

SEE ACCOMPANYING FLOOD INSURANCE INFORMATION

Please provide the information below to document your community's participation in and continued compliance with the NFIP, as well as to identify areas for improvement that could be potential mitigation actions. Indicate the source of information, if different from the one included.

Category	NFIP Topic	Source of Information	Comments
Insurance	How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist	11
Insurance	How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist	Unknown
Insurance	How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA)	100
Insurance	Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	Yes
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	?
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	Map assistance, permit review, public outreach, map revision records, inspections

Category	NFIP Topic	Source of Information	Comments
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	No in-house GIS
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Compliance History	Are there any outstanding compliance issues (i.e., current violations)?		No
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	Director of Public Works	?

11.3. Attachment 3: Documentation of Public Participation

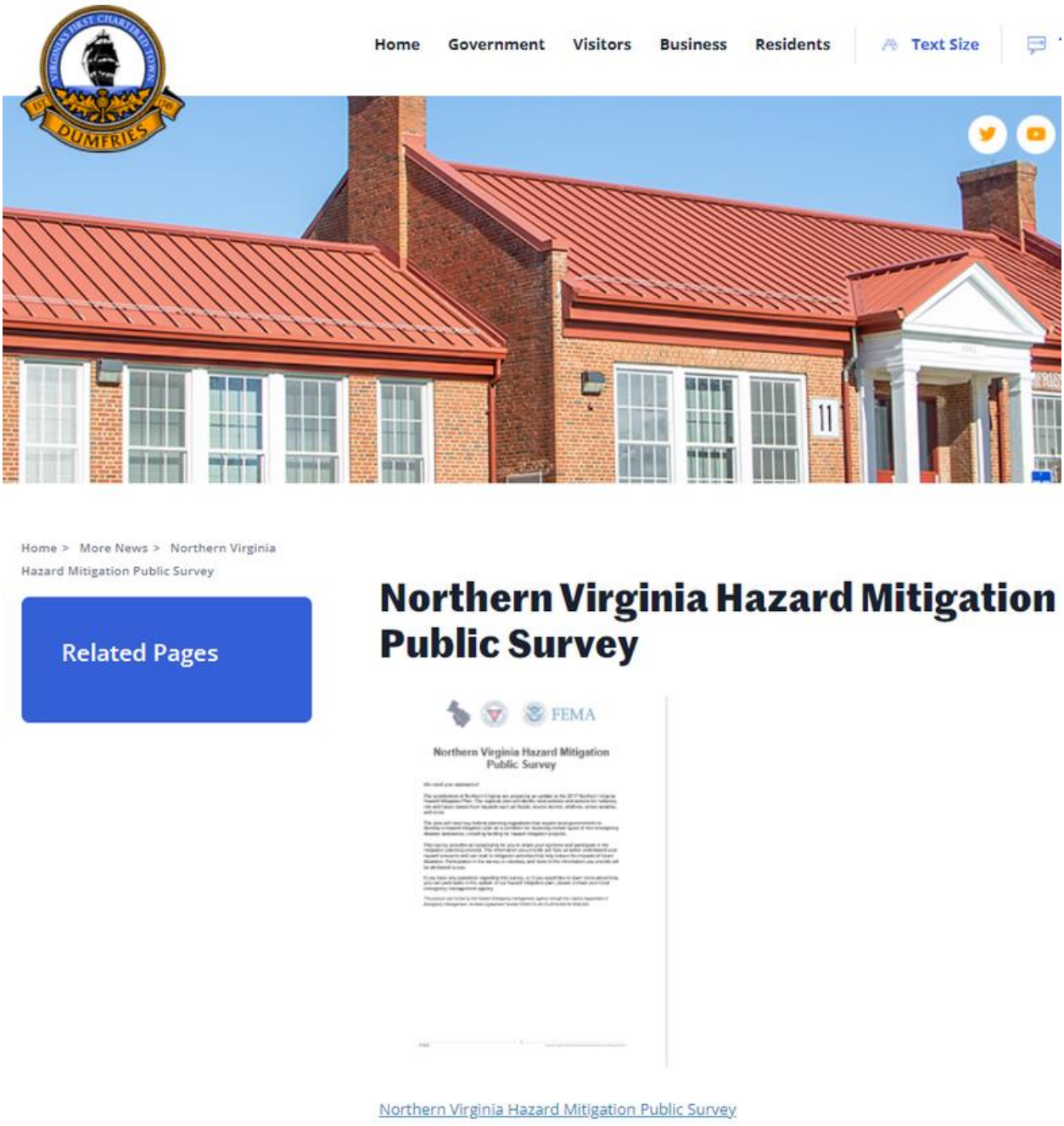

Figure 7: Town of Dumfries NOVA Mitigation Public Survey

11.4. Attachment 4: Mitigation Actions

#	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-1	Police Radios	Police Department	All Hazards	General Fund	Completed		Low	Improve communication with surrounding departments
2017-2	Public Safety Vehicle Replacement	Police Department	All Hazards	General Fund	2021	Purchase 1 vehicle in 2018	Low	Provide reliable transportation for police department
2017-5	Prince William Estates Drainage	Public Works	Flood	Stormwater Management Fees	2017		Medium	
2017-7	Quantico Creek Stream Restoration	Public Works	Flood	Stormwater Management Fees/ Grants	2021		High	Phase 1 completed. Phase II in design.
2017-8	Tripoli Boulevard Stormwater Management	Public Works	Flood	General Fund	2019		Medium	
2022-1	Public Outreach	Director (Dir.) of Public Works	All Hazards	General Fund	2023	2 Community meetings	Medium	Increase PO in all hazard areas. Create a new community center to improve outreach to citizens.
2022-2	Community Rating Visit (CAV)	Dir. of Public Works	Dam Failure, Flood, Severe Weather, Winter Weather	Stormwater Fees	2023	Schedule 1st CAV with FEMA Reg 3	Low	Prepare the Town for updates to the NFIP

#	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2022-3	Vehicle Replacement	Dir. of Public Works	All Hazards	General Fund	2023	1 new police vehicle	High	Signed contract for 12 new vehicles
2022-4	Training	Dir. of Public Works	All Hazards	General Fund/Stormwater Fees	2024	2 annual staff trainings	Medium	Train staff on all-natural hazards
2022-5	Backup power to critical facility	Dir. of Public Works	All Hazards	General Fund	2024		High	Add a new generator to critical facility (Town Hall)
2022-6	Quantico Creek Stream Restoration Phase 2	Dir. of Public Works	Flood, High wind/Severe Weather	SLAF/CIP	2025	SLAF grant award	High	Design of Phase II started. Required to meet MS4 permit TMDL goals
2022-7	Dry Pond Maintenance	Dir. of Public Works	Drought, Extreme Temperatures, Flood, Winter Weather	CIP	2024	Engineered plans	High	Repair failing dry pond to decrease sediment deposition in Quantico Creek to maintain stream channel flood capacity
2022-8	Provide Broadband and free Wi-Fi to Dumfries residents	Dir. of Public Works	All Hazards	ARPA Funds	Complete	Signed IT contract	High	American Rescue Plan Act funds to localities

Northern Virginia Hazard Mitigation Plan

Annex 17-B: Town of Haymarket

November 2022

Town of Haymarket Overview

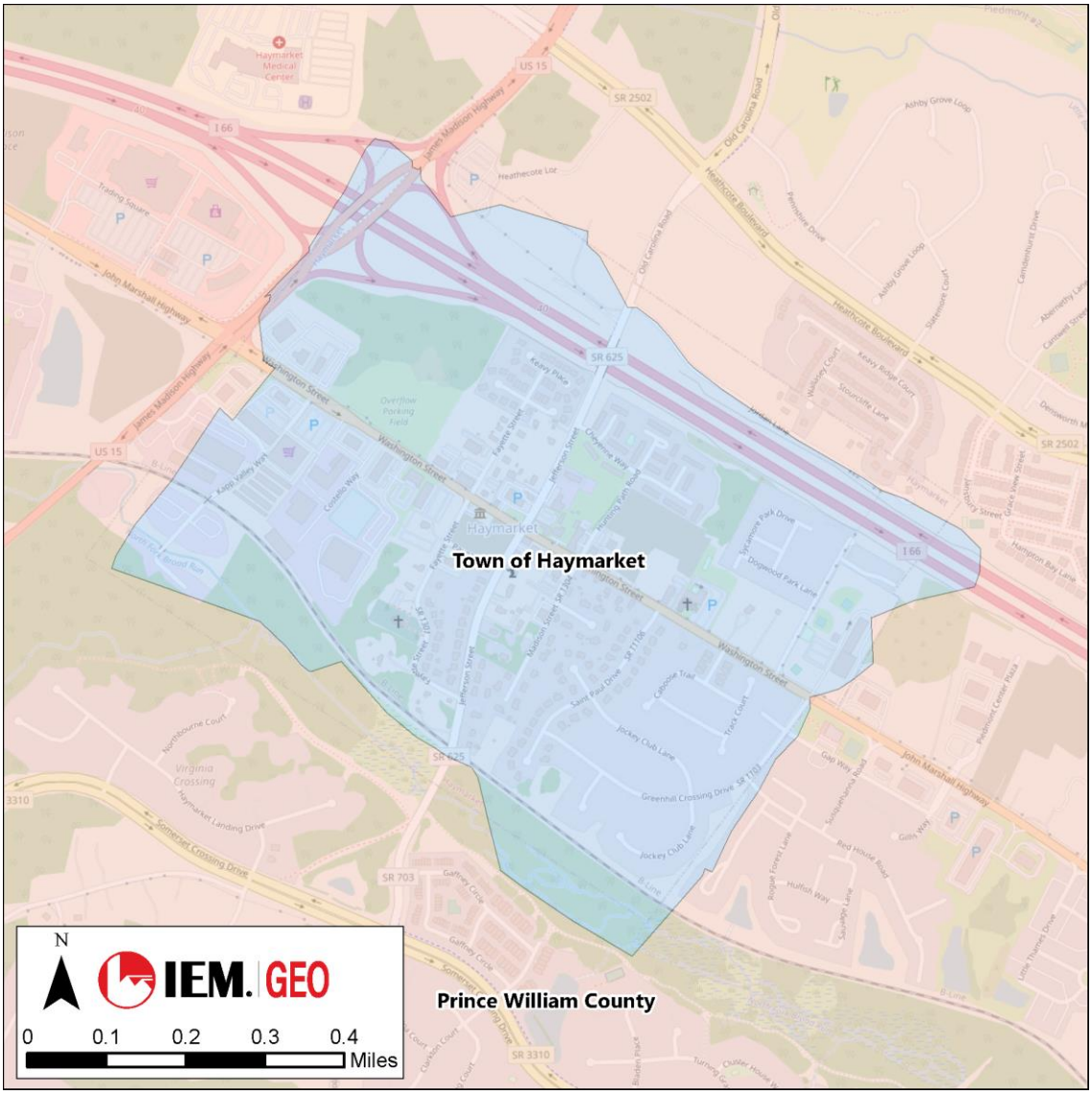

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
Founded in 1799 Incorporated 1888	0.5 sq. mi.	1,545	15000 Washington St. #100 Haymarket, VA 20169	490	Severe Storms and Winter Weather

Town of Haymarket's Risk Environment

The following is an overview of the basis for the details in this annex. The details in the annex and summarized here, lead up to a well-researched mitigation strategy for the community.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

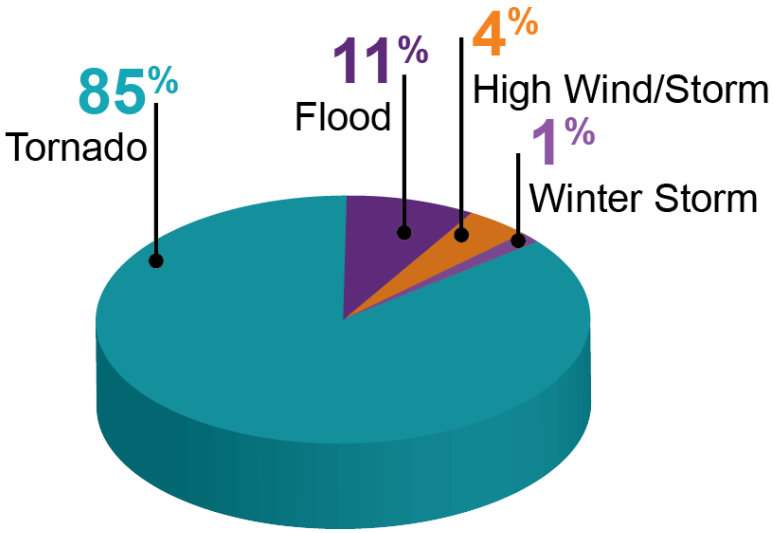

Figure 1: Percentage of Hazards

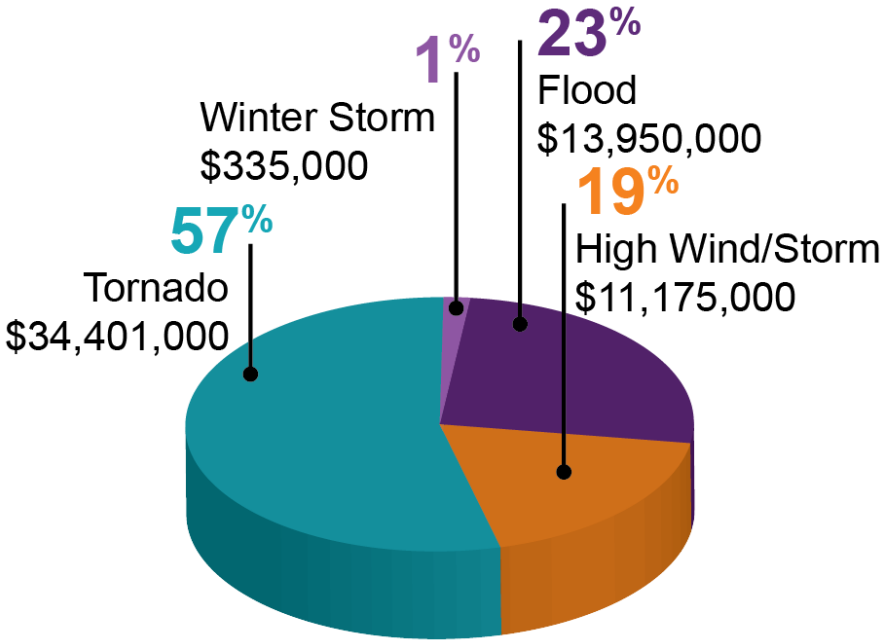

Figure 2: Property Damage Costs from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Ranking of Natural Hazards by Risk

Hazard	Hazard Ranking
Winter Weather	**High**
Flood/Flash Flood	**High**
High Wind/Severe Storm	**High**
Tornado	**Medium**
Drought	**Medium**
Extreme Temperatures	**Medium**
Dam Failure	**Medium**
Earthquake	**Medium**
Wildfire	**Low**
Landslide	**Low**
Karst/Sinkhole/Land subsidence	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	1
Food, Water, Shelter	1
Health and Medical	0
Energy	0
Communications	0
Transportation	12
Hazardous Materials	0
Education	3
Cultural/Historical	4
High Hazard Dams	0*

*A portion of the town would potentially be impacted by a failure at the North Fork Wetlands Bank Dam, a High Hazard dam located outside the town limits.

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking, Town of Haymarket

Capability	Ranking
Planning and Regulatory	Low
Administrative and Technical	Limited
Safe Growth	Moderate
Financial	Limited
Education and Outreach	Limited

Hazard Mitigation Plan Point of Contact

Table 5: Point of Contact Information

Contact Type	Contact Information
Point of Contact	Al Sibert, Chief Haymarket Police Department 703-753-2600 530-336-2110 asibert@townofhaymarket.org 15000 Washington Street #100 Haymarket, VA 20169

Town of Haymarket

This annex presents the following jurisdiction-specific information provided by the Town of Haymarket for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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List of Tables

List of Figures

1. Jurisdiction Profile

Established	1799
Total Land Area	0.5 square miles
Geographic Region	Piedmont/Coastal Plain
Persons Per Household	3.04
Persons Per Square Mile	2,981
Median Age	33.7

1.1. Location

Haymarket, Virginia, is a small town located in the foothills of Bull Run Mountain, near the first foothills of the Blue Ridge Mountains. The town is close to the rolling farms of Virginia's "horse country," just west of Manassas and less than an hour away from Washington, D.C.

1.2. History

Chartered in 1799 by the Virginia General Assembly, the Town of Haymarket was incorporated in 1882. Since the 1900s, the Haymarket area has been popular for fox hunting and steeple chasing and is also known for its wineries.

1.3. Demographics, Economy, and Governance

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context to the entire plan. The 2020 U.S. Census population for the Town of Haymarket was 1,545, an approximate 13% decrease since 2010. The town is densely populated with 337 housing units at an average density of 66.1 per square mile. Most of the population lives in single family homes from the central area to the east. The west side of the town is mainly a business district; however, there are some apartments located over commercial stores along Washington Street.

Table 6: Population and Growth Rate

Year	Population	Annual Percent Change
1980	230	
1990	466	102.6%
2000	913	95.9%
2010	1,782	95.2%
2020	1,545	-13.3%

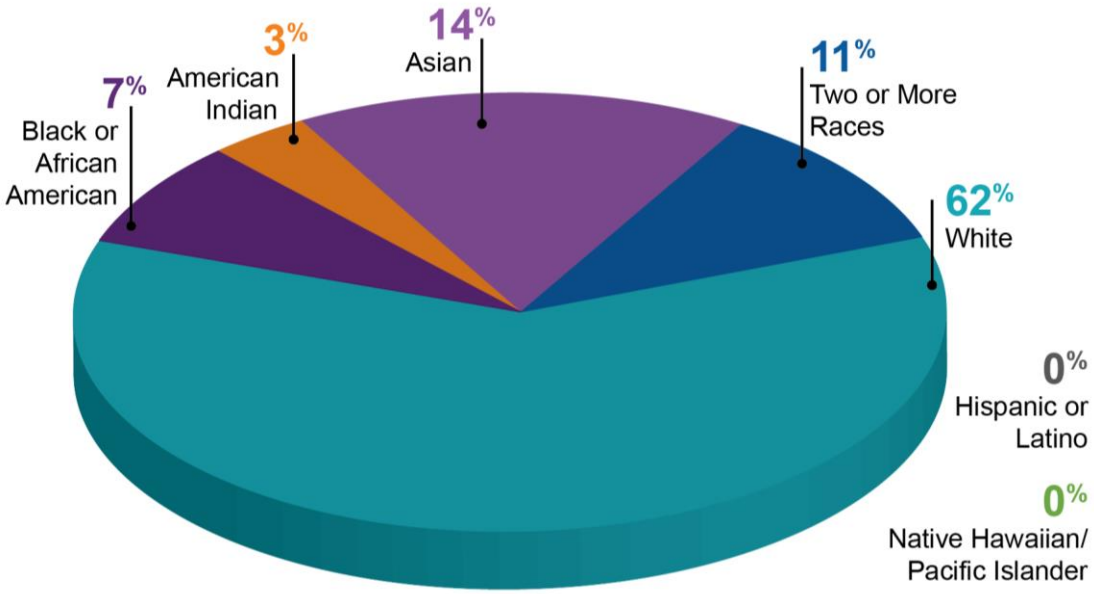

Figure 4: Race and Ethnicity Demographics

Table 7: Economic Data

Economy	Data
Median Household Income (in 2020 dollars) 2016–2020	$118,958
Unemployment Rate (September 2021)	2.2%
Per Capita Income (in 2020 dollars) 2016–2020	$40,336
Median House or Condo Market Value (2019)	$431,200
Percentage Below Poverty (2019)	3.7%

The percentage of Haymarket households below the poverty line is 3.7%, compared to 4.9% for Prince William County and 11.4% nationally. While the trends indicate the population as a whole experiences less poverty than the national average. Major employers for the town include Century Stair Company and Fortiline Waterworks, though each employ less than 100 workers.

The Town Council consists of six elected members (of which one serves as the Vice-Mayor) and an elected mayor. The council appoints a Town Manager, who is responsible for day-to-day operations of the town.

1.4. Built Environment and Community Lifelines

The information related to the county's Community Lifelines and critical assets presented in this section has been collected from multiple sources, including the Town of Haymarket, Hazus (Version 4.2), and county government websites. With the limitations in Hazus, breaking out local data for the town is difficult and may not be fully reflected. Due to the time lag in collecting and verifying data and the method of documenting the location and jurisdiction used in Hazus, this may not reflect the current inventory maintained in the town.

Table 8: Number of Assets per Community Lifeline/Sector

Lifeline/Sector	Number of Assets
Safety and Security	1
Food, Water, Shelter	1
Health and Medical	0
Energy	0
Communications	0
Transportation	12
Hazardous Materials	0
Education	3
Cultural/Historical	4
High Hazard Dams	0*

*A portion of the town would potentially be impacted by a failure at the North Fork Wetlands Bank Dam, a High Hazard dam located outside the town limits.

1.4.1. Safety and Security

The Town of Haymarket has a police department with six full-time officers. Fire and EMS service is provided by Prince William County from stations located outside the town.

1.4.2. Food, Water, Shelter

Food commodities are available in the town from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Should the need arise for the town to enter into memorandums of understanding or mutual agreements with viable entities withing the region to assist with post-disaster needs.

The water and wastewater services are provided to town residents through the Prince William County Service Authority.

The town has 492 housing units, 97% of which are occupied. Most housing units within the town are owner-occupied (82.4%), while renter-occupied housing makes up 17.5%.

1.4.3. Health and Medical

The Haymarket Medical Center (a UVA Health facility) is located across I-66 from the town.

1.4.4. Energy

Dominion Energy is the sole provider of electrical service within the Town of Haymarket

1.4.5. Communications

Most communications and information systems and infrastructure in the United States are privately owned; however, the county maintains authority and control over public safety communications for fire,

police, and other responding agencies, including the Town of Haymarket Police Department. In recent years, the federal government has taken a stronger role in protecting information and communications infrastructure, which may also present a challenge in relation to disaster impacts. Increasing reliance on this infrastructure by individuals, businesses, and government could cause vulnerabilities that emergency managers should take into consideration in pre- and post-incident planning and operations.

1.4.6. Transportation

Haymarket remains a crossroads, located along Interstate 66, U.S. Route 15, and Virginia Route 55. U.S. Route 29 runs south of the town.

1.4.7. Hazardous Materials

The data does not identify hazardous material facility located in the Town of Haymarket. There are several commercial/industrial properties in the western portion of the town which may store small quantities of hazardous materials.

1.4.8. Education

The town is served by the Prince William County School District, though no public schools are located within the town itself. There is 1 private elementary school located in the town.

1.4.9. Recreational, Cultural, and Historic Sites and Assets

The town maintains the Town of Haymarket Park and Playground for recreational purposes. The Haymarket Museum chronicles the history of Haymarket, most of which is itself a historical district, and the surrounding area.

1.4.10. High Hazard Dams

There are no high hazard dams in the town, however the western portions of the town may be impacted by a failure of the North Fork Wetlands Bank Dam, a High Hazard dam located northwest of the town.

1.5. Growth and Development Trends

The town has limited areas for growth due to its existing borders. There are several open areas within the town that could be developed, including along Washington Street (VA-28). Growth may also be infill development with businesses and housing units replacing existing structures, such as the recent redevelopment of property in the center of town that included building a Hilton brand hotel. While the growth trend for the surrounding area within Prince William County is upward, Haymarket will likely see slow and steady growth.

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the Town of Haymarket followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Group, the county supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction.

Table 9: Local Planning Participants

Name	Position/Title	Department/Agency
Al Sibert	Police Chief	Town of Haymarket Police Department

The town identified its chief hazard mitigation planning responsibility as representing the town in coordination with the Prince William representative to the Emergency Manager's Planning Group. The town also identified the following tasks as part of its mitigation planning responsibilities:

- Jurisdictional Planning Committee
- Planning Group resource/subject matter expert
- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Public outreach activities
- Implementation of the plan
- Maintaining the plan

Town planning participants coordinated primarily by means of virtual meetings during the planning process, and as needed, independently to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks, and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a Public Hazard Survey and access to the draft plan for review and input. These opportunities were placed on the Ready Prince William Facebook page and the Prince William County Emergency Management Twitter account.

In addition to the survey, the public was offered the opportunity to review and provide input to the Draft 2022 Plan update. Notification of the Draft Plan release was made through the same social media accounts. Documentation of the public survey and draft plan review is included in **Attachment 3** of this annex.

3. Jurisdiction Specific Hazard Event History

The Town of Haymarket comprehensive hazard history is part of the Prince William County's history described in **Section 5, Base Plan**. The diversity of the landscape increases the vulnerability to a variety of hazards, most notably flooding, severe storms, and winter weather.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 873 recorded natural meteorological events that took place in the county between January 1, 1950, and May 2021. Between 1996 and 2019, the NCEI Storm Events Database recorded 22 natural meteorological events in the Haymarket area. The county has been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 10: Federal Disaster and Emergency Declarations, 2017–2021

Declaration	Date	Hazard	Assistance Type
DR-4512-VA	4/2/2020 (continuing)	COVD-19 Pandemic	Individual Assistance, Public Assistance
EM-3448-VA	3/13/2020 (continuing)	COVID-19 Pandemic	Public Assistance (Category B)
EM-3403-VA	9/11/2018	Hurricane Florence	Public Assistance (Category B)

The Town of Haymarket submitted the following additional details related to significant hazard events since the 2017 plan. For all countywide events, see the **Prince William County Annex**.

Table 11: Town of Haymarket Significant Hazard Events, 2017–2021

Date	Hazard	Event and Description
July 2018	Flood	Rain and heavy precipitation 5.02 inches of rain in 24 hours

4. Hazard Risk Ranking

After developing hazard profiles, the Town of Haymarket Planning Committee conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4.2, Base Plan**. The Hazard Risk Ranking scores for the Town are provided in **Attachment 2** of this annex.

The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5, Base Plan**, and local detail is provided in the jurisdiction annexes. Non-natural hazard profiles are presented in **Volume II of the Base Plan**.

Table 12: Hazard Risk Ranking Summary, Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.7	3.5	7.2	**High**
Flood/Flash Flood	1.7	4.2	5.9	**High**
High Wind/Severe Storm	2.7	3.2	5.9	**High**
Tornado	1.3	4.3	5.6	**Medium**
Drought	2.3	3.2	5.5	**Medium**
Extreme Temperatures	3.0	2.5	5.5	**Medium**
Dam Failure	1.0	4.1	5.1	**Medium**
Earthquake	1.7	3.2	4.9	**Medium**
Wildfire	1.0	3.0	4.0	**Low**
Landslide	1.0	2.7	3.7	**Low**
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5	**Low**

Table 13: Hazard Risk Ranking Summary, Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease	3.0	5.8	8.8	**High**
Terrorism	1.0	6.4	7.4	**High**
Cyberattack	2.0	4.7	6.7	**High**
Civil Unrest	1.3	5.2	6.5	**Medium**
Hazardous Materials	1.3	3.9	5.3	**Medium**
Communication Disruption	1.3	3.7	5.0	**Low**
Active Violence	1.0	3.6	4.6	**Low**

Based on the hazard risk scores, the Town of Haymarket evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Flood/Flash Flood, High Wind/Severe Storm, and Winter Weather
- **Medium:** Dam Failure, Drought, Earthquake, Extreme Temperatures, and Tornados

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease, Terrorism, and Cyberattack
- **Medium:** Civil Unrest and Hazardous Materials

All other hazards are ranked as “low,” signifying a minimal risk to the town.

4.1. Additional Hazard Risk Considerations

4.1.1. National Risk Index

The National Risk Index (NRI) is a dataset and online tool developed by FEMA and other partners to help illustrate communities in the United States at risk for 18 natural hazards.

Hazard risk is calculated on data for a single hazard type and reflects the relative risk for that hazard type and should be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex.

In addition, some hazards are defined differently from the hazards in this plan, so a direct hazard-to-hazard comparison of risk is not able to be determined. The NRI is a county-level risk ranking, which includes the towns and is presented in **Annex 17: Prince William County, Section 4.1**.

4.1.2. Non-Natural Hazards

Volume II of the *2022 Northern Virginia Hazard Mitigation Plan* addresses non-natural hazards identified by the town.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

The Town of Haymarket is a participant in the National Flood Insurance Program (NFIP).

Table 14: NFIP Status[1]

Init FHBM Identified	08/09/1974
Init FIRM Identified	01/17/1990
Current Effective Map Date	01/05/1995
Reg-Emer Date	01/31/1990
Digital Flood Insurance Rate Map (DFIRM)/(Q3)	County Level Available

Table 15: NFIP Policy and Claims Status

Policies In-Force	Unknown
Premiums Paid	Unknown
Total Claims	Unknown
Total Payment	Unknown

Other hazard information for the Town of Haymarket is presented in the **Base Plan**.

5.2. Population

Estimates of the number of residents in Prince William County vulnerable to each hazard are presented in the various hazard sections in the **Base Plan**.

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations.

[1] FEMA NFIP Community Status Report, September 9, 2021

The Overall CDC SVI for Prince William County, including the Town of Haymarket, is presented in Annex 17: Prince William County.

5.3. Built Environment

Based on the best data currently available, the tables presented in this section provide a total number of exposed facilities and properties in relation to earthquake, flood, and hurricane wind.

Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events. The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA.

5.4. Community Lifelines and Assets

Prince William County reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events.[2] The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA.

Table 16: Vulnerable Community Lifeline Assets (in Thousands of Dollars)[3]

Sector	Total Number
Safety and Security	Replacement $ for PD
Food, Water, and Sheltering	Undetermined
Health and Medical	Undetermined
Energy	Undetermined
Communications	Undetermined
Transportation	
Hazardous Materials	Undetermined

Table 17: Town of Haymarket Critical Facilities Exposed to FEMA identified Floodplains

Type of Critical Facility	Total Facilities	Located Within the 100-Year Floodplain	Located within the 500-Year Floodplain
Railway segments	3	2	3
Highway bridges	4	1	1
Highway segments	5	0	0
Police stations	1	0	0
Total	**13**	**3**	**4**

[2] Although Prince William County maintains a separate critical facilities inventory, information used in this analysis is extracted from the Hazus critical facilities database to maintain consistency with other jurisdictions.
[3] Source: Hazus – Building Stock Exposure totals reflect data for those census tracts/blocks included in the study region.

5.5. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

5.6. Economy

Information related to economic vulnerability are presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2,500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets and presented in **Annex 17: Prince William County**.

5.7. Cultural/Historical

Information related to the vulnerability of cultural and historical assets are presented in the hazard-specific sections of the **Base Plan**.

The Town of Haymarket is designated as a historic district. Several landmarks in Haymarket are on the National Historic Register of Places as well as locally designated as landmarks.

Historic structures and sites are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites.

6. Capability Assessment

The Town of Haymarket reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - Town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard related information

6.1. Capability Assessment Summary Ranking and Gap Analysis

The Town of Haymarket ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans, and/or resources, and it can implement most mitigation actions.

Table 18: Capability Assessment Ranking Summary

Capability	Ranking
Planning and Regulatory	Low
Administrative and Technical	Limited

Capability	Ranking
Safe Growth	Moderate
Financial	Limited
Education and Outreach	Limited

6.1.1. Planning and Regulatory Capabilities Summary[4]

The Town has previously adopted a Comprehensive Plan (2008 – 2013) and a Capital Improvements Plan (2016-2021). The Town is committed to a well-balanced land use pattern and has established a Conservation District along North Fork Creek. Among other goals, the 2008 Comprehensive Plan recognizes the need to protect environmentally sensitive areas through land use planning. The Town's Zoning & Subdivision Ordinance (adopted in 2017) prohibits the use of flood prone land for residential occupancy or other uses that might endanger health, life, or property, or aggravate erosion of flood hazard.

Chapter 18 of the Town Code includes the Erosion and Sediment Control Ordinance of the Town of Haymarket that establishes requirements for the control of erosion and sedimentation. The ordinance adopts the regulations, references, guidelines, standards and specifications promulgated by the state soil and water conservation board for the effective control of soil erosion and sediment deposition to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources.

The Town has also adopted the Virginia Uniform Statewide Building Code which is enforced by the Prince William County Department of Development Services (since January 2018). The Town requires zoning approval prior to submitting a building permit application. The Town's Site Plan Checklist includes requirements to submit stormwater management computations and storm drainage system details.

The Town is a stakeholder of the Prince William County Emergency Operations Plan.

Capability Analysis: Low

Some planning and regulatory tools are in place in the Town of Haymarket; however, they demonstrate a limited integration of hazard mitigation planning with existing planning mechanisms. Adding hazard mitigation strategies when these plans are updated provides an opportunity to increase planning and regulatory capabilities.

There are several planning and regulatory tools in place that could address flooding, which is one of the top hazards in the Town. These tools include the Town's Comprehensive Plan, Capital Improvements Plan, and Erosion and Sediment Control Ordinance.

The Town of Haymarket should continue to participate in the County Hazard Mitigation Working Group

6.1.2. Administrative and Technical Capabilities Summary

- Staff in the Planning & Zoning Office include a planner and engineer with an understanding of natural and non-natural hazards who are integrated into mitigation planning.
- Staff in the Planning & Zoning Office, Police Department, and elsewhere are familiar with the Town's hazards.

[4] Source: Town of Haymarket jurisdictional capabilities assessment and Town of Haymarket website.

- The Town identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and implementation of the plan:
  - Planning & Zoning Office
  - Police Department

Capability Analysis: Limited

To strengthen the administrative and technical capabilities of the Town, all agencies with a role in hazard mitigation should be incorporated into the PWC Hazard Mitigation Working Group to effectively coordinate issues that cross agencies, with participation, at minimum, in the annual review of the HMP. This integration will provide a high level of coordination for the purpose of mitigation planning and action implementation.

6.1.3. Safe Growth Capabilities Summary

- Growth guidance instruments such as future land-use policies and the zoning & subdivision ordinance discourage or prohibit development or redevelopment within flood prone areas.
- The 2008 Comprehensive Plan includes a transportation element that addresses the appropriate placement and use of transportation systems.
- The 2008 Comprehensive Plan includes initiatives that encourage appropriate development to protect ecosystems.
- The statewide building code provides for a Base Flood Elevation (BFE) sufficient to protect property from 100-year flood events.

Capability Analysis: Moderate

The Town of Haymarket has established a moderate level of safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment. Additional enhancements to these capabilities include including provisions for mitigation of natural hazards in economic development or redevelopment strategies, and the inclusion of projects identified in the mitigation plan in the town's Capital Improvement Plan (CIP). The 2016-2021 CIP did not provide funding for projects identified in the 2017 HMP.

6.1.4. Financial Capabilities Summary

- The Town has limited authority to raise additional funding through general obligation bonds and impact fees for new development.
- The 2016-2021 CIP did not provide funding for projects identified in the 2017 HMP.
- The Town applies for applicable state and federal funding opportunities.

Capability Analysis: Limited

The Town continues to identify funding opportunities for mitigation activities.

6.1.5. Education and Outreach Capabilities Summary

- The Town conducts outreach through social media for a variety of events and topics, which could include hazard specific information for the community.

Capability Analysis: Limited

Jurisdictions have multiple opportunities to promote hazard mitigation and increase the involvement of stakeholders and the public. There is a critical need to inform the additional stakeholders and the public about the benefits of hazard mitigation planning and implementation. Many hazard mitigation educational tools and materials are available from state agencies and disaster preparedness and response organizations such as the American Red Cross, FEMA, and faith-based organizations with disaster response missions.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, PWC identified activities related to each natural hazard that support risk reduction.

Table 19: Capability Summary – Activities That Reduce Natural Hazard Risk or Impacts

Hazard	Capability
Dam Failure (Including Levees)	• All high-hazard dams in the county have emergency action plans for potential incidents.
Drought	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and international building codes provide for seismic design regulations.
Extreme Temperature	• Public education can address preparedness to reduce risk.
Flood/Flash Flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. • Public education can address preparedness to reduce risk.
High Wind/Severe Storm	• State and international building codes provide for wind loads and debris.
Karst/Sinkhole/Land Subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education can address preparedness to reduce risk.
Wildfire	• Public education can address preparedness to reduce risk.
Winter Storm	• Public education can address preparedness to reduce risk.
Non-Natural Hazards	• Public education can address preparedness to reduce risk.
Climate Change	• Public education can address preparedness to reduce risk.

7. Resilience to Hazards

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of “low risk” is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience. The Town of Haymarket is included in the Prince William County NRI in **Annex 17: Prince William County**.

7.1. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

The Town of Haymarket identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- The risk of cyber-related incidents on critical infrastructure and key resource sites.
- Impacts of climate change.
- Increases in the number of excessive rainfall events that impact new areas with flooding.

8. Mitigation Actions

8.1. Goals and Objectives

The Town of Haymarket Hazard Mitigation Planning Team adopted the regional goal statement presented in Section 8, Base Plan.

8.2. Status of Previous Actions

The Town of Haymarket monitors actions and tracks progress through the periodic review, evaluation, revision, and update of the NOVA HMP. All of the town's previous action items are ongoing.

Table 20: Status of Previous Mitigation Actions, Town of Haymarket

Previous Action Item #	Agency/Department Mitigation Action	Status
2017-1	Access roadway structures throughout town	Ongoing
2017-2	Employ warning systems	Ongoing
2017-3	RL and SRL outreach	Ongoing
2017-4	Stormwater inventory framework/monitoring system	Ongoing
2017-5	NFIP compliance	Ongoing

8.3. New Mitigation Actions

The Town of Haymarket County Hazard Mitigation Planning Team identified two new mitigation actions to include in this plan. **Attachment 4** of this annex includes a table that summarizes each action, describing the proposed activity, priority level, estimated cost, and lead agency.

Table 21: New Mitigation Actions, Town of Haymarket

2022 Action Item Number	Agency/Department Mitigation Action	Status
2022-1	Access Roads	Newly Identified
2022-2	Develop Evacuation Plan	Newly Identified

8.4. Action Plan for Implementation and Integration

The Town of Haymarket will work in coordination PWC Hazard Mitigation Working Group on the implementation of Mitigation Actions. The Town of Haymarket designated mitigation coordinator is responsible for implementing the mitigation plan on two levels: implementation of the jurisdiction's actions and facilitating the implementation of the multi-jurisdictional regional plan. Tasks to ensure that the jurisdiction's actions are implemented are integrated into the *Action Plan for Implementation and Integration* (which includes the prioritized list of Mitigation Actions) and plan maintenance procedures described in the next section.

The Action Plan for Implementation and Integration describes how the town's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 22: Action Plan for Implementation and Integration of Mitigation into Existing Plans and Procedures

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Maintain regulatory requirements of the floodplain management program (NFIP).	Train identified town staff on the NFIP program and update town ordinances or plans as needed to help maintain NFIP requirements.
Identify opportunities for mitigation education and outreach.	Determine how the town's current outreach program can be used for mitigation and preparedness related outreach.
Review/update zoning codes for consistency with mitigation goals.	The Town will consider incorporating mitigation goals into the Zone and Subdivision Ordinance during the review process; however, some components of zoning codes cannot be changed as they are adopted at the Commonwealth level.
Maintain stormwater management plan requirement for development.	The Town will continue to require stormwater management plans as part of the plan of development process in conjunction with site plan or subdivision plan approval.
Develop emergency plans to address evacuation.	The Town, working with external stakeholders at the county and regionally, will develop an evacuation plan.
Maintain ongoing enforcement of existing policies.	The Town will continue to review all policies to ensure necessary enforcement requirements are being done.
Monitor funding opportunities.	The Town will continue to monitor all possible funding opportunities and work with the PWC Hazard Mitigation Working Group and other stakeholders to identify and expand previously untapped funding sources for mitigation projects as they are identified and eligible.
Incorporate goals and objectives into day-to-day government functions.	The Town will work with the PWC Mitigation Working Group and Town leadership to identify ongoing integration of mitigation activities, where applicable, in day-to-day government functions.
Incorporate goals into day-to-day development policies, reviews, and priorities.	The Town will work with the PWC Mitigation Working Group and Town leadership to continue to identify ongoing integration of mitigation activities, where applicable, in day-to-day development of policies, reviews, and priorities.

9. Annex Maintenance Procedures

The Point of Contact for the Northern Virginia Mitigation Planning Committee is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan** and is responsible for initiating the annual activities, convening the Planning Committee, and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 23: Town of Haymarket Plan Maintenance Responsibilities for the NOVA Hazard Mitigation Plan (Base Plan)

Activity	Responsibilities
Monitoring the plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA Planning Group. • Maintain records and documentation of all jurisdictional monitoring activities. • Help disseminate reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA Planning Group. • Maintain records and documentation of all jurisdictional evaluation activities. • Help disseminate information and reports to stakeholders and the public.
Updating the plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and updating. • Collect and report data to the NOVA Planning Group. • Maintain records and documentation of all reviews and revisions of the plan by the jurisdiction. • Help disseminate reports to stakeholders and the public.

9.1. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP Base Plan**, the Town of Haymarket Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the Town of Haymarket Jurisdiction Annex. The town's maintenance method and schedule may coincide with that of Prince William County and be conducted simultaneously.

9.1.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following a major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in the fifth year

Table 24: Town of Haymarket Annex Maintenance Procedures

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with the jurisdiction planning team. 2. Review the status of all mitigation actions, using the Mitigation Action Implementation Worksheet (**NOVA HMP Base Plan, Section 3, Attachment A**).	• Produce an annual report that includes the following: ▪ Status update of all mitigation actions. ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities. ▪ Summary of activities conducted for the Action Plan for Implementation and Integration.
Evaluating the Annex	1. Schedule the annual plan evaluation with the jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the Planning Considerations Worksheet (**NOVA HMP Base Plan, Section 3, Attachment C**).	• Submit the annual report to the Prince William County/NOVA HMP Planning Committee Point of Contact.
Updating the Annex	1. Coordinate with Prince William County and the Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years helps maintain the jurisdiction's eligibility for federal post-disaster funding.

Mitigation actions presented in the Town of Haymarket Jurisdiction Annex may be reviewed, revised, and updated at any time.

The Town of Haymarket will continue to be a planning partner with multiple jurisdictions and regional entities, including Prince William County, to identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan.

10. Annex Adoption

The Town of Haymarket Jurisdiction Annex will be adopted simultaneously with the adoption of the *NOVA HMP*.

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 3: Documentation of Public Participation
- Attachment 4: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.

11.2. Attachment 3: Documentation of Public Participation

Figure 5: Screenshot of Public Outreach

Figure 6: Screenshot of Social Media Public Outreach

11.3. Attachment 4: Mitigation Actions

Mitigation Action Matrix

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment	Current Status
2017-01	Access the roadway structure at various intersections throughout the Town of Haymarket to avoid repeated flooding.	Town of Haymarket Police Department	Dam Failure Earthquake	FEMA Unified Hazard Mitigation Assistance Funding, County funding	December	Identify funding sources by 2017	High	No	
2017-2	Continue to identify and employ a broad range of warning systems throughout the Town of Haymarket.	Town of Haymarket Police Department	All Hazards	UASI Funding, DHS grants, town/county funding	December 2020	Identify one new warning system to utilize by December 2017	High	No	Ongoing
2017-3	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, and flood insurance information) that can assist them in reducing their flood risk.	Town of Haymarket Town Manager	All Hazards	FEMA Unified Hazard Mitigation Assistance Funding for qualified structures	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2018	Medium	No	Ongoing
2017-6	Review locality's compliance with the National Flood Insurance Program with an annual review of the floodplain ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct annual review of repetitive loss and severe	Town of Haymarket Police Department	Flood Earthquake	General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2017	Medium	No	Ongoing

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment	Current Status
	repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.								
2017-7	Establish a schedule of review and review committee (if necessary) by June 2017.	Town of Haymarket Town Manager and Building Official	All Hazards	FEMA Unified Hazard Mitigation Assistance Funding for qualified structures	December 2018	Research and identify applicable funding mechanisms to develop the plan	Low	No	
2022-1	Assess Crossroads Village Center construction impact on flooding once construction is complete.	Haymarket Police Department and Town of Haymarket Planner	Flood Karst/Sinkhole/Land Subsidence	Town and County funding	December 2025	Identify Flood Prone areas by December 2023.	Low	Groundbreaking has just begun.	
2022-2	Develop evacuation and safe shelter plan for town businesses and citizens.	Haymarket Police Department and Town of Haymarket Planner	Dam Failure Earthquake High Wind/Severe Storm Tornado Wildfire Winter Weather	Town and County funding	December 2025	Have safe shelter areas identified by December 2023.	High		

Northern Virginia Hazard Mitigation Plan

Annex 17-C: Town of Occoquan

November 2022

Town of Occoquan Overview

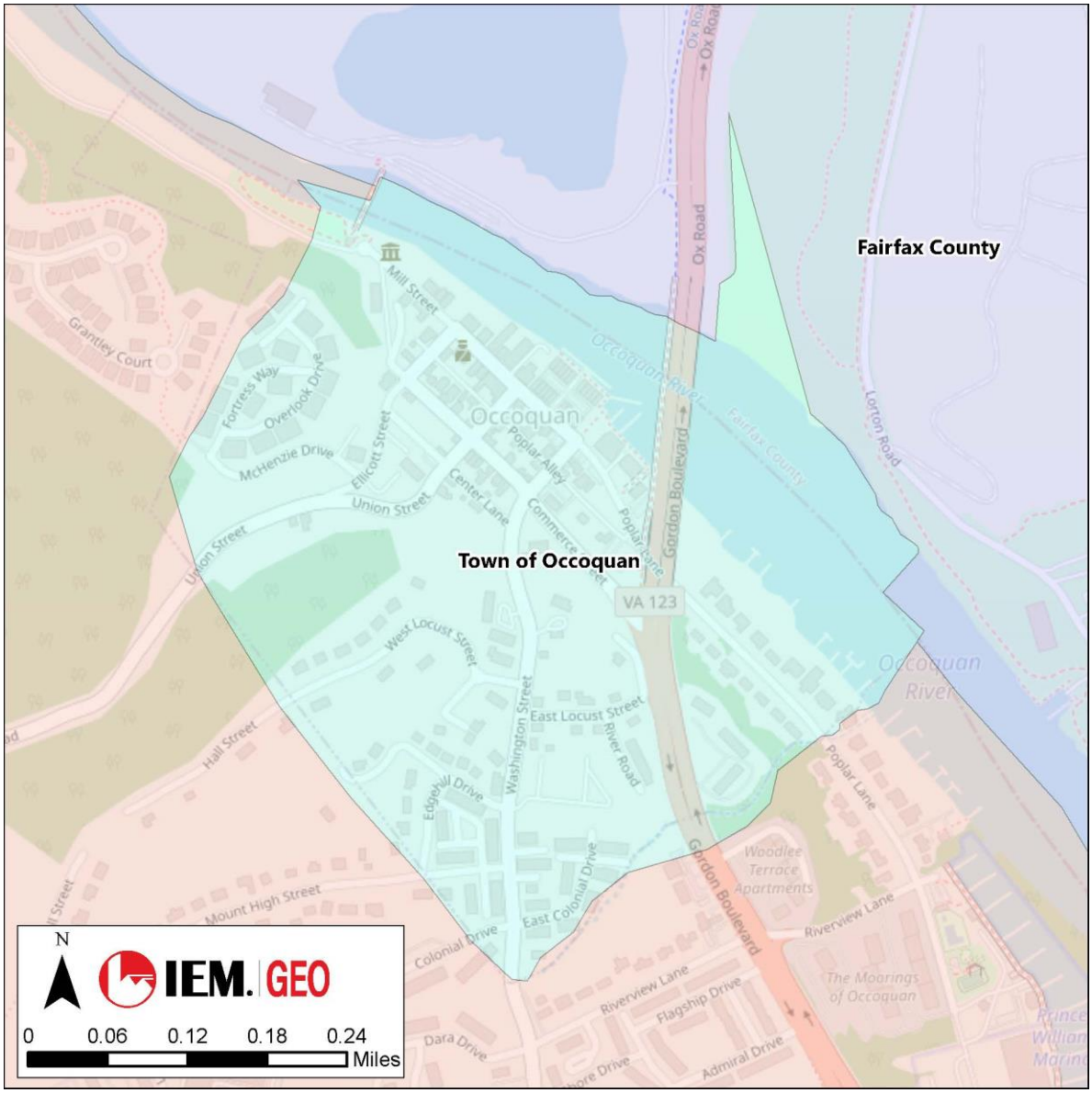

Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1804	0.2 sq. mi.	1,053	314 Mill Street, PO Box 195, Occoquan, VA 22125	548	Flood/Flash Flood

Town of Occoquan's Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI), 1950–June 2021

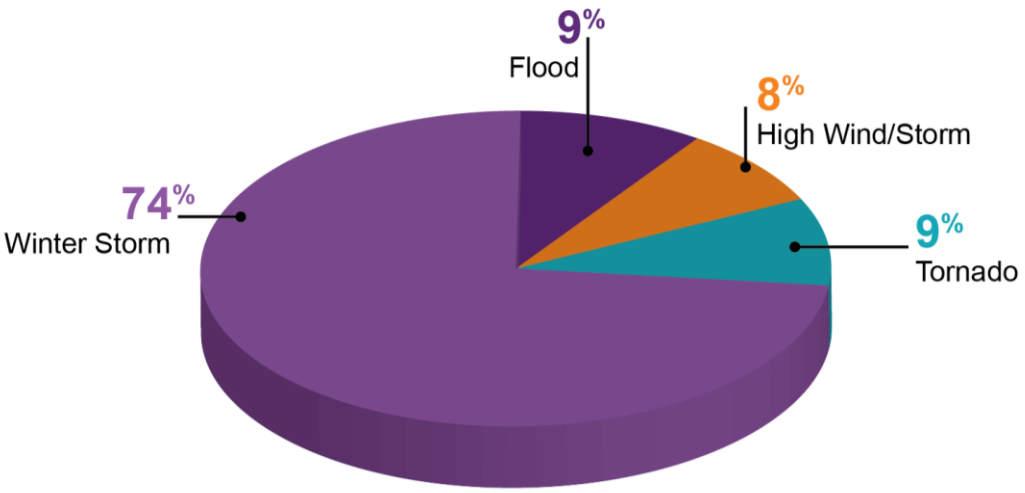

Figure 1: Percentage of Hazards

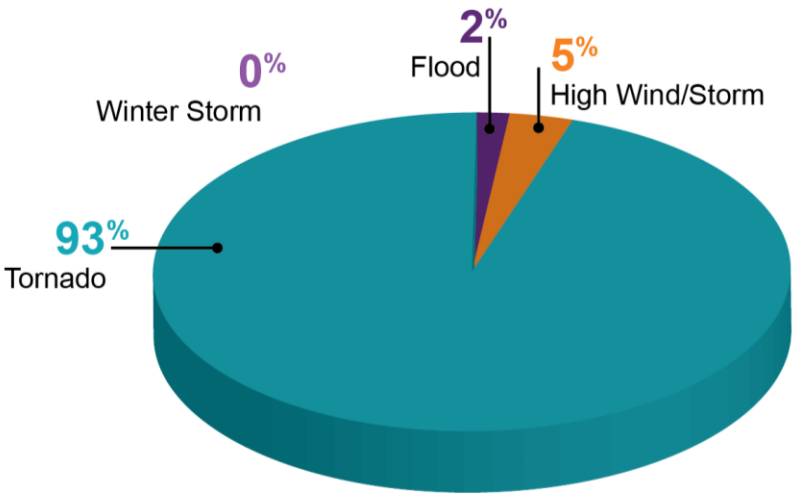

Figure 2: Property Damages from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Natural Hazard Risk Ranking Summary

Hazard	Hazard Ranking
Dam Failure	**High**
Flood	**High**
Tornado	**High**
High Wind/Severe Storm	**High**
Winter Weather	**Medium**
Earthquake	**Medium**
Extreme Temperatures (Hot/Cold)	**Medium**
Karst/Sinkhole/Land Subsidence	**Medium**
Drought	**Medium**
Landslide	**Low**
Wildfire	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	1
Food, Water, Shelter	17
Health and Medical	0
Energy	1
Communications	3
Transportation	2
Hazardous Materials	1
Education	1
Cultural/Historical	40
High Hazard Dams	1

A lifeline enables the continuous operation of government and business functions which are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

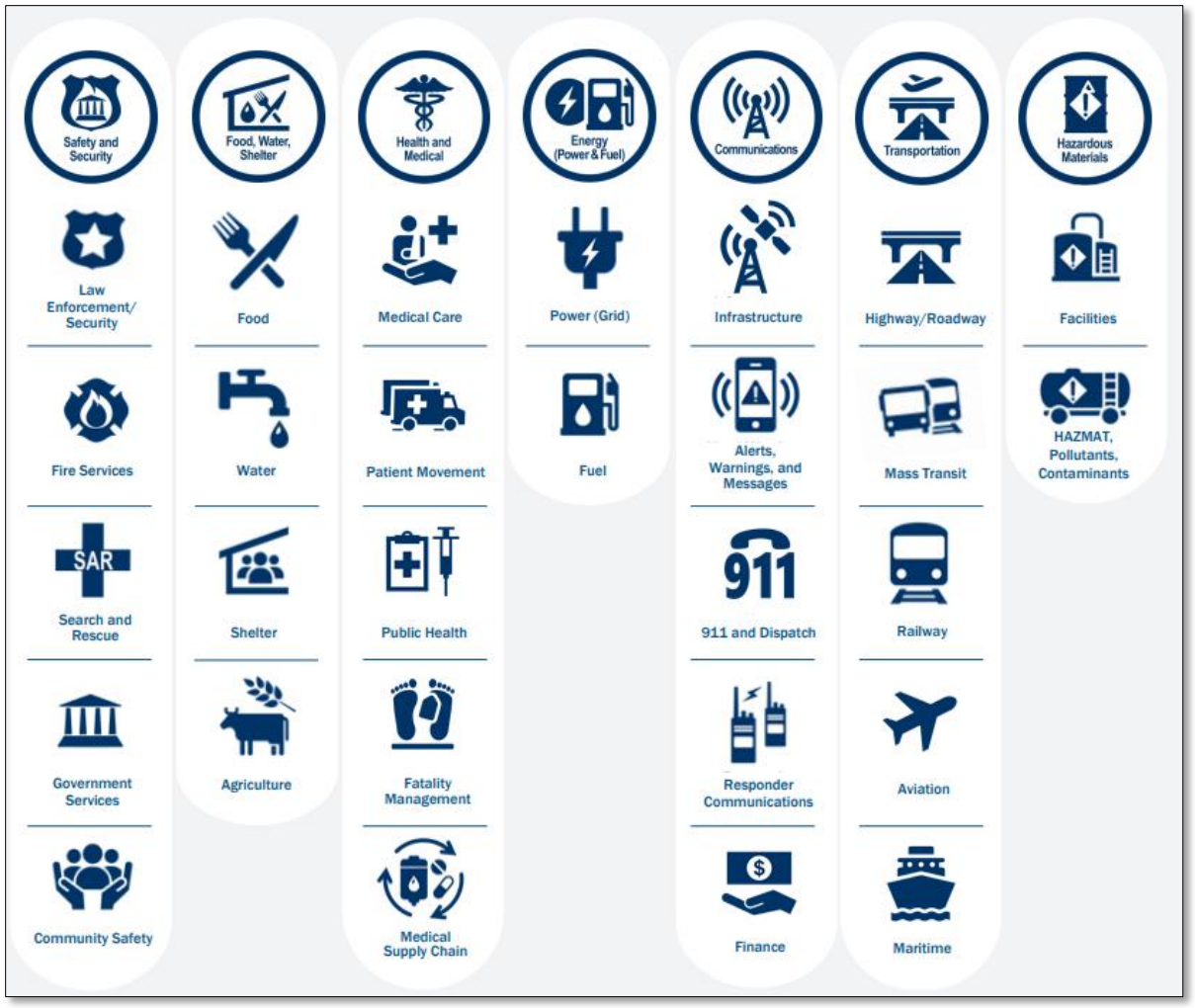

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials :** Facilities, HAZMAT, Polluants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for Town of Occoquan

Capability	Ranking
Planning and Regulatory	Moderate
Safe Growth	Moderate
Administrative and Technical	Moderate
Financial	Low
Education and Outreach	Moderate

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Jason Forman, Deputy Chief of Police Town of Occoquan 571-284-0549 jforman@occoquanva.gov
Secondary Point of Contact	Katie Kitzmiller, Deputy Emergency Management Coordinator Prince William County 571-359-3501 kkitzmiller@pwcgov.org

Town of Occoquan

This annex presents the following jurisdiction-specific information provided by the Town of Occoquan for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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List of Figures

1. Jurisdiction Profile

Established	1734
Chartered	1804
Total Land Area	0.2 sq. mi.
Geographic Region	Piedmont
Persons Per Household	1.92
Persons Per Square Mile	5,265
Median Age	35.6
Elevations	7 feet

1.1. Location

The Town of Occoquan is located along the Occoquan River in both Prince William County (PWC) and Fairfax County. The town is situated 88 miles north of the Commonwealth of Virginia's capital of Richmond and is 23 miles south of the Nation's capital of Washington, D.C.

1.2. History

The Town of Occoquan is located along the Occoquan River in the northeastern portion of Prince William County and the southeastern portion of Fairfax County. The Town occupies approximately 125 acres, including 25 acres of the Occoquan River. While the populated portion of the Town is located along the southern shore of the Occoquan River, the Town boundary extends into the Fairfax County. The Town is situated at the "fall line," which delineates the Piedmont and Coastal Plain geological provinces and represents the end of the navigable waters of the Occoquan River. The downtown and Poplar Lane portions of Occoquan are on a relatively level and low lying plain adjacent to the river. To the southwest of this low–lying plain is a ridge underlain by mostly granite rock. The ridge is dissected by several small streams that empty into the river. The largest stream is Ballywack Branch. The other streams are Furnace Branch, Boundary Branch, Phelps Creek, and the tributary of Boundary Branch designated as Edgehill Creek. The "high ground" located in Town is generally rolling with some very steep slopes and rocky outcrops adjacent to streams and the river plain.

Occoquan established its commercial and residential successes long before Virginia was a colony when Captain John Smith traveled the Occoquan River to establish trade routes between the Dogue Indians and English settlers. The rolling hills, strong waterfalls, and natural beauty of the area attracted entrepreneurs like John Ballandine. During the late eighteenth century, he established Occoquan as a full-service town with mills, forges, stores, tolling points, and multiple residences.

1.3. Demographics, Economy, and Governance

Table 6: Population and Growth Rate[1]

Year	Population	Percent Increase over Previous Census
1980	241	
1990	361	49.8%
2000	759	110.2%
2010	934	23.1%
2020	1,053	%

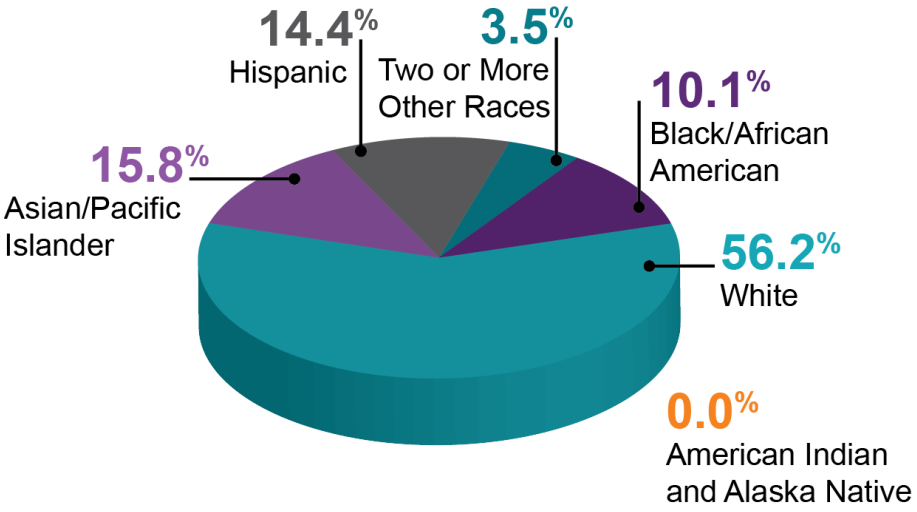


Figure 4: Race and Ethnicity Demographics

Table 7: Economic Data

Economy	Data
Median Household Income (2020)	$110,000
Unemployment Rate (September 2021)	3.2%
Per Capital Income (2020)	$61,542
Median House or Condo Market Value (2019)	$214,800
Percentage Below Poverty (2020)	3.6%

The Town of Occoquan in managed by a council-manager form of government, in which the Council is the governing body, elected by the public, and the manager is appointed by the Council to carry out the policies it establishes. Occoquan's Town Council consist of five council members and the mayor and are

[1] U.S. Census Bureau: Occoquan town, Virginia

elected for four-year terms. The Town Hall is located at 314 Mill Street and houses the Town's operations, including staff offices, Town Council, and board and commission meetings. The Town Police Department operates out of their Headquarters located at 124 Commerce St.

1.4. Built Environment and Community Lifelines

The information related to Community Lifelines and critical assets in the Town of Occoquan presented in this section has been collected from multiple sources, including Hazus (Version 4.2) and government websites. Data extracted from the Hazus Level 1 assessment indicates that the Town has an estimated 57 critical and historic assets. Due to the delay in collecting and verifying data and the method of documenting location and jurisdiction used in Hazus, this may not reflect the current inventory maintained by the Town of Occoquan.

The Town of Occoquan maintains a detailed list of community lifeline facilities, sites, and critical assets.

Table 8: Number of Assets per Community Lifeline/Sector

Lifeline/Sector	Number of Assets
Safety and Security	1
Food, Water, Shelter	17
Health and Medical	0
Energy	1
Communications	3
Transportation	2
Hazardous Materials	1
Education	1
Cultural/Historical	40
High Hazard Dams	1

1.4.1. Safety and Security

The Town of Occoquan Police Department (OPD) is the primary law enforcement agency responsible for the Town. The Prince William County Police Department and Fairfax County Police Departments respectfully supports the OPD with its day-to-day mission.

Fire and Rescue services are provided by the Prince William County and Fairfax County Fire and Rescue Departments.

1.4.2. Food, Water, Shelter

Food commodities are available throughout the Town from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

1.4.3. Health and Medical

There are no medical facilities in the Town of Occoquan.

1.4.4. Energy

The Town receives its energy from Dominion Power. Within the Town there is a Dominion Power switch bringing power resources across the Occoquan River from Fairfax County into Prince William County.

1.4.5. Communications

The Town of Occoquan has an Emergency Notification System (ENS) which serves as the primary information alert system for residents and business within the Town. The Town is supported by the Prince William County Office of Emergency Management with additional ENS capabilities.

Fairfax County Department of Emergency Management and Security supports the Town with the Occoquan Reservoir Dam siren and notification system.

The Town's public safety is dispatched through Prince William County and Fairfax County 911 systems. The Town of Occoquan Police Department operates upon the Prince William County Public Safety Communications System and has inoperable communications with Fairfax County and regional Public Safety partners.

Privately owned communications sector critical infrastructure exists in the Town.

1.4.6. Transportation

The Town of Occoquan owns and maintains a public dock providing for maritime transportation upon the Occoquan River.

Route 123 runs north and south through the Town, connecting with Interstate 95 (I-95) and U.S. Route 1 just south of Occoquan. Route 123 has been identified by the Virginia Department of Transportation (VDOT) as a primary thoroughfare.

1.4.7. Hazardous Materials

Daily. Hazardous Materials are transported and stored within the Town of Occoquan.

1.4.8. Education

There are no public educational facilities within the Town of Occoquan. Occoquan elementary school is located 0.4 miles outside of the Town's Corporate limits. A privately owned, special needs education and care facility is located within the town. This is not a 24/7 facility.

1.4.9. Recreational, Cultural and Historic Sites, and Assets

There are 40 historical buildings in the Town under Historic Preservation, National, and VA registries. The Town created an Old and Historic District Overlay to preserve their historic district and history.

The Town of Occoquan maintains two public parks located along the Occoquan River. The Town also owns17acres of property within a conservation easement and includes a blazed trail that connects to Prince William County's Occoquan Greenway Trail. In addition, the Town of Occoquan has a

collaborative partnership with Northern Virginia Park Authority who maintains the Occoquan Regional Park located along the Occoquan River on the Fairfax County shoreline.
The Town also owns and maintains a free public kayak and canoe access ramp on suitable for people with ambulatory disabilities.

1.5. Growth and Development Trends

The Town of Occoquan Comprehensive Plan 2016–2026 outlines the development the Town would like to realize and goes into greater detail about land use, growth, and development trends. The Town continues to steadily grow, and while it does not have room to grow out, it will continue to infill. The continuations of their mixed-use business model will allow for residents and business owners to live and work in a neighborhood partnership.

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the Town of Occoquan followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Group, the Town supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction.

Table 9: Local Planning Participants

Name	Position/Title	Department/Agency
Adam Linn	Town Manager	Town of Occoquan
Jason Forman	Deputy Chief of Police	Town of Occoquan

The jurisdiction identified its chief hazard mitigation planning responsibility as representing the Town in coordination with the Prince William County representative to the Emergency Managers Group. The Town also identified the following tasks as part of its mitigation planning responsibilities:

- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review plan drafts and provide input
- Public outreach activities
- Implementation of the plan
- Maintaining the plan

Town of Occoquan planning participants coordinated primarily by means of virtual meetings during the planning process, and as needed, independently to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a Public Hazard Survey, which was posted and advertised on the Town's website: Town of Occoquan, VA (occoquanva.gov).

In addition to the survey, the public was offered the opportunity to review and provide input to the draft 2022 Plan update. Notification of the Draft Plan release was made through the same town web link. Documentation of the public survey and draft plan review is included in **Attachment 2** of this annex.

3. Jurisdiction-Specific Hazard Event History

The Town of Occoquan' comprehensive hazard history is generally combined with that of Prince William County and described in **Sections 4 and 5, Base Plan**.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,019 recorded natural meteorological events that took place in Prince William County between January 1, 1950, and May 2021. The County and its municipalities have been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 10: Federal Disaster and Emergency Declarations, 2017–2021, Prince William County

Declaration	Date	Hazard	Assistance Type
DR-4512-VA	4/2/2020 (continuing)	COVD-19 Pandemic	Individual Assistance, Public Assistance
EM-3448-VA	3/13/2020 (continuing)	COVID-19 Pandemic	Public Assistance (Category B)
EM-3403-VA	9/11/2018	Hurricane Florence	Public Assistance (Category B)

Tables 18 and 19 in **Annex 17: Prince William County** provide a summary of all high wind/severe storm and severe winter storm events that have occurred in Prince William County between 1950 and May 31, 2021.

Table 11: Significant Hazard Events, Town of Occoquan, 2017–2021

Date	Hazard	Event and Description
March 2020–TBD	Pandemic COVID-19	Worldwide pandemic affecting all aspects of life

4. Hazard Risk Ranking

After developing hazard profiles, the Town of Occoquan conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an overall risk score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan**.

The overall risk score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5, Base Plan**, and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II of the Base Plan**.

Table 12: Hazard Risk Ranking Summary, Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Dam Failure	4.0	7.9	11.9	**High**
Flood	4.0	6.9	10.9	**High**
Tornado	4.0	6.0	10.0	**High**
High Wind/Severe Storm	4.0	5.4	9.4	**High**
Winter Weather	4.0	4.2	8.2	**Medium**
Earthquake	2.0	4.7	6.7	**Medium**
Extreme Temperatures (Hot/Cold)	4.0	2.4	6.4	**Medium**
Karst/Sinkhole/Land Subsidence	2.0	3.2	5.2	**Medium**
Drought	2.0	2.0	4.0	**Medium**
Landslide	2.0	2.0	4.0	**Low**
Wildfire	2.0	2.0	4.0	**Low**

Table 13: Hazard Risk Ranking Summary, Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Active Violence	4.0	6.1	10.1	**High**
Civil Unrest	4.0	6.1	10.1	**High**
Hazardous Materials	4.0	6.0	10.0	**High**
Terrorism	4.0	5.9	9.9	**Medium**
Communication Disruption	4.3	5.2	9.5	**Medium**
Cyberattack	4.3	5.2	9.5	**Medium**
Infectious Disease/Public Health	4.0	3.9	7.9	**Low**

Based on the hazard risk scores, the Town of Occoquan evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Nine natural hazards were identified as high or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Dam failure, flood, tornado, and high wind/severe storm
- **Medium:** Winter weather, earthquake, extreme temperatures, karst/sinkhole/land subsidence

Six non-natural hazards were ranked as high or medium risk:

- **High:** Infectious disease/public health, terrorism, and civil unrest
- **Medium:** Cyberattack and hazardous materials

All other hazards are ranked as “low,” signifying a minimal risk.

4.1. Additional Hazard Risk Considerations

4.1.1. Non-Natural Hazards

Volume II of the *2022 Northern Virginia Hazard Mitigation Plan* addresses non-natural hazards identified by the Town of Occoquan.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

The Town of Occoquan is a participant in the National Flood Insurance Program (NFIP).

Table 14: National Flood Insurance Program Status, Town of Occoquan

NFIP Data	Date
Initial flood hazard boundary map (FHBM) identified	7/19/1974
Initial flood insurance rate map (FIRM) identified	1/5/1995
Date of the current effective map	1/5/2015
Regular-Emergency date	9/1/1978
Digital Flood Insurance Rate Map (DFIRM)/(Q3)	Unknown

Table 15: NFIP Policy and Claims Status, Town of Occoquan

NFIP Policy	Claims Status
Policies In-Force	34
Premiums Paid	$57,025
Total Claims	19
Total Payment	$65,187

Table 16: NFIP Status, October 18, 2021

Category	NFIP Topic	Source of Information	Comments
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	Yes
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	Unknown
Staff Resources	Provide an explanation of NFIP administration	Community FPA	Map assistance, permit review, public outreach,

Category	NFIP Topic	Source of Information	Comments
	services (e.g., permit review, GIS, education or outreach, inspections, engineering capability).		map revision records, and inspections.
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	No in-house GIS
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Compliance History	Are there any outstanding compliance issues (i.e., current violations)?		No
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		Unknown

Additional hazard information for the Town of Occoquan is presented in the **Base Plan**.

5.2. Population

Estimates of the number of residents in the Town of Occoquan vulnerable to each hazard are presented in the various hazard sections in the **Base Plan**.

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations.

The Overall CDC SVI for Prince William County, including the Town of Occoquan, is presented in **Annex 17: Prince William County**.

5.3. Built Environment and Community Lifelines and Assets

Using Hazus data available, scenarios were run at the county level for earthquake, flood, and hurricane wind to determine potential exposure of buildings, infrastructure, and economy. Information presented in **Annex 17: Prince William County** includes the Town of Occoquan.

Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events. The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA.

Overlaying the critical facilities in Occoquan on the mapped flood zones illustrate that there are two critical facilities in the flood zone: one police station and one water facility.

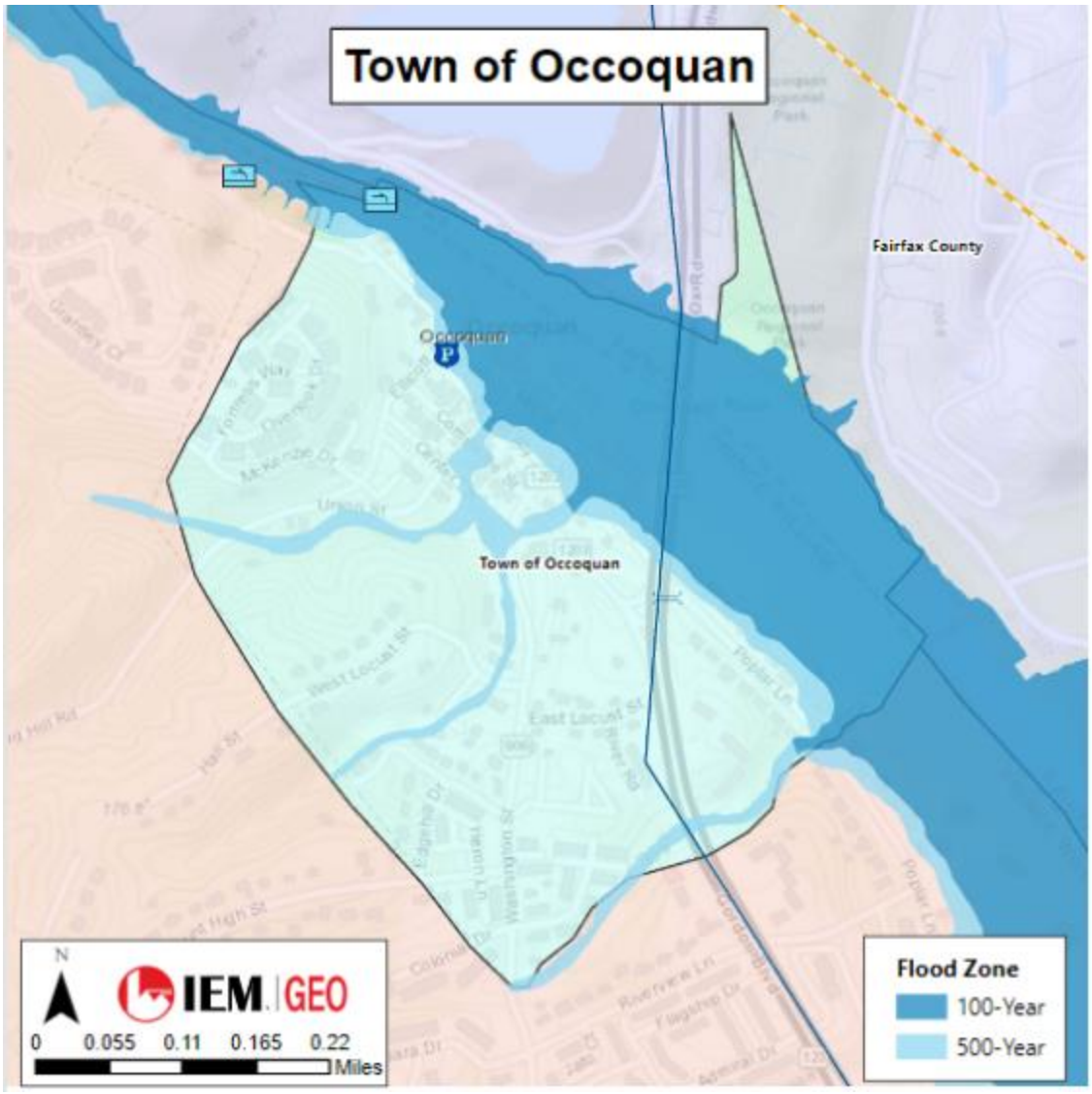


Figure 5: The Town of Occoquan Critical Assets Located in the Flood Zone

5.4. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

Additional environmental community assets in Prince William County include the Occoquan Bay National Wildlife Refuge as a critical habitat due to their forests, meadows, marshes, and grasslands and the presence of many bird species.

5.5. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2,500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets and presented in **Annex 17: Prince William County**.

5.6. Cultural and Historical Assets

Information related to vulnerability of cultural and historical assets are presented in the hazard-specific sections of the **Base Plan**. There are numerous historic buildings in the Town and the Occoquan Historical District is listed on the National Register of Historical Places.

Historic structures and sites are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites.

6. Capability Assessment

The Town of Occoquan reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a capabilities assessment worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - County, and Town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the Town completed a jurisdiction needs identification questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed in order to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans and/or resources, and it can implement most mitigation actions.

Table 17: Capability Assessment Ranking Summary, Town of Occoquan

Capability	Ranking
Planning and Regulatory	Moderate
Administrative and Technical	Moderate
Safe Growth	Moderate
Financial	Low
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary

The Town is working toward utilizing an all-hazards approach when developing any jurisdictional plans and land use planning ordinances and building codes are an effective measure for reducing hazard impacts and are adequately administered and enforced.

Planning and Regulatory Capability Analysis: Moderate

The Town maintains a 2016-2026 Comprehensive Plan, updated in 2021, and a Capital Improvement Program which is updated annually.

The 2016-2026 Comprehensive Plan addresses strong zoning, subdivision, floodplain, stormwater management, and erosion and sediment control ordinances used to reduce hazard impacts by protecting people and property. This document can be leveraged to implement more mitigation actions within the Town.

The Capital Improvement Program (CIP) is the Town's five-year plan for capital projects that is reviewed and updated annually as part of the budget process. The CIP identifies stormwater projects but focuses more on deferred maintenance issues.

The Town of Occoquan has a robust emergency planning and preparedness program. This program is in the process of completing a Continuity of Operations Plan (COOP), an All-Hazards Plan (AHP), a Town Evacuation Plan, and the design of a emergency management public outreach program. The Town is a member of the Prince William County local Emergency Operations Plan (EOP).

Within the Town of Occoquan building codes and site plan review requirements are enforced.

The Prince William County Joint Local Emergency Planning Committee (LEPC) provides umbrella inclusion for the Town of Occoquan.

To strengthen these capabilities, the Town plans to update the floodplain ordinance and ensure all plans (comprehensive plans, codes and ordinances, etc.) are up to date and current according to local, state, and federal guidelines and regulations.

6.1.2. Administrative and Technical Capabilities Summary

Due to the limited number of Town staff, the Town of Occoquan leverages regional partnerships as well as contract resources.

Administrative and Technical Capability Analysis: Moderate

The Town has extensive capabilities that can be expanded through the use of consulting firm(s) for various tasks. For specific expansion of those capabilities, the Town has reached out to other consultants on an as-needed basis.

6.1.3. Safe Growth Capabilities Summary

- Growth guidance instruments such as future land-use policies, regulations, and maps identify natural hazard areas such as floodplains and discourage or prohibit development or redevelopment within these areas.
- Environmental policies encourage appropriate development to protect ecosystems.
- Public safety plans and procedures address emergency evacuation and other safety measures associated with safe growth.
- The building code contains provisions to strengthen or elevate construction to withstand hazard forces.
- The zoning ordinances conform to the comprehensive plan in terms of discouraging development or redevelopment within natural hazard areas.

Safe Growth Capability Analysis: Moderate

The Town of Occoquan has safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment.

6.1.4. Financial Capabilities Summary

- The Town of Occoquan CIP could provide funding for mitigation project in the future but does not currently.
- The Town has the authority to incur debt through general obligation bonds and/or special tax bonds, as well as fees for utility services and impact fees for new development.
- The Town participates in multiple federal and state funding programs through various disciplines.

Financial Capability Analysis: Low

The Town of Occoquan has access to and eligibility for multiple funding resources, including state and federal funding. These external funding sources have been used in the past for stream restoration, roadway project funding, and road improvements. More money can be used to improve traffic flow to get people out during emergencies. Additional funding streams could be used for a flood warning system and broadband to improve access to the internet and emergency information.

6.1.5. Education and Outreach Capabilities Summary

- Prince William County is designated as a StormReady community, which includes the Town in components of public education and training. The Town of Occoquan Police Department which includes Emergency Management functions is near completion of a Public Outreach Program which will work in collaboration with Prince William County Office of Emergency Management to educate business and residents on evacuation procedures and hazards facing the Town.

- The Town works with governmental and non-profit agencies t to help clean up rivers, streams and reduce flooding.

Education and Outreach Capability Analysis: Moderate

The Town will increase public awareness through collaboration with Prince William County Office of Emergency Management with a local public outreach program.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, the Town of Occoquan identified activities related to each natural hazard that support risk reduction. They are listed in the following Table.

Table 18: Capability Summary – Activities That Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Dam Failure (Including Levees)	• Public education and operational plans address preparedness and response to reduce risk.
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and international building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	• Public education and operational plans address preparedness and response to reduce risk.
Flood/Flash Flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. • Stormwater management program and projects address flood prevention and risk reduction.
High Wind/Severe Storm	• State and international building codes provide for wind load design regulations.
Karst/Sinkhole/Land Subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Winter Storm	• Public education and operational plans address preparedness and response to reduce risk.
Non-Natural Hazards	• Public education and operational plans address preparedness and response to reduce risk.

Hazard	Activity
	• Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate Change	• Ongoing resilience planning will allow for the identification and mitigation of climate change-related issues in future planning cycles.

7. Resilience to Hazards

7.1. National Risk Index

The National Risk Index (NRI) is a dataset and online tool developed by FEMA and other partners to help illustrate communities in the United States at risk for 18 natural hazards. It provides an overview of hazard risk, vulnerability, and resilience. The designation of "low risk" is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

Hazard risk is calculated on data for a single hazard type and reflects the relative risk for that hazard type and should be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex.

In addition, some hazards are defined differently from the hazards in this plan, so a direct hazard-to-hazard comparison of risk is not able to be determined. The NRI is a county-level risk ranking, which includes the towns and is presented in **Annex 17: Prince William County, Section 7**.

7.2. New Hazard Risk Challenges or Obstacles to Be Monitored in the Next Planning Cycle

- The risk of cyber-related incidents on critical infrastructure and key resource sites
- Climate change
- Increases in the number of excessive rainfall events that impact new areas with flooding

8. Mitigation Actions

8.1. Goals and Objectives

The Town of Occoquan Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

The Town of Occoquan did not identify any mitigation actions during the 2017 Northern Virginia Hazard Mitigation Planning process.

8.3. New Mitigation Actions

The Town of Occoquan has identified new mitigation actions for this plan update: **Attachment 3** of this annex includes a table that summarizes each new action, describing the proposed activity, priority level, estimated cost, and lead agency.

8.4. Action Plan for Implementation and Integration

The Town of Occoquan will collaborate with the Prince William County Office of Emergency Management in accomplishing hazard mitigation activities within the Town. The Town of Occoquan Town Manager is responsible for implementing the mitigation plan. Tasks to ensure the Town's actions are implemented are integrated into the *Action Plan for Implementation and Integration* (which includes the prioritized list of Mitigation Actions) and plan maintenance procedures are described in the next section. The *Action Plan for Implementation and Integration* describes how the Town's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 19: Action Plan for Implementation and Integration, Town of Occoquan

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Maintain regulatory requirements of the National Flood Insurance Program (NFIP).	Revise Town ordinance to help maintain NFIP requirements.
Continue public engagement in mitigation planning.	Public outreach within the Town.
Identify opportunities for mitigation education and outreach.	Determine how the Town's newsletter, website and social media can be used for outreach.
Review/update emergency plans to address evacuation and sheltering.	Finalize Town Evacuation Plan, Traffic Incident Management Plan, and All Hazards Plan.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.
. This process will involve representatives from all participating jurisdictions.

Table 20: Town of Occoquan Plan Maintenance Responsibilities for the NOVA Hazard Mitigation Plan (Base Plan)

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to Prince William County/NOVA Planning Group. • Maintain records and documentation of all jurisdictional monitoring activities. • Help disseminate reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the Prince William County/NOVA Planning Group. • Maintain records and documentation of all jurisdictional evaluation activities. • Help disseminate information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the Prince William County/NOVA Planning Group. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP Base Plan**, the Town of Occoquan Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**. The Town's maintenance method and schedule may coincide with that of Prince William County and be conducted simultaneously.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following a major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in the fifth year

Table 21: Town of Occoquan Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with the jurisdiction planning team. 2. Review the status of all mitigation actions, using the Mitigation Action Implementation Worksheet (**NOVA HMP Base Plan, Section 3, Attachment A**).	• Produce an annual report that includes the following: ▪ Status update of all mitigation actions. ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities. ▪ Summary of activities conducted for the Action Plan for Implementation and Integration.
Evaluating the Annex	1. Schedule the annual plan evaluation with the jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the Planning Considerations Worksheet (**NOVA HMP Base Plan, Section 3, Attachment C**).	• Submit the annual report to the Prince William County/NOVA HMP Planning Team Point of Contact.
Updating the Annex	1. Coordinate with Prince William County and the Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years will maintain the Town's eligibility for federal post-disaster funding.

Mitigation actions presented in the Town of Occoquan Jurisdiction Annex may be reviewed, revised, and updated at any time.

The Town of Occoquan will continue to be a planning partner with multiple jurisdictions and regional entities, including Prince William County, to identify hazard mitigation opportunities that reduce risk to the hazards identified in this plan.

10. Annex Adoption

The Town of Occoquan Jurisdiction Annex will be adopted simultaneously with the adoption of the *NOVA HMP* and the *Prince William County Annex*.

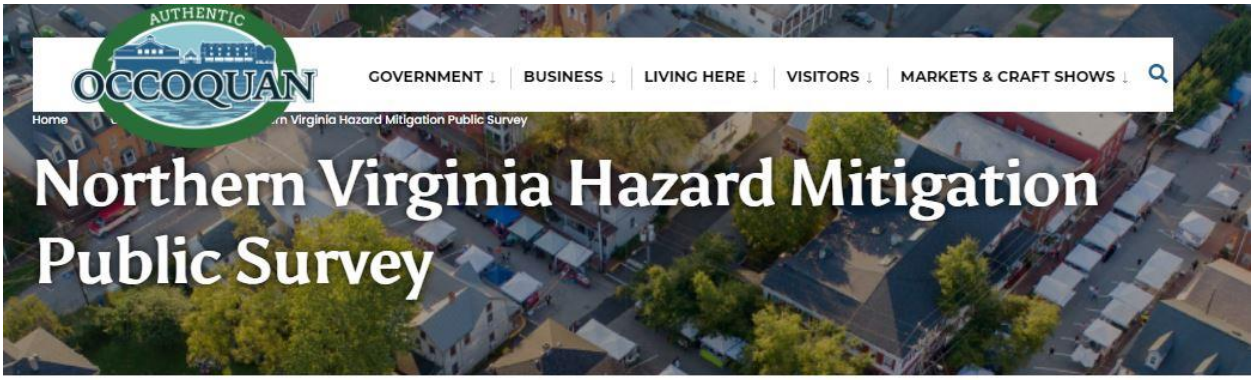
11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Documentation of Public Participation



October 1, 2021 | Uncategorized | Kirstyn Jovanovich

We need your assistance!

Northern Virginia jurisdictions are preparing an update to the **2017 Northern Virginia Hazard Mitigation Plan**. The regional plan will identify local policies and actions for reducing risk and future losses from hazards such as floods, severe storms, wildfires, winter weather, and more.

The plan will meet key federal planning regulations that require local governments to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance, including funding for hazard mitigation projects.

This survey provides an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that help lessen the impacts of future disasters.

Participation in the survey is voluntary and none of the information you provide will be attributed to you.

Take the Survey

Town News

- Northern Virginia Hazard Mitigation Public Survey
- Town Council Meeting: October 5, 7:00 pm
- Public Hearing on Proposed Occoquan Town Charter Update – October 5, 7:00 p.m.
- OCQ 2021 River Paddle Challenge – October 2, 2021
- Movie Night in the Park: Hocus Pocus – October 23

11.3. Attachment 3: Mitigation Actions

2022 Action Item	Agency/Department Mitigation Actions	Lead Agency/Department Organization	Hazard	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comment
2022-1	Public Safety Communication Enhancements: This will include Portable and mobile radios as well as Computer Aided Dispatch (CAD) Computers.	Occoquan Police Department	All Hazards	Various funding sources	2023	Assessment of need has been completed. Initial planning meetings have begun.	High	PWCPD is assisting with this action.
2022-2	Public Safety Maritime Operations: The acquisition of watercraft used for public safety operations.	Occoquan Police Department	All Hazards	Various funding sources	2023	Looking for funding sources	Medium	
2022-3	Alternate Power Supply: Ensuring Town facilities has alternate reliable power sources through the acquisition of standalone emergency generators.	Occoquan Police Department	All Hazards	Various funding sources	2024	Assessment of need has been completed. Initial planning meetings have begun, and funding sources sought after	High	PWCOEM is assisting with this action.
2022-4	Emergency Management Plans: Development and Implementation of a Town Comprehensive Emergency Management Program.	Occoquan Police Department	All Hazards	Various funding sources	2023	Initial DRAFTS of documents have been completed	Medium	

2022-5	Emergency Management Plans: Development and Implementation of a Continuity Of Operations (COOP) Program and Plan	Occoquan Police Department	All Hazards	Various funding sources	2023	Initial DRAFTS of documents have been completed	Medium	
2022-6	Emergency Management Plans: Development and Implementation of a All-Hazards Plan	Occoquan Police Department	All Hazards	Various funding sources	2023	Initial DRAFTS of documents have been completed	Medium	
2022-7	Emergency Management Plans: Development and Implementation of a Town Evacuation Plan	Occoquan Police Department	All Hazards	Various funding sources	2023	Initial DRAFTS of documents have been completed	Medium	
2022-8	Emergency Management Plans: Development and Implementation of a Traffic Incident Management Plan	Occoquan Police Department	All Hazards	Various funding sources	2023	Initial DRAFTS of documents have been completed	Medium	
2022-9	Emergency Management Plans: Development and Implementation of a comprehensive acts of violence program	Occoquan Police Department	All Hazards	Various funding sources	2023	Initial DRAFTS of documents have been completed	Medium	
2022-10	Acts of Violence Program: Acquisition of a special operations vehicle used to store and deploy acts of violence equipment as well as have the capability of running incident command during an act of violence, high threat incidents and special/pre-planned events.	Occoquan Police Department	All Hazards	Various funding sources	2024	Assessment of need has been completed and funding sources sought after	High	

2022-11	Acts of Violence Program: Acquisition of equipment and training needed to respond to effectively respond to and mitigate acts of violence, high threat incidents and special/pre-planned events.	Occoquan Police Department	All Hazards	Various funding sources	2023	Policy and planning has been completed. Initial funding received for equipment and acquisition is in progress.	High	
2022-12	Traffic Incident Management: Acquisition of TIM equipment needed to effectively respond to and facilitate an evacuation of the Town.	Occoquan Police Department	All Hazards	Various funding sources	2024	Assessment of need completed	Medium	
2022-13	Weather Incidents: Acquisition of equipment and training needed to properly mitigate the effects of severe and winter weather impacting the Town.	Occoquan Police Department	All Hazards	Various funding sources	2024	Assessment of need completed	Medium	
2022-14	Weather Incidents: Design and Build a Storm Ready facility for public safety and Town government to ensure essential functions can resume.	Occoquan Police Department	All Hazards	Various funding sources	2026	Assessment of need completed	Medium	
2022-15	Cyber Initiatives: Completion of a cyber threat analysis on Town systems	Occoquan Police Department	All Hazards	Various funding sources	2024	Assessment of need completed. Funding sources sought after	High	

2022-16	Cyber Initiatives: Acquisition of systems to detect, deter and defend Town systems from a Cyber Attack	Occoquan Police Department	All Hazards	Various funding sources	2024	Assessment of need completed. Funding sources sought after	High	
2022-17	Cyber Initiatives: Acquisition of redundant Information Technology systems to ensure Essential Functions during a Continuity Event or Cyber Attack	Occoquan Police Department	All Hazards	Various funding sources	2024	Assessment of need completed. Funding sources sought after	High	
2022-19	Operations: Completion of an ADA facilities assessment of all Town facilities.	Occoquan Police Department	All Hazards	Various funding sources	2023	Assessment of need completed. Funding allocated and actions began.	Medium	
2022-20	Operations: Expansion and rehabilitation of the Town Dock to allow more maritime travel into and out of the Town.	Town of Occoquan	All Hazards	Various funding sources	2026	Assessment of need completed.	Medium	
2022-21	Town Facilities Improvements: – Implementing flood and severe weather mitigation improvements, such as waterproofing, to Town facilities, including Town Hall and the Mill House Museum.	Town of Occoquan	All Hazards	Various funding sources	2026	Assessment of need completed.	Medium	
2022-22	Town Facilities Improvements: Updating Town Hall energy systems and envelope in order to increase resiliency to hazard	Town of Occoquan	All Hazards	Various funding sources	2026	Assessment of need completed.	Medium	

	events and reduce future mitigation costs.							
2022-23	Stormwater System Improvements: Center Lane pipe replacement	Town of Occoquan	All Hazards	Various funding sources	2026	Assessment of need completed.	Medium	
2022-24	Stormwater System Improvements: Commerce Street pipe reinforcement	Town of Occoquan	All Hazards	Various funding sources	2026	Assessment of need completed.	Medium	
2022-25	Stormwater System Improvements: 200 Mill Street culvert/sidewalk repair	Town of Occoquan	All Hazards	Various funding sources	2026	Assessment of need completed.	Medium	
2022-26	Stormwater System Improvements: Execute stormwater system mapping and planning project to assess current condition and needs of the system.	Town of Occoquan	All Hazards	Various funding sources	2026	Assessment of need completed.	Medium	
2022-27	Stormwater System Improvements: Repair, retrofit, and construct BMPs in accordance with results of stormwater system planning project.	Town of Occoquan	All Hazards	Various funding sources	2026	Assessment of need completed.	Medium	
2022-28	Stormwater System Improvements: Town-wide streambed restoration in accordance with the results of the stormwater system planning project. Potential areas include: Ballywack Branch, Furnace Branch, Boundary Branch, and Phelps Creek.	Town of Occoquan	All Hazards	Various funding sources	2026	Assessment of need completed.	Medium	

2022-29	Stormwater System Improvements: Implement riparian buffer restoration and other green BMPs to reduce runoff and erosion along the Occoquan River, informed by the results of the stormwater system planning project.	Town of Occoquan	All Hazards	Various funding sources	2026	Assessment of need completed.	Medium	
2022-30	Infrastructure Preparedness: Underground Town power lines to protect Town energy systems from hazard events and ensure LED street lighting remains on in the event of an emergency.	Town of Occoquan	All Hazards	Various funding sources	2026	Assessment of need completed.	Medium	
2022-31	Infrastructure Preparedness: Installing water hazard markings in potentially dangerous and/or sensitive areas of the Occoquan River.	Occoquan Police Department	All Hazards	Various funding sources	2023	Assessment of need completed.	Medium	PWCOEM is assisting with this action

APPENDIX A: THE PLAN PROCESS

Contents

A-1: Participation Summary

NOTE: All participating jurisdictions were given opportunities to attend planning meetings. Those who could not attend provided their information via emails and phone calls and this information was integrated into the plan.

Jurisdiction	Kick Off Meeting	Loudoun County Meeting	City of Manassas Meeting	Planning Meeting	HIRA Overview, Hazard Risk Ranking Methodology	Arlington County	Plan Format, Risk Ranking Methodology, Non-Natural Hazard Decision	Hazard Data Updates, Capabilities Assessment	Mitigation Strategy 1: Goals and Objectives, Hazard Problem Statements	Mitigation Strategy 2: Mitigation Actions and Priorities	Fairfax County Action Item Workshop
Date	4/19/2021	5/5/1021	5/21/21	5/25/21	6/1/21	6/4/21	6/4/21	6/22/21	7/6/21	7/20/20	7/23/21
Arlington County	X			X	X	X		X		X	
City of Alexandria	X			X				X	X	X	
City of Fairfax	X				X			X	X	X	
City of Falls Church	X							X		X	
City of Manassas	X		X	X	X				X	X	
City of Manassas Park	X			X	X						
Fairfax County	X			X	X			X	X	X	X
Town of Vienna	X										
Town of Clifton											
Town of Herndon											
Loudoun County	X	X		X	X			X		X	
Town of Leesburg	X			X	X			X		X	
Town of Lovettsville											
Town of Purcellville	X			X							
Town of Middleburg											
Town of Roundhill											
Prince William County	X			X	X		X	X	X	X	
Town of Dumfries											
Town of Haymarket											
Town of Occoquan											

Jurisdiction	City of Manassas Park Action Item Workshop	PWC HMP catch up Documentation Workshop	Meeting-Loudon County and Towns	Fairfax County Action Item Workshop-Non-Natural Hazards	Nova HMP Mitigation Strategy 3: Projects Workshop	City of Fairfax HMP catch up workshop	City of Manassas Hazard Mitigation Meeting	Fairfax County Non-Natural Hazards Action Item Workshop	City of Manassas Park Action Item Prioritization and Action Plan	Loudon County Meeting	Nova HMP Hazard Risk Ranking Update Discussion
Date	7/28/21	7/30/21	8/2/21	8/3/21	8/3/21	8/5/21	8/9/21	8/10/21	8/11/21	8/23/21	8/24/21
Arlington County					X						
City of Alexandria											
City of Fairfax					X	X					
City of Falls Church					X						
City of Manassas					X		X		X		
City of Manassas Park	X										
Fairfax County				X	X			X			
Town of Vienna											
Town of Clifton											
Town of Herndon											
Loudoun County			X							X	
Town of Leesburg					X						
Town of Lovettsville											
Town of Purcellville											
Town of Middleburg											
Town of Roundhill											
Prince William County		X			X						X
Town of Dumfries											
Town of Haymarket											
Town of Occoquan											

Jurisdiction	City of Alexandria Action Item and Action Plan Workshop	Town of Herndon Action Item Review	Town of Lovettsville NOA HMP Meeting	City of Manassas Action Item Review	Town of Dumfries Hazard Mitigation Planning Workshop	Manassas Park HMP Action Plan Review	Town of Occoquan Hazard Mitigation Planning Workshop	Manassas Park Action Plan Review	Planning Wrap Up Meeting	Town of Occoquan Mitigation Plan
Date	8/26/21	8/26/21	8/27/21	9/7/21	9/9/21	9/10/21	9/10/21	9/13/21	9/14/21	
Arlington County									X	
City of Alexandria	X								X	
City of Fairfax									X	
City of Falls Church									X	
City of Manassas				X					X	
City of Manassas Park						X		X		
Fairfax County									X	
Town of Vienna										
Town of Clifton										
Town of Herndon		X								
Loudoun County									X	
Town of Leesburg									X	
Town of Lovettsville			X						X	
Town of Purcellville										
Town of Middleburg										
Town of Roundhill									X	
Prince William County									X	
Town of Dumfries					X					
Town of Haymarket										
Town of Occoquan							X			X

Jurisdiction	Town of Haymarket Hazard Mitigation Planning Workshop	Town of Middleburg Meeting	Nova Hazard Mitigation Plan Stakeholder Engagement and Education Meeting	Town of Clifton Mitigation Review Workshop	City of Manassas Meeting	NOVA Planning Meeting
Date	10/20/21	11/5/21	11/5/21	11/22/21	2/1/2022	2/1/2022
Arlington County			X			
City of Alexandria			X			X
City of Fairfax			X			
City of Falls Church			X			
City of Manassas					X	
City of Manassas Park			X			
Fairfax County			X			X
Town of Vienna						
Town of Clifton				X		
Town of Herndon						
Loudoun County						X
Town of Leesburg			X			X
Town of Lovettsville			X			
Town of Purcellville						
Town of Middleburg		X				
Town of Roundhill						
Prince William County			X			X
Town of Dumfries						
Town of Haymarket	X					
Town of Occoquan						

List of Forms and Worksheets filled out by jurisdiction

2022 Northern Virginia Hazard Mitigation Plan - Planning Status	Identify Hazards - Worksheet 1	Community Assets - Worksheet 3	Jurisdiction Information Form	Jurisdiction Needs Questionnaire	Hazard Risk Ranking	Capabilities Assessment Worksheet	NFIP Form	Critical Facilities List	Prioritized Mitigation Action List	Action Plan for Implementation	Public Survey Posted and Screenshot Submitted	Documents Reviewed (IEM)	Jurisdiction Contacted (IEM)	Earthquake Risk Ranking Adjusted (IEM)	Infectious Disease
Arlington County	x	x	x	x	x	x	x	x	x	x	x	x	x	x	ID and public health emergencies
Fairfax County	x	x	x	x	x	x	x	x	x	x	x	x	x	x	ID
City of Alexandria	x	x	x	x	x	x	x	x	x	x	x	x	xx	x	
City of Fairfax	x	x	x	x	x	x	x	x	x	x	x	x	xx	x	ID
City of Falls Church	x	x	x	x	x	x	x	x	x	x	x	x	xx	x	ID and public health emergencies
Town of Clifton	Inc. in county	x	x	Inc. in county	x	x		Inc. in county	x	x	Inc. in county				
Town of Herndon	x	x	x	x	x	x	x	x	x	x	Inc. in county	x	x (via county)	x	ID
Town of Vienna	x	x	x	x	x	x	x	x	x	x	Inc. in county	x	x (via county)	x	ID

Loudoun County	x	x	x	x	x	x	x	x	x	x	x	x	xx	x	
Town of Leesburg	x	x	x	Inc. in county	x	x	x	x	x	x	x	x	xx	x	ID
Town of Lovettsville	x	x	x	x	x	x	x	x	x	x	x	x	x	x	ID
Town of Middleburg	x	x	x	Inc. in county	x	x		x	Inc. in county	Inc. in county	Inc. in county	x	xx (via county)	x	ID
Town of Purcellville	x	x	x	Inc. in county	x	x	x		x	x	Inc. in county	x	xx (via county)	x	ID
Town of Round Hill	x	x	x	Inc. in county	x	x	x	x	x	x	x	x	xx	x	ID
Prince William County	x	x	x	x	x	x	x	x	x	x	x	x	xx	x	ID
City of Manassas	x	x	x	x	x	x	x	x	x	x	x	x	xx	x	
City of Manassas Park	x	x	x	x	x	x		x	x	x	x	x	xx	x	
Town of Dumfries	x	x	x	x	x	x	x	x	x	x	x			x	
Town of Haymarket	x	x	x	x	x	x	x	x	x	x	x			x	
Town of Occoquan											x			x	
Town of Quantico											x				

A-2: Planning Meetings

Kick-Off Meeting – April 19, 2021

Northern Virginia (NOVA)
Hazard Mitigation Plan - 2022 Update

April 7, 2021

The **Northern Virginia Hazard Mitigation Plan** was last approved by the Federal Emergency Management Administration (FEMA) in 2017, for the five-year period of 2017-2022. In order to begin the update process for 2022, we will be conducting a **virtual Kick-Off meeting** to introduce this important project that will identify how your community can reduce its future vulnerability to natural and human-caused hazards. We are inviting you as a representative of a participating jurisdiction in the plan, along with key stakeholders, and the public to participate in the update process.

As a part of the plan update process, participants will review how past hazard events have affected the community; assess vulnerable areas of the community; review current community risk reduction capabilities; and determine how current and proposed mitigation actions are aligned with other community objectives.

You are being asked to join us in this effort for several reasons. As a leader in your community, your involvement will create community-wide input for the plan. Being familiar with your jurisdiction, you are also in a position to identify barriers to implementation and help us develop a plan that can realistically be carried out. Finally, you can ensure that we incorporate into the plan relevant information about your area of expertise.

The most successful plan is built on cooperative partnerships between and among the stakeholders and the public of Northern Virginia. The project is being funded by FEMA through the Virginia Department of Emergency Management and administered by Prince William County. The planning process will be coordinated through the Mitigation Advisory Committee (MAC) and supported by IEM, a nationally-recognized disaster response and recovery firm.

Please plan to participate in the Virtual **Kick-Off meeting**, an agenda for which is attached:

Date: April 19, 2021
Time: x-x
VIRTUAL MEETING INSTRUCTIONS will be provided prior to the meeting.

If you are unable to participate in the Kick-Off Meeting, please send a designated representative who is authorized on your behalf to represent your jurisdiction or organization throughout the planning process, which will last through January 2022. Please ***respond whether or not*** you intend to join us on April 19 by sending an email to Nancy.Freeman@iem.com. If you are unable to attend this important meeting, please let us know who will participate in your place.

Feel free to contact us if you have questions about the planning process.

We look forward to your participation!

The Project Team

Northern Virginia (NOVA)
Hazard Mitigation Plan - 2022 Update

Mitigation Advisory Committee Virtual Kickoff Meeting

AGENDA

April 19, 2021 10:00 AM – Noon

Virtual Meeting Instructions:

1) Welcome and Introductions

2) Today's Goals
3) Why Mitigation?
4) Project Overview

    a) Project Phases and Key Activities
    b) Project Timeline
    c) Project Staffing

5) Mitigation Planning Process
    a) Planning Organization
    b) Data Collection Workbook

        i. Hazard Identification and Ranking
        ii. Community Lifeline Inventory
        iii. Capability Assessment/NFIP Assessment
        iv. Vulnerability Assessment
        v. Mitigation Goals and Objectives
        vi. Mitigation Action Worksheet
        vii. Action Plan for Implementation

Appendix A: The Planning Process

6) Roles & Responsibilities

    a. IEM
    b. Mitigation Advisory Committee
    c. Jurisdiction Lead/Alternative
    d. Stakeholders/Technical Specialists

7) Assignment

8) Next Steps

    a. Present Best Practices Analysis
    b. Complete Needs Assessment Questionnaire
    c. Begin public outreach
    d. Data Worksheets
    e. Future Meetings
    f. Communication & Coordination

NORTHERN VIRGINIA

HAZARD MITIGATION PLAN

2022 UPDATE

PLANNING KICK-OFF MEETING
AGENDA AND MINUTES

April 19, 2021
10:00 AM – 11:08 AM

PARTICIPANTS

Name	Title	Agency/Jurisdiction
John Morrow	Operations Analyst	Metropolitan Washington Airports Authority
Alan Brewer	Director	Loudoun County
Michelle Coleman	Deputy Director, Zoning Administrator	City of Fairfax
Mark Dale	Lieutenant for Herndon Festival	Town of Herndon
Joe Dame	Emergency Manager	Town of Leesburg

Erin DeLuca	Emergency Management Specialist	Arlington County Department of Public Safety Communications and Emergency Management
Walter English	Deputy Emergency Coordinator	City of Fairfax
Amelia Gagnon	Emergency Management Specialist	City of Manassas
Norm Goulet	Environmental & Resiliency Planner	Northern Virginia Regional Planning Commission
Harry Gruenspecht		Northern Virginia Emergency Response System (NVERS)
Rob Hoffower	All Hazards Planner	VDEM
Teresa Scott Hoggard	Deputy Emergency Management Coordinator	City of Alexandria
Allison Horner	Office of Energy….	Fairfax County
Cara Howard	Lead Planner	Fairfax County Emergency Management
Dan Janickey	Chief of Police	Town of Vienna
Taylor Jones	Senior EM Specialist	Prince William County Emergency Management
Colleen Kardasz	Department of Economic Development	Loudoun County
Katie Kitzmiller	Deputy Emergency Management Coordinator/ Project Coordinator	Prince William County Emergency Management
Matthew Marquis	Regional Planner	Fairfax County
Cindy McAlister	Chief of Police	Town of Purcellville
Hooper McCann	Director of Administration	Town of Purcellville
Cindy McCain		Loudoun County
Sydney McKenna	Preparedness Manager	Arlington County Department of Public Safety Communications and Emergency Management
Rachael Metz	Emergency Planner	Arlington County Department of Public Safety Communications and Emergency Management
Matt Meyers		
Elizabeth Moore	Emergency Preparedness Specialist	Loudon County
Kelly Myers	Assistant Coordinator	Loudoun County
Keith Nguyen	Assistant City Manager	City of Manassas Park
John O’Neal	City Fire Chief	City of Fairfax

Alaina Ray	Director of Planning and Zoning	Loudoun County
Laurel Schultzberger	Emergency Management Safety Coordinator	Fairfax County
Mihai-Cristian Statie	Deputy Emergency Management Coordinator	City of Falls Church
Elizabeth Thurber	Design Engineer	Arlington County Department of Public Safety Communications and Emergency Management
Hannah Winant	Public Affairs Manager	Arlington County Department of Public Safety Communications and Emergency Management
Greg Zebrowski	Assistant Coordinator, Planning and Policy	Fairfax County Emergency Management
Andrew Slater	Program Director	Northern Virginia Emergency Response System (NVERS)
Greg Vernon	Manager, Emergency Management	Metropolitan Washington Airports Authority (MWAA)
Nancy Freeman	Senior Mitigation Planner	IEM, Contractor

WELCOME and INTRODUCTIONS **Katie Kitzmiller, Prince William County**

- Katie opened the meeting and asked participants to enter their name, position, and jurisdiction in the Chat feature of WebEx. She explained that she was representing Prince William County as the Project Coordinator/Point of Contact (POC) for the multi-jurisdictional plan update.
- Katie then introduced Nancy Freeman representing IEM, the project contractor.

MEETING PRESENTATION **Nancy Freeman, IEM**

Nancy introduced herself and then presented PowerPoint slides (attached) covering the following topics:

- "Re-introduce" Mitigation Planning Process
  - Billion-dollar disasters, 1980 – 2020
  - Federal Disaster declarations, 2017 - 2021 – Northern Virginia jurisdictions
  - Factors for consideration – growth management and
- Project Organization, roles and responsibilities
  - NOVA EM Managers group meets on the first Friday of each month and will provide oversight of the project, including approval of plan format, hazards, and plan components.
  - NOVA EM Planners will function as the "Working Group" to assist in developing plan data, content and other deliverables.

  - Stakeholders/Technical Specialists will participate in planning activities, including review of hazard sections related to their areas of expertise.
  - Katie clarified that the Lead Planner identified for each County will coordinate data and information with Towns in their jurisdictions, and we will lean on VDEM and the Planning Commission for the regional aspect.
- Project Phases
  - The four project phases cover the scope of the grant agreement.
  - Phase 3 is where most plan development tasks are defined
- Project timeline and proposed meeting schedule
  - The timeline follows the logical sequence of mitigation planning steps and allows for some flexibility if there is a disruption in the workflow.
  - The grant contract ends on April 1, 2022
- Planning process steps and opportunities
  - The planning process will follow the FEMA guidance for local hazard mitigation plans
  - There are opportunities to enhance components of the plans by adding recent tools such as the CDC Social Vulnerability Index or using Community Resilience Indicators to assist with development and prioritization of mitigation actions.
- Assignment
  - Worksheet #1 – Hazard Identification – due to Nancy on April 30
  - Worksheet #3 – Community Assets – due to Nancy on April 30
  - Jurisdiction Information Form – due to Nancy on April 26
- Next Steps
  - Best Practices research is being completed this week and will be presented to the EM Planners Group at their May 13 meeting, and to the EM Managers at their June 4 meeting.
  - Jurisdiction needs assessment questionnaires will be disseminated to jurisdiction POCs by Wednesday, April 21 to be completed in coordination with their jurisdiction planning committees. Following completion of the questionnaires, the Jurisdiction Reps will contact Nancy to schedule virtual meetings with their jurisdiction to discuss issues in the questionnaires and identify key needs and concerns.
  - Jurisdiction meetings are anticipated to be completed around mid-May.
  - Nancy described a public survey that will be released to each jurisdiction to gather public opinion and information about hazards and their impacts in each jurisdiction.

QUESTIONS

  - A question regarding a presentation slide depicting Prince William County as the jurisdiction with the highest population in the region was raised. It was noted that Fairfax County has a higher population.
    - [*Follow-up: Nancy checked the 2018 Virginia Hazard Mitigation Plan which was the source of the information and confirmed that the table showing Prince William County as the highest population of the NOVA jurisdictions was in relation to only the ten jurisdictions in the state with the highest growth rates. Fairfax County was not included in the table as*

it had a lower growth rate; but the slide should have indicated this. She sent an email clarification to the individual who asked this question.]

- A participant commented in the Chat box that their jurisdiction was developing a climate resilience plan.
  - Nancy pointed to this comment and confirmed that this type of plan and others, including reports and studies are needed to review to consider incorporating information into this HMP update. She asked that other jurisdiction provide access to this type of documents to review.
- Will the public surveys also be available in Spanish or any other language?
  - Nancy stated that we could provide a Spanish translation and she would check on the need for additional language(s) versions.
- Will a new HAZUS, either level 1 or level 2 be conducted for this plan update?
  - Nancy explained that she had been in contact with the GIS expert for the project to discuss this question. The last level II HAZUS was conducted for the 2017 HMP and some jurisdictions have experienced very little growth since that time, which would result in very little change the HAZUS data. It's possible that we might update data for some jurisdictions, but not all.

SUMMARY

- Nancy asked Katie for clarification of the process to present information to the two project groups. Katie asked that the EM Planners first be presented with information so they might refine it prior to presenting to the EM Managers group for review and approval.
- Katie will send out the initial email, and then provide the information for them to confirm and then get started.

NEXT MEETINGS

- May 7 – EM Managers meeting
  - Best Practices Research update
  - Additional topics
- May 13 – EM Planners meeting
  - Best Practices Research and Summary
  - Plan Components and Format
  - Initial Hazard Review

Minutes Prepared by:

Nancy Freeman, IEM Senior Mitigation Planner

NORTHERN VIRGINIA

HAZARD MITIGATION PLAN

2022 UPDATE

PLANNING MEETING
AGENDA AND MINUTES

May 25, 2021
2:00 – 4:00 PM
Virtual Meeting – Teams Platform

PARTICIPANTS

Name	Title	Agency/Jurisdiction
Cindy McAlister	Chief of Police	Town of Purcellville
Joe Dame	Emergency Manager	Town of Leesburg
Kelly Myers	Assistant Coordinator-Planning	Loudoun County Office of Emergency Management
Katie Kitzmiller	Deputy Emergency Mgmt. Coordinator	Prince William County
Teresa Scott Hoggard	Deputy Emergency Management Coordinator-Regional Planner	City of Alexandria
Alex Weston	All Hazards Planner	Virginia Department of Emergency Management
Taylor Jones	Senior EM Specialist	Prince William County
Amelia Gagnon	Emergency Management Specialist	City of Manassas
Brent Ruggles	Deputy Emergency Management Coordinator	Alexandria OEM
Cara N. Howard	Lead Planner	Fairfax County OEM
John Morrow	Operations Analyst	Metropolitan Washington Airports Authority
Matthew Marquis	Regional Planner	Fairfax County OEM
Sydney McKenna	Preparedness Manager	Arlington County Department of Public Safety, Communications and Emergency Management

Gregory Zebrowski	Assistant Coordinator	Fairfax County
Keith Nguyen	Assistant City Manager	Manassas Park
Normand Goulet	Director of Environmental and Resiliency Planning	Northern Virginia Regional Commission
Andrew Slater	Program Director	Northern Virginia Emergency Response System/Northern Virginia Hospital Alliance
Elizabeth Adams	All Hazards Planner	Virginia Department of Emergency Management
Nancy Freeman	Senior Mitigation Planner	IEM, Contractor
Elizabeth Burnett	Jr. Planner	IEM, Contractor

WELCOME **Nancy Freeman, IEM, Contractor**

- Nancy welcomed everyone to the call and asked that they enter their name, position title, agency and email in the Chat box feature.

MEETING PRESENTATION **Nancy Freeman, IEM**

- Best Practices in Hazard Mitigation Planning – Discussion of Research Findings
  - No questions heard when asked.

- Jurisdiction Needs Identification – Status Update
  - Nancy- Mentioned new hazards to potentially add into the hazards section, for human-caused and technological. A number of comments were made about which “non-natural” hazards might be addressed in the plan, and how that would be formatted. *[Comments noted at the end of the minutes.]*

- Plan Template and Components – Discussion of Plan Format Options
  - Nancy- Requested the Preferred format for the 2022 plan after walking through the differences between the four (4) options. The choices for the planning committee were Options A (NOVA 2017 HMP), B (Modified 2017), C (Realigned), and D (Reorganized). Nancy highlighted the pros and cons of each option.
  - Plan Maintenance location preference- earlier in the plan (Sydney),
  - FEMA requires that the plan has goals that represent the long-term vision for reducing risk. The 2017 plan has goals and “strategies” which are really objectives in FEMA terminology and are not required, and referenced for the jurisdictions. Discussion during the meeting and feedback from recent jurisdiction meetings support the preference for a regional base plan and individual jurisdictional annexes that consolidate jurisdiction information.

- Next Steps
  - Nancy reviewed the proposed meeting schedule for the next several months and noted that the participants may have a conflict for the meeting scheduled on June 15, due to the Virginia Emergency Management Symposium scheduled for that week. **By virtual vote of 10 to 3, participants chose to move the meeting to June 22, from 2:00 – 3:00 p.m.**
  - There are still several jurisdictions that need to return the questionnaire and set up virtual jurisdiction meetings. Once those are completed, the information and feedback provided by jurisdictions will be summarized in the report and it will be disseminated.

- Technical Assistance
  - Nancy offered technical assistance for the Worksheets distributed at the Kick-Off meeting, as well as the Jurisdiction Questionnaire. There were no requests for assistance.
    - Worksheet #1 – Hazard Identification
    - Worksheet #3 – Community Assets
    - Jurisdiction Information Form

QUESTIONS/Statements

  - Should new mitigation actions be added, or removed, how should that be done, do we take the old plan and look at it?
    - Yes, we will go over that at a future meeting and discuss the how to document the status of previous actions; if it is continued, completed, or removed and if removed what was the reason.
  - Why are the non-natural hazards in the appendix?
    - This option places the non-natural hazards in that location of the plan in order to facilitate FEMA review. Only natural hazards are required to meet FEMA planning criteria, but the non-natural hazards may be included anywhere in the plan. Some places have put the non-natural hazards in the appendix so as not to bog down the plan for the FEMA review process. It does not really affect if it is regional or jurisdiction specific.
  - Comment - we would prefer to avoid things just because they are easier for FEMA. Be thinking about what makes the most sense, including all hazards together.
  - Participant asked if there had been a decision to add non-natural hazards to the plan.
    - Not yet, but it has had broad discussion by the Emergency Managers and was brought up to make sure that the plan addresses the hazards that are decided by group consensus.

COMMENTS/RESPONSES FROM THE CHAT BOX

  - What are the EM concerns with including non-natural hazards in the HMP?

        - I think there is merit in including non-natural hazards, and there are probably better strategies that we could develop.
        - The concerns are if you include terrorism for example you have to put what your mitigation actions are. I.E., agencies are completely opposed to releasing that information.
        - One way to look at it is maybe IT Depts don't need the mitigation dollars, which would lead us to the answer of whether to include cyber.
        - One other option we could look at of putting it in an appendix is it could be redacted.
        - Man-made disaster is considered as a pipeline disruption, or hospital being hit by an attack, how to evacuate and where to take them, feds come in and mitigate the attack on the system.
    - How would it be submitted to the jurisdiction Board? If it is in there, then it is public.
        - It would depend on the public records law, some places exempt the entire plan, some parts can be eliminated and kept on file within a specific agency or department.
        - COOP plans- are redacted but referenced, and that could work for non-natural, but some places might not want to do that.
    - Mitigation actions, can you touch on them vs the best practices
        - Response: Specific to the most local level- applying for federal money you apply at your jurisdictional level even if it goes through another jurisdiction. Present the actions in the annex, but in the base plan you want a regional snapshot of what is going on. As an example, a joint public education program for flood mitigation information. Possible to have actions that cross jurisdiction lines, but one entity would have to take responsibility to carry it out. Jurisdiction annexes can expand on the regional goal/objectives with local goals, or they can adopt those. Base plan will show a summary of all jurisdictions, the details will be in the jurisdiction annexes
            - Do the regional, then the actions for the jurisdiction to help with all funding and obtaining assistance. In favor of having jurisdiction information in one place. It was a challenge to give them enough of the plan to indicate what is going on within a specific jurisdiction, not spread out and harder to locate.

SUMMARY

- In summary the meeting yielded a very thorough discussion on the possible addition or continued omission of man-made or technological hazards, provided the planning team with additional information on potential formats for the 2022 updated Regional Plan, and allowed the participants to decide the second meeting date in June due to scheduling conflicts.
- Participants were provided with a **Feedback Form** to indicate any Best Practices they would like to see in the plan, and to rank each of the four plan format Options in order of their preference. They are **due to Nancy by June 1.**

NEXT MEETINGS

- June 1 – Planning Meeting
  - Hazard Identification and Overview
  - Hazard Risk Ranking Methodology
- June 22– Planning Meeting (this was done with a 10-3 vote using the Thumbs up button for liking a comment in the chat box, one for the 15th and one for the 22nd.
  - Hazard Risk Assessment and Findings

Minutes Prepared by:

Elizabeth Burnett, IEM Junior Planner

NORTHERN VIRGINIA

HAZARD MITIGATION PLAN

2022 UPDATE

PLANNING MEETING
AGENDA AND MINUTES

June 1, 2021
2:00 – 3:00 PM
(Virtual – via Microsoft Teams)

PARTICIPANTS

Name	Title	Agency/Jurisdiction
Joe Dame	Emergency Manager	Town of Leesburg
Kelly Myers	Assistant Coordinator-Planning	Loudoun County Office of Emergency Management
Taylor Jones	Senior EM Specialist	Prince William County Emergency Management
Amelia Gagnon	Emergency Management Specialist	City of Manassas
Cara N. Howard	Lead Planner	Fairfax County OEM
Matthew Marquis	Regional Planner	Fairfax County OEM
Sydney McKenna	Preparedness Manager	Arlington County Department of Public Safety Communications and Emergency Management

Gregory Zebrowski	Assistant Coordinator	Fairfax County
Keith Nguyen	Assistant City Manager	Manassas Park
Normand Goulet	Director of Environmental and Resiliency Planning	Northern Virginia Regional Commission
Andrew Slater	Program Director	NVERS/NVHA
Elizabeth Adams	All Hazards Planner	Virginia Department of Emergency Management
Walter English	Deputy Emergency Coordinator	City of Fairfax
Elizabeth Thurber		Arlington County Department of Public Safety Communications and Emergency Management
Greg Vernon	Manager, Emergency Management	Metropolitan Washington Airport Authority
Nancy Freeman	Senior Mitigation Planner	IEM, Contractor
Elizabeth Burnett	Jr. Planner	IEM, Contractor
Sheila Hascall	Project Manager	IEM, Contractor

MEETING PRESENTATION **Nancy Freeman, IEM**

- The primary topic for the meeting today was review of the Hazard Risk Ranking Methodology
    - Nancy went over the definitions of the categories of hazards, to ensure that everyone is on the same page on what they mean in relation to mitigation planning.
    - Definitions also covered the extent, impact & consequence, risk and vulnerability, to ensure everyone understands the hazard profile criteria, regardless of the type of hazard being described.
    - Discussed the different types of people, by Access/Functional Needs and Vulnerable Populations that would be more at risk then the regular population, for example homeless, or functional needs.
    - Discussed the Hazard Identification and Risk Assessment (HIRA) process for identifying hazards that affect each jurisdiction, showing the bottom-up approach as a way that we will identify and rank each of the identified hazards, beginning at the local level with the hazard and risks, vulnerability, then determining the hazard ranking and profiles.
    - With this approach the results will be a thorough list of hazards of most concern which would identify any that may be eliminated from further consideration.
- Reviewed the 2017 Northern Virginia (NOVA) Hazard Mitigation Plan (HMP) risk ranking system

  - The system used for 2017 was the same as the one used for the 2018 State Hazard Mitigation Plan (SHMP) and the 2010 NOVA HMP.
  - Nancy reviewed each of the six categories of ranking criteria (population vulnerability; population density; geographic extent; annualized fatalities and injuries; annualized property and crop damage; and annualized events), explaining the purpose of the ranking criteria, how the data was acquired and how the SHMP used total population for the state
    - We would use the population vulnerability category to relate the hazard to the total population for each of the participating jurisdictions.
    - Example: Dam Failure wasn't part of the 2017 hazard ranking, possibly due to inconsistent data that is not in the NOAA's National Centers for Environmental Information (NCEI) database.
  - The PowerPoint presentation provided an example of what the risk ranking would look like using City of Alexandria data as an example, illustrating where inconsistencies in data might impact the methodology.
  - Nancy walked through the 2017 summary hazard rankings to give them an idea of similarities and differences that each jurisdiction had when combined into one table.
  - An explanation of how we could get the data, some being quantitative and other qualitative, was provided.
- Three options for conducting the hazard risk ranking process were presented:
  - Option 1: Maintain the 2017 hazard ranking methodology with no changes
  - Option 2: Conduct the 2017 hazard ranking process, and add an Impacts/Consequences component based on Emergency Management Accreditation Program (EMAP) standard criteria. Some jurisdictions are looking to pursue EMAP accreditation, and the HIRA/EMAP plan option breaks down the process to conduct an impact assessment/consequence analysis as an extra step in the risk ranking process. Examples of Impact and Consequence criteria was presented.
  - Option 3: Eliminate the 2017 risk ranking criteria and base the process on the EMAP Impact and Consequence criteria.
- Nancy discussed additional factors that could be considered, including the CDC Social Vulnerability Index (SVI). An explanation of how the SVI is formatted was provided, along with an example of a map for the City of Alexandria showing variations in vulnerability. She also went over how to interpret the information, and clarified that the SVI Index/score would not change for each hazard, but as a collective when it came to what was covered under the SVI score. Nancy recommended that the SVI not be included as criteria in the hazard risk ranking process, but should be considered in the vulnerability section within each jurisdiction's annex.
- A Consensus Poll was taken to determine which option the group would like when it came to maintaining the 2017 methodology, potentially adding EMAP criteria, or making other changes. A participant asked Nancy to describe each of the three options, including pros and cons for each:
  - Option 1- Use 2017 Methodology
    Pro- The methodology is consistent with the 2018 SHMP process.

Con- The multiple data sources provide data in different formats, which could result in inconsistent analysis. Also, population density would be constant for each hazard within each jurisdiction analysis and would not have any impact on the risk score. Population density would be addressed in the jurisdiction profile so that it would support cost effectiveness for mitigation project applications.

- Option 2- Conduct the 2017 risk ranking and add step for EMAP Impact & Consequence Analysis

Pro- This option utilizes the same format and criteria as the 2017 process, which is based on data from previous events; however, adding the impact and consequence criteria (EMAP process) would add a broader approach to risk analysis that also assists those jurisdictions pursuing emergency management accreditation.

Con- Adds an additional step in the risk ranking process

- Option 3- Replace the 2017 risk ranking criteria and add EMAP

Pro- Eliminates the issue with inconsistency of data from multiple sources for all hazards. This also simplifies the risk assessment process by using consistent, concise ranking criteria that applies to all hazards.

Con- will not be follow the state ranking criteria used in the 2018 SHMP.

QUESTIONS/Statements/Comments

Q: Sydney McKenna- has it come up from VDEM that they align with their plan when it comes to hazard rankings?

A: Greg Zebrowski- it is not required but requested.

Q: Norm Goulet – does the hazard risk ranking affect funding

A: Sheila Hascall - With the role IEM had with the state (VDEM HM division) we do know that the risk methodology did not and will not affect any sub-applicants' consideration for HMA funds.

Comment: Sydney- landing between option 2 and 3, hearing the pros and cons, some are beneficial, and some are not, but consider option 2 and amend the criteria being used.

Comment: Nancy commented that the Commonwealth of Virginia is EMAP accredited, so they would have had to conduct an impact assessment/consequence analysis but as it was not part of the risk ranking criteria, it must have been done independently of that process.

Q: Nancy- Does any jurisdiction have an all hazard risk ranking system that is already in place, for something else? Do any of the other plans rely on the hazard risk assessment?

A: Arlington and Leesburg use the hazard mitigation plan and THIRA as the basis for their all-hazard planning. Fairfax also uses the Regional hazard mitigation plan as their HIRA source.

Q: Sydney- How would we look into man-made hazards because they wouldn't have that information?

A: Greg Z- 2010 mitigation plan earthquake wasn't in it, and after the quake a lot of jurisdictions were grilled for it, but that data would be hard to find even though it is out there

Nancy- similar to the current pandemic and for similar events, using data from previous occurrences would be hard to rank some hazards above a low rank, but basing risk on the impacts and consequences of this type of event would add a broader dimension to the risk ranking approach.

Q: Sheila- The 2017 NOVA HMP is extremely large, hard to find hazards and vulnerabilities and actions. Will any of the options contribute to it being larger, or smaller and easier to find and locate? The HMP should be a tool to implement actions and assist in resiliency and mitigate against current and future vulnerabilities.

A: Nancy- Option 2 would make it clearer, do the risk ranking by jurisdiction and only adding one chart that checks the box to establish the number of impact or consequences but that would be in the jurisdictions annex. The rank for each hazard by each jurisdiction would be in one chart in the base plan, would not add to the length of the base plan.

Q: Greg Z- reminded the group that the discussion of man-made, non-natural hazards should be presented on Friday to the NOVA Emergency Managers

A: Sheila, asked Nancy to prepare a recap of the options by tomorrow (June 2, 2021) to be presented on Friday. Nancy will develop a short write-up for the hazard risk ranking consensus for the Managers' meeting on Friday. Each jurisdiction would look at their own hazard environment and see what potential impacts and consequences could result, such as mass casualty issue, communications issues, and others, and apply this process to all hazards, including natural and manmade. The same criteria would apply for each hazard.

Q: Greg Z- what is the benefit of the jurisdictional meeting and who should attend

A: Nancy- we are using it to capture the input on how well the last plan worked for them and how to improve on it; and how the hazards are ranked or should that change; what has been done in the last 5 years; and what could be done; and other information. Appropriate attendees would be the Floodplain manager, public works, anyone in mitigation projects, planners, etc.

- Final topic- Public Outreach
    - A public information Flier is ready to be disseminated and a survey is prepared in test format. We would like to disseminate the survey link to get feedback in late June or early July. Jurisdictions should provide web links and include in social

media for the survey as well as updates to the public and input for the review and feedback on the draft plan.
    - Would like input on where you would like it placed, online, newspaper, social media, and be able to capture the information in a screen shot of where it is being disseminated for the public to participate. We will provide instructions when the survey and flier go out.

SUMMARY

- By the end of the meeting, four (4) people had indicated support for Risk Ranking Option 2 in the Teams "chat" box.

NEXT MEETINGS

- June 22– Planning Meeting (this was done with a 10-3 vote using the Thumbs up button for liking a comment in the chat box, one for the 15th and one for the 22nd)
    - Hazard Risk Assessment and Findings
- July 6 – Planning Meeting
    - Hazard Review
    - Initiate Capabilities Assessment

Minutes Prepared by:

Elizabeth Burnett, IEM Junior Planner

NORTHERN VIRGINIA
HAZARD MITIGATION PLAN
***2022 UPDATE*[1]**

PLANNING MEETING
AGENDA AND MINUTES

June 22, 2021
2:00 – 3:00 PM
(Virtual – Teams Meeting)

PARTICIPANTS

Name	Title	Agency
Joe Dame	Emergency Manager	Town of Leesburg
Andrew Slater	Program Director	Northern Virginia Emergency Response System
Elizabeth Adams	All Hazards Planner	VDEM R7
Kelly Myers	Assistant Coordinator	Loudoun County OEM
Cara Howard	Lead Planner	Fairfax County OEM
Teresa Scott Hoggard	Deputy Emergency Management Coordinator	City of Alexandria
Elizabeth Moore	Emergency Preparedness Specialist	Loudoun County OEM
Matthew Marquis	Regional Planner	Fairfax County OEM
Normand Goulet	Director of Environmental and Resiliency Planning	Northern Virginia Regional Commission
Katie Kitzmiller	Deputy Emergency Management Coordinator	Prince William County
Sydney McKenna	Emergency Preparedness Manager	Arlington County Department of Public Safety, Communications and Emergency Management
Joe Carter	EM Coordinator	City of Falls Church
Walter English	Deputy Emergency Coordinator	City of Fairfax
Taylor Jones	Senior Emergency Management Specialist	Prince William County
Erin De Luca	Emergency Management Specialist	Arlington County Department of Public Safety Communications and Emergency Management
Nancy Freeman	Senior Mitigation Planner	IEM, Contractor
Elizabeth Burnett	Jr. Planner	IEM, Contractor
Sheila Hascall	Project Manager	IEM, Contractor

MEETING PRESENTATION — Nancy Freeman, IEM

[1] *This project is funded by the Federal Emergency Management Agency through the Virginia Department of Emergency Management, via Grant Agreement Number PDMC-PL-03-VA-2018-003 for $250,000.*

- An overview was presented of what has been completed in the project scope and timeline, and what will be addressed next. The Mitigation Strategy will be covered in the next three meetings, July 6, July 20 and August 3.
- Reviewed the natural hazards that will be included in the 2022 plan update (dam failure, drought, earthquake, extreme temperature, flood/flash flood, high wind/severe storm, karst/sinkhole/land subsidence, landslide, tornado, wildfire, winter storm), including three hazards that FEMA suggests be considered (avalanche, tsunami, volcano), but are not a threat to the planning area. Additional hazard suggested by FEMA is coastal erosion, which is included in the flood/flash flood section. The list of non-natural hazards (acts of violence, civil unrest, communication disruption, cyber-attack, hazardous materials, pandemic/public health, terrorism) was also presented.
- There have been three Federal Disaster Declarations since the 2017 plan was prepared and adopted, including one in 2016 (Severe Winter Storm) and two in 2020 (COVID-19).
- Nancy presented an overview of each of the eleven (11) natural hazards to be included in the 2022 plan update, providing current data sources and updates, information to be added to the plan in relation to the hazard, and potential needs for additional data.
    - Dam Failure – Data source: National Dam Inventory; High Hazard Potential Grant Program to be added to the hazard section.
    - Drought – Data Source: NCEI, Storm Events Database and U.S. Drought Monitor (current map examples provided for short-term (indicating severe drought in the region over a three-month period), and long-term (indicating a return to normal conditions in approximately six months)).
    - Earthquake – Data Source: USGS and Virginia Department of Conservation and Resources, Dam Safety and Floodplain Office).
    - Flood/Flash Flood/Coastal Erosion – Data Source: NCEI, Storm Events Database. Flood is the second most frequent event and third for property damage costs in the planning area.
    - High Wind/Severe Storm – Data Source: NCEI, Storm Events Database; most frequent hazard of the eleven natural hazards that affect the planning area. Derecho, which was included in the 2017 plan has been the focus of studies that examine the potential affects of climate change. At this point, there is no indication that climate change will increase the frequency or severity of derechos.
    - Karst/Sinkholes/Land Subsidence – Data Source: USGS, *2018 Commonwealth of Virginia Hazard Mitigation Plan*; was not ranked for risk in the 2017 NOVA HMP.
    - Landslide – Data Source: *2018 Commonwealth of Virginia Hazard Mitigation Plan*, Southern Appalachian Vitality Index; ranked as a low-risk hazard in the 2017 plan; no incidents since 2015; highly site specific.
    - Tornado - Data Source: NCEI, Storm Events Database; sporadic in frequency, but high impact to human life and property; highest dollar loss for property damage of all hazards in the planning area.
    - Wildfire – Data Source: National Risk Index; Virginia Department of Forestry; highest percent of land area within a high-risk classification is in Fairfax and Prince William Counties, mostly forested public park lands.
    - Winter Storm – Data Source: NCEI, Storm Events Database; most recent natural hazard declaration (2016); third most frequent hazard in the planning area

- Nancy discussed the upcoming Capabilities Assessment, which is to identify resources available to support mitigation actions that reduce long-term vulnerability. A Capabilities Assessment worksheet and NFIP Survey Form will be sent to each jurisdiction for review to determine how best to complete the survey within the jurisdiction. Suggestions were made to involve staff from planning/growth management, floodplain managers and finance to help collect the information. Contractor staff will follow-up with each jurisdiction representative a few days after the worksheet is sent out to provide assistance in completing the form.
- The process to complete the Hazard Risk Ranking will include a draft completed survey sent to each jurisdiction for review and revision. Again, contractor staff will follow up to assist in finalizing the risk assessment.

QUESTIONS/Statements/Comments

Q: Joe Dame – I believe there are more high hazard dams in my jurisdiction than what the National Dam Inventory stated. Should I provide that information?

A: Nancy Freeman – Yes, if you have different (and more recent) information, please provide it and the source.

Q: Katie Kitzmiller – Do you want additional hazard impact information from local declarations?

A: Nancy Freeman – Yes, so we can accurately track the local impacts and include that information in the jurisdiction annexes.

Q: Elizabeth Adams – How do we plan to address the climate change for each hazard?

A: Nancy Freeman - It was addressed briefly in the last plan; at this time, our plan is to include it at the end of the natural hazard section as a separate “subsection” that describes potential impacts based on studies, plans, reports, etc., and a summary of potential impacts for each hazard. Some plans have a short summary within each hazard section, if we choose to use that approach depending on what the group wants to do. Sometimes approaching it within the hazard section can miss the bigger picture of multi-hazard impacts.
[Additional question - How does the state address it?]
Sheila Hascall – Putting the impacts of climate change within the hazard section is more consistent with the way that FEMA looks at the information within the plan.

Q: Sydney McKenna – Regarding the capability assessment, about how much time will we have to fill it out and complete it?

A: Nancy Freeman – We don’t have an urgent deadline for this as it’s part of the mitigation strategy that we’ll be covering in July and early August. We would like to start within the next week or so, it might not be completed in one call but that should help identify what you will need, and might take two to three weeks to complete.

Q: Sydney McKenna – The July 20th meeting will be the action worksheets. Some plans require two action worksheets for each hazard; is that required in our plan?

A: Nancy Freeman – Not aware of a specific requirement for two action worksheets, nor is there a requirement that an action worksheet be prepared for every action. They should be used for actions that are potentially eligible for grant funding, or high priority for high-risk hazard projects.

A: Sheila Hascall – It is required to have actions, not worksheets; the worksheets are used to gather the information to put into the application or mini-action worksheet.

SUMMARY

- Participants provided the following links to data sources during or immediately following the meeting:
  - Sea level rise in Northern Virginia - https://experience.arcgis.com/experience/d8319e3a2b5c42efa9dd241ddc0a0932/page/page_8/
  - Climate Resiliency - https://www.novaregion.org/1481/ClimateResiliency-Dashboards
  - Urban Heat Islands - https://www.novaregion.org/1509/Urban-Heat-Islands

NEXT PLANNING MEETINGS

- July 6 – Mitigation Strategy 1
  - Goals and Objectives
  - Previous Mitigation Actions
  - Prioritization Criteria
  - New Actions
- July 20 – Mitigation Strategy 2
  - Technical Assistance Workshop - Action Worksheets
- August 3 – Mitigation Strategy 3
  - Prioritize Mitigation Actions
  - Implementation Plan

Minutes Prepared by:
Elizabeth Burnett, IEM Junior Planner

NORTHERN VIRGINIA HAZARD MITIGATION PLAN – 2022 UPDATE

PLANNING MEETING MINUTES

July 6, 2021
2:00 – 3:00 PM
(Virtual – Teams Meeting)

PARTICIPANTS

Name	Title	Agency
Elizabeth Adams	All Hazards Planner	Virginia Division of Emergency Management
Erin DeLuca	Emergency Management Specialist	Arlington County, Dept. of Public Safety Communication and Emergency Management
Walter English	Emergency Planner	City of Fairfax
Lauren Fricke	Intern	Arlington County, Dept. of Public safety Communication and Emergency Management
Amelia Gagnon	Emergency Management Specialist	City of Manassas
Norm Goulet	Environmental & Resiliency Planner	Northern Virginia Regional Planning Commission
Cara Howard	Lead Planner	Fairfax County OEM
Taylor Jones	Senior Emergency Management Specialist	Prince William County
Katie Kitzmiller	Deputy Emergency Management Coordinator	Prince William County
Matthew Marquis	Regional Planner	Fairfax County OEM
Sydney McKenna	Emergency Preparedness Manager	Arlington County, Dept. of Public safety Communication and Emergency Management
Keith Nguyen	Assistant City Manager,	City of Manassas Park
Brent Ruggles	Deputy Emergency Management Coordinator	City of Alexandria Office of Emergency Management
Ray Whatley	Emergency Management Coordinator	City of Alexandria OEM
Greg Zebrowski	Assistant Coordinator, Planning and Policy	Fairfax County OEM
Nancy Freeman	Senior Mitigation Planner	IEM, Contractor
Jessica Mason	Hazard Mitigation Planner	IEM, Contractor
Elizabeth Burnett	Jr. Planner	IEM, Contractor
Sheila Hascall	Project Manager	IEM, Contractor

MEETING PRESENTATION **Nancy Freeman and Jessica Mason, IEM**

- Nancy opened the meeting and introduced Jessica Mason, new Hazard Mitigation Planner with IEM, who will be assisting with this project.
- Nancy provided an update for what has been completed in the project, and where we are on the timeline of phases and tasks.
- A summary of the planned schedule for today's meeting and the next two meetings (July 20 and August 3) was presented to describe the approach to developing the Mitigation Strategy. The next meeting on July 20 will be mainly technical assistance, in helping each jurisdiction develop implementable actions.
- Nancy provided an overview of the Mitigation Strategy, which involves goals, actions and the action plan, describing each component and how they work together to address hazard vulnerabilities. The goals are the broad statements, the actions are the specific projects and activities that will reduce risk, and the action plans set the framework for implementing the actions by identifying who will lead each action, how long it will take, how it will be funded and how it will be prioritized.
- Jessica introduced herself to the group and described her background in mitigation planning.
- Jessica introduced the process for reviewing and updating the goals that were in the 2017 plan and presented three options for the planning team to consider in moving forward into 2022 goals.
    - Option 1: Keep the goals as they are in the 2017 plan and move them into the 2022 plan.
    - Option 2: Create new detailed goals for the 2022 plan.
    - Option 3: Switch to a more streamlined goals statement.
- Discussion included the following comments:
    - Greg Zebrowski – Which approach Jessica would suggest.
        - Jessica stated that it would be what they thought was best for the jurisdictions; what would benefit them more.
    - Katie Kitzmiller – Although it was helpful having the detailed goals in the 2017 when applying for HMGP/BRIC funding, the current goals are not as useful, and a more detailed approach is favored for her jurisdiction given the hazards they have faced.
        - Ray Whatley – asked Katie about when they went through the funding process was it helpful having goals that were specific to the projects?
            - Katie responded that it was tied to how the project applied to current and future goals as it was presented.
    - Sydney McKenna – How have the streamlined goals helped other jurisdictions when applying for these or other grants?
        - Jessica responded that it was not a hurdle in her experience, but it could be specific to the jurisdiction if it's been an issue or not.
        - Sheila Hascall stated it depend on the FEMA region, and most consistent in BRIC and other grant applications this year. FEMA is

looking at how they are important, and how the action is identified in the plan.
        - Jessica added that the goals do help to prioritize the funding.
    - Katie Kitzmiller – More detailed actions are a good starting point for jurisdictions that did not have them.
    - Nancy stated that the goals should be framed around the range of mitigation actions, as a starting point when forming actions and projects.
    - Jessica showed an example (addressing natural hazards) of a more concise goal in the presentation slides to illustrate what it could look like if planners chose that option.
        - Greg Zebrowski – Since the decision was that non-natural hazards should be included in this, could this statement be revised.
        - Nancy suggested changing it to include "all" hazards instead of just natural hazards in the statement.
        - Sheila stated it should not say "all", but something like "multi-hazard".
        - Sydney McKenna provided a sample revision to the statement, "from the natural and non-natural hazards identified in this plan, and to lessen the impacts of these hazards on property and the community," and add environment to the statement.
        - Jessica – We will rework the statement and then send it out to the committee for them to review and disseminate to the Emergency Managers.
        - Greg Zebrowski – In Incident Command within the Fire Service, they use the three statements in their line of work.
        - A question was asked as to whether the Emergency Managers needed to approve the goal. The question was directed to Katie Kitzmiller as the Project Coordinator, who stated that the Planners should be able to make this decision and inform the Managers just to solicit their consensus.
- Participants were asked to enter their preference in the Chat Box feature in Microsoft Teams. The outcome of the vote for consensus was:
    - Option 1 – Keep the goals as they are in the 2017 plan and move them into the 2022 plan; zero (0) votes
    - Option 2 – Create new detailed goals for the 2022 plan; one (1) vote
    - Option 3 – Switch to a more streamlined goals statement; eight (8) votes
- Nancy continued the presentation with an overview of Mitigation Actions:
    - We will initially look at the actions in the 2017 plan, working directly with the jurisdictions to get status updates, including whether there were any issues, whether they should be moved forward, if any have been completed or are no longer needed, then creating new actions for the community.
    - We want to look at what is the actual problem when it comes to developing actions – what is the root cause of the hazard issue or vulnerability?

  - A Mitigation Action Flow Chart illustrated the process for looking at the level of risk from a hazard and determining if it is acceptable or not. If not, how do we develop an action to address the problem? We'll look at several options and prioritizing the choices to see which is the most cost effective, technically feasible and acceptable.
  - Mitigation Actions will be classified in one of the four categories of Mitigation Actions as presented in FEMA's Local Mitigation Planning Handbook: local plans and regulations, structure and infrastructure projects, natural systems protection and public education and awareness.
  - Action Plan for Implementation – will be jurisdiction-specific and include who will handle administration of the project, how it will be funded and prioritized, and incorporated into existing planning mechanisms.
- Prior to the next meeting, we will send out Action Worksheets to illustrate the type of information that will be needed for a project. We will provide technical assistance during the next meeting to help fill out the worksheets.

QUESTIONS/STATEMENTS/COMMENTS

Q: Greg Zebrowski – Could we be informed ahead of time about a meeting that needs to have a decision so we can have the right people in the meeting instead of being caught off-guard?

A: Yes, we will let you know.

Q: Sydney McKenna – What is the expected timeline for receiving the mitigation actions and returning the new ones?

A: Nancy - The timeline for completing mitigation actions is August (earlier preferred) so that will give you at least a month to complete and time to reach out for assistance, if needed.
Sheila – We will have a strategy meeting in two days to talk about the approach and have staff members, Jessica and Elizabeth will reach out to you to help take some of the administrative work off your hands. We will let you know how the outreach will work before the end of the week.

Q: Sydney McKenna – Will you be sending out the previous actions for us to look over?

A: Nancy – Yes, we will send the list of actions your jurisdiction included in the 2017 plan for your review and send a blank Action Worksheet for you to look over prior to the meeting.

Q: There is the planning commission and other planning partners – should we be reaching out to them to solicit information related to get that information from them. Is it worth it to do a review with the stakeholders or wait until we have something in hand to show them?

A: Sheila – If you are willing to introduce us to the stakeholders, we can do the leg work so that we can reach out to them sooner.
Katie Kitzmiller – I have some that are ready to help when needed for the stakeholders, and how to start pulling regional people in for their input.
Sydney McKenna – They would be good groups to engage for the regional priorities, or input for more specific goals.
Katie Kitzmiller – They could be both, and give us a guide in our project, and here is what we are looking at hazard-wise, do they have concerns or additions to this information or the direction we are going in.

Q: Sydney McKenna- how are we going to incorporate the considerations for diversity and inclusion, would that go into capabilities assessment or another place?

A: Nancy - That has not come up yet in our discussion, but we do look at the population profile that shows the diversity, non-English speaking, and that kind of thing, in the vulnerability assessment and addressed through a statement based on the data analysis of demographics; it's been limited to that area of the plan in the past, but we can address that in other ways as suggested.
Sydney McKenna – This came up a lot for the COVID response, and prioritizing mitigation action response may be appropriate; it's becoming an integral piece of the community.
Nancy – It would be important to put a statement under each hazard in relation to population vulnerability, but if any other part of that is appropriate, please let us know.
Jessica - There are disparities in how hazards affect the population in the community for outreach and education. If you have a mitigation education program you can't add to that, but you can make changes to include more diverse education and outreach.

SUMMARY

- Sydney McKenna shared this link in relation to diversity and inclusion for FEMA's *Building Alliances for Equitable Resilience*: https://www.arcgis.com/apps/MapSeries/index.html?appid=b9b5f7cb1c8b45469408ddff18c04200

NEXT PLANNING MEETINGS

- July 20 – Mitigation Strategy 2
  - Technical Assistance Workshop - Action Worksheets
  - Prioritization Criteria
- August 3 – Mitigation Strategy 3
  - Prioritize Mitigation Actions
  - Implementation Plan

Minutes prepared by:
Elizabeth Burnett, IEM Junior Planner

Northern Virginia Hazard Mitigation Plan – 2022 Update

Planning Meeting – Mitigation Strategy 2
Agenda and Minutes
July 20, 2021
2:00 – 3:00 PM
(Virtual – Teams Meeting)

Participants

Name	Title	Agency
Elizabeth Adams	All Hazards Planner	Virginia Division of Emergency Management
Joe Carter	Emergency Manager	City of Falls Church
Joe Dame	Emergency Manager	Town of Leesburg
Erin DeLuca	Emergency Management Specialist	Arlington County, Dept. of Public Safety Communication and Emergency Management
Walter English	Deputy Emergency Coordinator	City of Fairfax
Lauren Fricke	Intern	Arlington County, Dept. of Public safety Communication and Emergency Management
Amelia Gagnon	Emergency Management Specialist	City of Manassas
Norm Goulet	Environmental & Resiliency Planner	Northern Virginia Regional Planning Commission
Cara Howard	Lead Planner	Fairfax County OEM
Taylor Jones	Senior Emergency Management Specialist	Prince William County
Katie Kitzmiller	Deputy Emergency Management Coordinator	Prince William County
Matthew Marquis	Regional Planner	Fairfax County OEM
Sydney McKenna	Emergency Preparedness Manager	Arlington County, Dept. of Public safety Communication and Emergency Management
Elizabeth Moore	Emergency Preparedness Specialist	Fairfax County
Kelly Myers	Assistant Coordinator	Loudoun County Emergency Management
Brent Ruggles	Deputy Emergency Management Coordinator	City of Alexandria Office of Emergency Management
Andrew Slater	Program Director	Northern Virginia Emergency Response System/Hospital Authority
Mihai-Cristian Statie	Deputy Emergency Management Coordinator	City of Falls Church
Gregory Vernon	Manager, Emergency Management	Metropolitan Washington Airport Authority
Greg Zebrowski	Assistant Coordinator, Planning and Policy	Fairfax County OEM
Nancy Freeman	Senior Mitigation Planner	IEM, Contractor
Jessica Mason	Hazard Mitigation Planner	IEM, Contractor
Elizabeth Burnett	Jr. Planner	IEM, Contractor

Meeting Presentation **Jessica Mason, IEM**

- Jessica described the current status of the project and the agenda for today's meeting, which is to review the 2017 actions items and discuss the process to develop new action items.
- She reviewed the streamlined Mitigation Goal approved after the last meeting: "Our goals are to protect life and reduce bodily harm from the natural and non-natural hazards identified in this plan, and to lessen the impacts of these hazards on property, the environment, and the community."
- The process for reviewing the 2017 action items was explained, and an example of the spreadsheet was displayed in the presentation. Jessica explained what information should be reviewed and updated on the spreadsheet.
- Jessica explained new action item requirements, including:
    - At least two action items for each natural hazard
    - At least one action item for each non-natural hazard (these will not be included in the base plan)
    - Can include an expansion of a previous action that is ongoing or completed
    - Must be a variety of actions from all categories
    - Must address the root cause of the hazard
- Jessica explained that the mitigation actions will be classified in one of four categories, and provided examples of actions for each of the categories:
    - Local plans and regulations
    - Structure and infrastructure projects
    - Natural systems protection
    - Public education and awareness
- Jessica emphasized "resilience" as a key word when looking for natural/green opportunities.
- Examples of new actions items were presented using the spreadsheet to demonstrate the type of information needed.
- Try to figure out who and what you would like to collaborate or work with or obtain to deal with those hazards.
- The "New Action Information Page" was explained. This is optional but it is a way to go deeper into that action and provide information that would be useful down the line when funding becomes available. Information needed to complete the form follows grant application criteria so that a "mini" grant application can be prepared. We should think not just of financial benefits, but other benefits like reduction of loss of life or injuries, repetitive flooding, new recreation green space, etc. Being able to show how it truly benefits the community will also help when it comes to getting funding for that project.
- A slide listing potential funding sources was displayed and Jessica described the specific programs and opportunities that can be identified for actions, including local budgets, federal and state grants, and public/private/nonprofit partnerships.
- Jessica provided updates on other planning tasks:
    - Public survey – has been approved and will be available on Survey Monkey. We will send the link to the survey as soon as it is active.

- Capabilities assessments – have completed initial research for each jurisdiction and we will be meeting with the jurisdictions individually to walk through the information and assist with completing the assessment.
- Outreach to participants – we will be contacting jurisdictions that still have pending information to submit and working with them to bring it up to date.
- Office hours – in addition to the outreach, we will be hosting a series of virtual open office sessions via Microsoft Teams in the next few weeks so that anyone can reach out at those times to obtain information, assistance, or answers to questions. We will send an email with the dates and times and a calendar invitation to access the office hours.

Questions/Statements/Comments

Q: Sydney McKenna ask if we have heard how FEMA will handle HMGP with COVID items.
A: We have not heard anything yet but will let them know how this will be applied when we hear.
Q: Sydney McKenna – How will we figure out priorities of actions, when will we decide?
A: We will be discussing this at the next meeting on August 3, but generally we will be using some type of "STAPLEE" criteria approved by the group.
Q: Sydney McKenna – What will the hazard profiles look like?
A: We are still looking at that and will be completing a draft hazard risk ranking and send it to you for review and/or revision. Jurisdiction-specific hazard information will be included in the annexes, so if you have something you really want to see in a hazard profile, please submit it.
Nancy Freeman – There will be a regional approach to the non-natural hazards in Volume II, but in each of the annexes those will also be identified. It can also be in both Volume II and the jurisdiction annex depending on what the jurisdiction prefers.

Summary

- We are available to assist with action item development. You can set up an individual call with your jurisdiction or call in during one of the "office hours" sessions.

Next Planning Meeting

- August 3 – Mitigation Strategy 3
  - Prioritize mitigation actions
  - Implementation and integration plan
  - Hazard risk ranking
  - Stakeholder and public engagement

Minutes prepared by:
Elizabeth Burnett, IEM Junior Planner

NORTHERN VIRGINIA HAZARD MITIGATION PLAN – 2022 UPDATE

PLANNING MEETING – Mitigation Strategy 3
AGENDA AND MINUTES

August 3, 2021
2:00 – 3:00 PM
(Virtual – Teams Meeting)

PARTICIPANTS

Name	Title	Agency
Elizabeth Adams	All Hazards Planner	Virginia Division of Emergency Management
Joe Carter	Emergency Manager	City of Falls Church
Joe Dame	Emergency Manager	Town of Leesburg
Erin DeLuca	Emergency Management Specialist	Arlington County, Dept. of Public Safety Communication and Emergency Management
Walter English	Deputy Emergency Coordinator	City of Fairfax
Lauren Fricke	Intern	Arlington County, Dept. of Public Safety Communication and Emergency Management
Amelia Gagnon	Emergency Management Specialist	City of Manassas
Norm Goulet	Environmental & Resiliency Planner	Northern Virginia Regional Planning Commission
Cara Howard	Lead Planner	Fairfax County OEM
Taylor Jones	Senior Emergency Management Specialist	Prince William County
Katie Kitzmiller	Deputy Emergency Management Coordinator	Prince William County
Matthew Marquis	Regional Planner	Fairfax County OEM
Sydney McKenna	Emergency Preparedness Manager	Arlington County, Dept. of Public Safety Communication and Emergency Management
Elizabeth Moore	Emergency Preparedness Specialist	Fairfax County
Kelly Myers	Assistant Coordinator	Loudoun County Emergency Management
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Andrew Slater	Program Director	Northern Virginia Emergency Response System/Hospital Authority
Mihai-Cristian Statie	Deputy Emergency Management Coordinator	City of Falls Church
Gregory Vernon	Manager, Emergency Management	Metropolitan Washington Airport Authority
Greg Zebrowski	Assistant Coordinator, Planning and Policy	Fairfax County OEM
Nancy Freeman	Senior Mitigation Planner	IEM, Contractor
Jessica Mason	Hazard Mitigation Planner	IEM, Contractor
Elizabeth Burnett	Jr. Planner	IEM, Contractor

MEETING PRESENTATION Jessica Mason, IEM

- Jessica provided a project update, explaining what has been done and where we are in the task schedule.
- Jessica described how prioritization of the mitigation actions will work, using a holistic approach to look at each hazard to guide planning and decision making.
- STAPLEE (or STAPLE/E) criteria was explained, going through each of the categories:
    - Social – community acceptance, is the action potentially going to disproportionately impact any segment of the community?
    - Technical – proposed action is technically feasible, will help to reduce losses in the long term, and has minimal secondary impacts.
    - Administrative – examines the anticipated staffing, funding, time, and maintenance requirements for the mitigation action to determine if the jurisdiction has the personnel and administrative capabilities to implement the action or whether outside help will be necessary.
    - Political – isn't linked to each action but references those actions that might need approval at the elected official.
    - Legal – whether the jurisdiction has the legal authority to implement the action.
    - Economic – consider the information that every $1 spent saves $6 in future disaster costs
    - Environmental – impact on the environment and statutory considerations.
- The STAPLEE information sheet was displayed, with the explanation of how to use a plus sign (+) or a minus sign (-) to evaluate an action within each of the seven categories.
- Jessica asked for feedback, and if anyone opposed
    - General consensus was unanimous in supporting this approach
- Next topic is related to how actions are ranked as low, medium or high. Jessica reviewed the criteria for each category, described how the STAPLEE worksheet has looked at the action, and takes into consideration at hazard risk level.
    - Feedback from participants suggested adding an identified time frame with each.
- Jessica displayed the Action Plan for Hazard Mitigation Implementation and Integration in the presentation, describing its purpose and how the information will be used in the jurisdiction annexes.
- The Action Plan will be due August 20.
- The draft Hazard Risk Ranking tables were presented and explained, walking through the process. The current plan is for IEM to fill out the form for each jurisdiction and submit to them for their review, revision and approval, or they can fill it out if they prefer to do so. She requested that the jurisdictions that are not including non-natural hazards remind us using the Chat Box during the call so we will know that before we start filling this section out for them. [No messages from jurisdictions were received confirming omission of non-natural hazards.] The Hazard Risk Ranking methodology includes the impacts and consequence analysis in Step 2 that is consistent with EMAP standards for accreditation.
- Jessica presented suggestions for stakeholder engagement and how to document this outreach. Suggestions included using internal and external stakeholders as technical

specialists, or to leverage regional partners and local organizations. Katie Kitzmiller proposed two approaches to conduct this outreach – one using the EM Managers meeting, the other through getting on the agenda at the next NVERS Steering Committee to get input and suggestions. They will be given the opportunity to review the plan and provide feedback.
    - Other suggestions for outreach – Greg Zebrowski noted that letters were sent out during the last plan update process; is that the approach this time? Just to confirm that we're not each going out to all these groups separately. Katie confirmed that as the plan, but asked how the jurisdictions wanted to handle the colleges and universities. Greg suggested reaching out to them directly.
- Jessica reviewed the requirements for public engagement and provided examples of how public engagement could be conducted. There is a requirement that at least two engagement opportunities be offered to the public and documented to meet FEMA requirements – one could be through the public hazard survey; the second will be when the draft plan is released for public review and comment. It's important to the plan to identify stakeholders who have a role in hazard mitigation, such as helping with data collection, or resources that support actions. Planners were reminded to send us the documentation of any outreach to the public. This could be a sign-in sheet if you hold an in-person meeting or other form of proof that the effort was made.
    - Katie Kitzmiller presented a proposed strategy for this outreach with a two-pronged approach that utilizes "one voice"; one with the NOVA Emergency Managers meeting to provide updates to other groups, such as military, NVERS/NVHA, etc. She will walk them through the approach and ask about other stakeholders that should be engaged. Outreach will be conducted through multiple methods, including social media. VDEM will be includes in the outreach to document state participation, as well as neighboring jurisdictions. Outreach to colleges and universities will be through the regional component.
- Jessica offered to develop a "public engagement materials package" to planners to use for meetings, outreach, etc. and asked if Planners would like this. Feedback was positive.
- Jessica stated that the Public Hazard Survey is now ready to go and the link to the Survey Monkey site will be sent out to planners shortly.
- Jessica reviewed upcoming information needed and asked for feedback for due dates. The following dates were decided, IEM will fill out as much as possible before sending out:
    - August 5 – catch up documentation
    - August 20 – action items
    - We will fill out as much as possible for the following and send them out after August 20:
        - Capabilities assessment, including NFIP information
        - Critical facilities
        - Hazard risk ranking
- **In acknowledgement of all the planning information due, we are suggesting that we not have a second meeting in August and meet again on September 14 for a Planning Wrap Up Workshop.**
    - **General consensus was in agreement to this proposed schedule.**

- Office hours – the virtual open office sessions via Microsoft Teams will continue during the next few weeks so that anyone can reach out at those times to obtain information, assistance, or answers to questions. We will send an email with the dates and times and a calendar invitation to access the office hours.

QUESTIONS/STATEMENTS/COMMENTS

Q: Sydney McKenna – Will the STAPLEE Information Sheet be in the plan, or is it going to be there because we are using it?

A: Jessica – It will not be in the plan, other than the description; it is a reference tool for you to use.

Comment: Katie – I like the holistic approach and will be beneficial moving forward; thank you for putting this together.

Q: Jessica – Is anyone opposed to using the STAPLEE, or would you like to consider other options?

Q: Katie Kitzmiller – Can it impact a specific population in equity?

A: Jessica – yes, it can be applied to more than one segment.

Q: Sydney - by identifying a timeframe with the low, medium, high priorities, are we considering that as when the project is going to start or when it will be finished?

A: Jessica: It would generally be the timeframe in which a project could be completed. We can refine the definitions to be more structured:

Low – Implemented as funding becomes available, 5+ years

Medium – implemented in 3 to 5 years

High – Implemented in 1-2 years

Q: Katie – If there are a couple of projects that don't have funding or other parts to address the actions, do we still use this?

A: Jessica – Recommend doing it that way and make a comment that states they are looking for funding or project scoping.

Q: Sydney – What is the timeframe for when this should be finished or when it should be started?

A: Joe Dame – match up things to when they can happen

Jessica – the way FEMA and others look at it, is when you receive the money how long until you finish it, but you can add to the comments to explain details.

Q: Sydney – do we know if the universities have their own mitigation plan?

A: Greg – no they fall under the Commonwealth and the NOVA Hazard Mitigation Plan. They would fall under the jurisdiction they are in, unless they have their own, or they could decide to participate in the jurisdiction's plan.

Nancy – Some may have their own Hazard Mitigation Plan if they are pursuing the EMAP accreditation designation for higher education entities.

Q: Sydney – How will the Action Plan for Implementation be integrated into the plan?

A: Jessica – We can type it up in a paragraph or use the table as it is in a cleaned-up format in your jurisdiction annex.

Nancy – We would capture this as the action plan within your annex.

ADDITIONAL COMMENTS:

- I like how the action plan becomes a usable document instead of just a checklist so we can keep reviewing this with our mitigation working groups for benchmarks as they come up.
- I think this looks good! So, will the jurisdictions fill this out first? [Hazard Risk Ranking Process]
- The next NVERS Steering Committee meeting will take place on Monday, September 27, 2021 from 1:30 to 3:30 pm.
- What is the status on the jurisdictional surveys?
- The catch-up data meetings have been incredibly useful for us and we were able to get everything addressed with clear due-outs for us within an hour. I highly recommend one-on-one meetings!

SUMMARY

- We are available to assist with planning information documents. You can set up an individual call with your jurisdiction or call in during one of the “office hours” sessions.

NEXT PLANNING WORKSHOP

- September 14, 2021 – Planning Wrap-up Workshop

Minutes prepared by:

Elizabeth Burnett, IEM Junior Planner

NORTHERN VIRGINIA HAZARD MITIGATION PLAN – 2022 UPDATE

PLANNING MEETING – Planning Wrap-Up
AGENDA AND MINUTES

September 14, 2021
2:00 – 3:00 PM
(Virtual – Teams Meeting)

PARTICIPANTS

Name	Title	Agency
Genesis Acosta		MWAA
Elizabeth Adams	All Hazards Planner	Virginia Division of Emergency Management
Joe Betts	Project Manager	Town of Lovettsville
Joe Carter	Emergency Management	City of Falls Church
Joe Dame	Emergency Manager	Town of Leesburg
Erin DeLuca	Emergency Management Specialist	Arlington County, Dept. of Public Safety Communication and Emergency Management
Walter English	Deputy Emergency Coordinator	City of Fairfax
Lauren Fricke	Intern	Arlington County, Dept. of Public safety Communication and Emergency Management
Amelia Gagnon	Emergency Management Specialist	City of Manassas
Norm Goulet	Environmental & Resiliency Planner	Northern Virginia Regional Planning Commission
Cara Howard	Lead Planner	Fairfax County OEM
Taylor Jones	Senior Emergency Management Specialist	Prince William County
Katie Kitzmiller	Deputy Emergency Management Coordinator	Prince William County
Matthew Marquis	Regional Planner	Fairfax County OEM
Sydney McKenna	Emergency Preparedness Manager	Arlington County, Dept. of Public safety Communication and Emergency Management
John Merritt	Planning Director	Town of Lovettsville
Elizabeth Moore	Emergency Preparedness Specialist	Fairfax County
Kelly Myers	Assistant Coordinator	Loudoun County Emergency Management
Brent Ruggles	Deputy Emergency Management Coordinator	City of Alexandria Office of Emergency Management
Andrew Slater	Program Director	Northern Virginia Emergency Response System/Hospital Authority
Mihai-Cristian Statie	Deputy Emergency Management Coordinator	City of Falls Church
Gregory Vernon		Metropolitan Washington Airport Authority
Harriet West		Town of Round Hill
Greg Zebrowski	Assistant Coordinator	Fairfax County OEM
Nancy Freeman	Senior Mitigation Planner	IEM, Contractor
Jessica Mason	Hazard Mitigation Planner	IEM, Contractor
Elizabeth Burnett	Jr. Planner	IEM, Contractor

MEETING PRESENTATION Jessica Mason, IEM

- Jessica announced that the meeting would be recorded today for participants who are unable to attend.
- The agenda was reviewed, pointing out where we are in the project timeline.

- Jessica provided an update on the public hazard survey. So far there are more than 900 responses, a great response. It will be left up longer than initially anticipated since a few new jurisdictions have joined the planning process. Reminder that a paper copy can be printed if participants want to distribute the survey that way.
- Jessica explained how the earthquake risk ranking was determined. Even though it is low frequency, it is potentially high consequence event in terms of population, property and infrastructure and economy. Another factor that contributed to this is the high-level HAZUS data that has been used which is based on various scenarios on a 6.5 earthquake over a period up to a 2,500-year event. The risk ranking criteria also comes into play when you consider population vulnerability and geographic extent added to the impact and consequence categories, which outweigh the lower probability category. FEMA wants participants to consider the worst-case scenario along with the historical occurrences to get a fuller picture of the hazard. Also, the vulnerability of older buildings and infrastructure (anything over 20 years old) come into play, but the history of low frequency and low magnitude, mitigation measures such as addressing higher building codes may not be feasible or cost effective. This issue only applies to earthquake; other hazard risk rankings are within the expected ranges when compared to how they were ranked in the 2017 plan. IEM recommends that the hazard risk for earthquake be adjusted to a 5.8, a 1,000-year event (like the 2011 earthquake), and adjust the scores to reflect a less impactful event. Also, an explanation, indicated with an asterisk by "earthquake" of how it is ranked in the vulnerability assessment will be added. This will acknowledge how bad it could be, but also acknowledging the reality of the risk. An example of how earthquake risk would be adjusted was shown using Arlington County's hazard risk ranking. A question was asked about how the high, medium, low was determined. Jessica explained the holistic approach to grouping the hazards based on their final score, just to have an even but realistic distribution and that these could be redistributed after ranking all hazards. It's a good idea to point out that "probability" is not a high-risk factor in determining earthquake. Tornado is another example of how historically it is a low probability, but if it occurs would be a high risk. Consensus was in favor of this recommended approach to rank earthquake.
- Public engagement – reminder to post the public survey. It is a planning requirement that there is an opportunity during the planning process, so be sure to post it. Closing September 30. Send screenshots or weblinks so IEM can document it in the plan. Second opportunity for public engagement is when the draft plan is posted for public review and input, which is a specific requirement for FEMA. Again, will need screenshots or weblinks, or photographs. Reminder that we sent the public engagement materials packet. Provide documentation for any other opportunities you've done locally. September is National Preparedness month, so it's a good time for this effort.
- Stakeholder engagement – The goal is to leverage regional and state partners and others to contribute to action items and the mitigation strategy. IEM will provide an update to the NVERS group and then send a draft of the plan when complete for their review and input. Jessica will participate in their meeting on Sept. 27 and explain how data was used, risk ranking, action steps and ask for additional considerations. Also, participants are encouraged to reach out to local stakeholders, just make sure to document and send to IEM (emails, etc.).
- Draft review – a lot of the sections are being drafted, but timeline is also contingent on when all the information is submitted from the jurisdictions. The plan will be sent as a PDF broken into sections (Base Plan, with non-natural hazard information separated), and jurisdictional annex. This will allow flexibility in posting what participants want. Will send a document that allows you track changes and comments.

- VDEM and FEMA Review – VDEM will review first, provide feedback if necessary for revisions. Once they approve it, they will send to FEMA who has 45 days to review (by rule) and provide feedback, but could easily take longer. Any revision that must be resubmitted gets another 45 days. Once FEMA approves the draft, it becomes Approvable Pending Adoption (APA). Then each jurisdiction's governing body must adopt the plan. IEM will send a draft adoption resolution for participants to customize. Five-year clock for plan update starts once the first participant adopts the plan. Once all jurisdictions adopt the plan, a final plan will be sent out.

QUESTIONS/COMMENTS

Questions were asked during the meeting presentation and responses are incorporated in the presentation notes.
Additional comments**:**

- Joe Dame stated that the discussion about how earthquake risk should be realistically considered may apply to other hazards like communication disruption. He suggested other hazards that can be addressed in a similar fashion.
- Katie Kitzmiller asked about the holistic approach to ranking in the low, medium, high categories and suggested that a sub-category, such as medium-high could be used for earthquake, with tornado as another example that could be in this sub-category. Jessica responded that this can be done, and could apply to other hazards like the 2017 plan. Also, consider any significant change that has occurred in relation to a hazard since 2017. Look at the Overall Risk Numbers for all hazards, and change as needed to reflect the data.
- Greg Zebrowski pointed out the perception of a high-ranking hazard as one that might happen more frequently when in fact, the probability of the event might be very low, with the impact being high. Jessica confirmed this will be addressed in the caveat for earthquake.

SUMMARY

- Reminder that we are available to assist with completing planning information documents. You can set up an individual call with your jurisdiction or email us directly to schedule a meeting.

NEXT PLANNING MEETING

- TBD – Approve Draft Plan for release for Public Posting and Comment

Minutes Prepared by:
Elizabeth Burnett, IEM Junior Planner

NORTHERN VIRGINIA HAZARD MITIGATION PLAN – 2022 UPDATE

Stakeholder Engagement and Education Workshop
November 5, 2021
2:00-3:00pm

Stakeholder Engagement and Method of Coordination

Name	Position or Title	Agency
Eric Reist	Manager	Inova Fairfax Medical Campus, Department of Safety, Security, and Emergency Management
Eric Cembrook	Lieutenant	Metropolitan Washington Airports Authority Police Department
Amanda David	Health Emergency Coordinator	Prince William Health District
Jeff Walker	Regional Emergency Coordinator	Virginia Department of Health
Andy John	Chief Regional Coordinator	Virginia Department of Emergency Management
Jake Kezele	Disaster Response and Recovery Officer	Virginia Department of Emergency Management
Amy Hoffman	North Capital Region Public Safety and Homeland Security Liaison	Virginia Department of Emergency Management
JP Koushel	Captain	Virginia State Police, Fairfax Division
Amy Cornell-Titcomb	Emergency Preparedness and All Hazards Manager	Prince William County Service Authority water utility service
Adam Buckley	Senior Project Manager	Northern Virginia Emergency Response System
Jordan Meservy	Project Manager	Northern Virginia Emergency Response System
Kristin Nickerson	Executive Director	Northern Virginia Emergency Response System
Pam Leins	Emergency Preparedness Coordinator	Northern Virginia Emergency Response System, Stone Springs Hospital
Stephen Allen	Deputy Director/Planner/Program Manager	Jefferson County, West Virginia, Department of Homeland Security and Emergency Management
Brian Lichty	Director	Clarke County, Virginia, Fire, EMS, and Emergency Management Department
Michael Guditus	Emergency Manager	Fauquier County, Virginia, Department of Emergency Management
Virgil Gray	Deputy Emergency Management Coordinator	Stafford County, Virginia, Department of Emergency Management
John (Jack) E. Markey	Director	Frederick County, Maryland, Division of Emergency Management
Marianne Souder	Chief, Planning Division	Montgomery County, Maryland, Office of Emergency Management and Homeland Security
Michael Boldosser	Emergency Management Specialist II	Montgomery County, Maryland, Office of Emergency Management and Homeland Security
Ronald Gill Jr.	Director of Emergency Management	Prince George's County, Maryland, Office of Emergency Management
Michelle Lilly	Director of Emergency Services	Charles County, Maryland, Emergency Services Department
Dr. Christopher Rodriguez	Director	Washington DC Homeland Security and Emergency Management Agency

JaLessa Tate	State Hazard Mitigation Officer	Maryland Department of Emergency Management
Zachary Pope	Director	Arlington County Public Schools
Trina R. Littlejohn	Administrative Officer	Washington Aqueduct
Mel M. Tesema	Chief, Operations Branch	Washington Aqueduct
Anne L. Spiesman	Water Treatment Engineer	Washington Aqueduct
Hanif K. Drzal	Interim Chief, Planning and Engineering Branch	Washington Aqueduct
Rudolph S. Chow	General Manager	Washington Aqueduct
Malyanya S. Westmoreland	Emergency Management Specialist	Joint Base Myer-Henderson Hall, United States Army
Eddie W. Stewart	Emergency Manager	Joint Base Myer-Henderson Hall, United States Army
Rob Lazaro	Executive Director	Northern Virginia Regional Commission
Gregory Prelewicz	Manager, Planning	Fairfax Water
Susan Miller	Manager, Public Affairs	Fairfax Water
Amy Wyks	Director	Town of Leesburg Utilities
Darrin Geldert	Planning Manager	Loudoun Water
Jessica Dzara	Program Director, Asset Management	Loudoun Water
Tony Dawood	Director	City of Manassas Utilities
Allen Rowley	Engineering Services Manager	City of Manassas Park Utilities
Holly Brown	Emergency Services Coordinator	Virginia Dept. of Health, Office of Drinking Water
Marybeth Leongini	External Affairs Manager	Virginia American Water
Robert McIntyre	Manager	Dominion Energy
Rob Dull	Chair, President, Chief Executive Officer	Dominion Energy
Michael Wang	Regional Dam Safety Engineer	Virginia Department of Conservation and Recreation
Angela Davis	Floodplain Program Manager	Virginia Department of Conservation and Recreation
Brandy Buford	Floodplain Program Manager	Virginia Department of Conservation and Recreation, Division of Dam Safety and Floodplain Management
Kate Archie	Emergency Manager	Virginia Department of Social Services
Dereck Baker	Division Chief	Virginia Department of Fire Programs
Alan Lacy	Pollution Response Coordinator	Virginia Department of Environmental Quality
Debbie Messmer	State Hazard Mitigation Officer	Virginia Department of Emergency Management
Alex Krupp	Hazard Mitigation Grant Administrator	Virginia Department of Emergency Management
Andy John	Chief Regional Coordinator	Virginia Department of Emergency Management
	Administrator	Northern Virginia National Voluntary Organizations Active in Disaster
Jason Terry	Emergency Manager	Quantico Station, United States Marine Corps
Holly Mann	Emergency Manager	Fort Belvoir, United States Army
Kevin Good	Fire Chief	Fort Belvoir, United States Army
Jacki Collert	Operations Officer	Pentagon Force Protection Agency, Office of Emergency Management
Julie Gall	Senior Project Manager	Northern Virginia Emergency Response System
Paul Thompson	Teacher	Fairfax County Public Schools

Beth Brown	Emergency Planner	George Mason University
Shaheer S. Ahmed	Emergency Planner	George Mason University
Tom Mayhew	Director of Emergency Management	Northern Virginia Community College
Greg Vernon	Manager, Emergency Management	DC Water
Dusti Lowndes	Director, Emergency Management	DC Water
Wendy Trask	Chief of Staff	Washington Gas
John Jackson	Operations Manager	Columbia Gas
Ralph Cooper	Terminal Manager	Kinder Morgan Products (SE) Pipeline
Paul Jolley	Lead Operator	Colonial Pipeline
Kim Luckabaugh	Senior Manager	Volunteer Fairfax
	Administrator	Fairfax County Business Emergency Operations Council
Alex Iams	Director	Fairfax Economic Development Authority
John Boylan	President and Chief Executive Officer	Dulles Chamber of Commerce
	Administrator	United States Army Corps of Engineers, Baltimore District
Peter Bromley	Bus Operations Manager	Fairfax County Department of Transportation
Bob Hester	Senior Planning and Exercising Specialist	Washington Metropolitan Area Transit Authority
Rich Dalton	Chief Executive Officer	Virginia Railway Express
Michael McLean	Regional Emergency Manager	Amtrack
Trice Burgess	Emergency Management Specialist III	Fairfax County Local Emergency Planning Committee
Joshua Davis	Assistant State Fire Marshal	Virginia State Fire Marshal's Office
Jim McGlone	Urban Forest Conservationist	Virginia State Department of Forestry
Chris Strong	Warning and Coordination Meteorologist	National Weather Service, Baltimore, Maryland/Washington, DC location
Kim Kadesh	Director	Federal Emergency Management Agency Office of the National Capital Region Coordination
Rob Brown	Chief Executive Officer/Executive Director	International Association of Fire Chiefs
Joe Lenz	Disaster Program Manager	American Red Cross, Fairfax County
Rebecca Chestnutt	Divisional Disaster Director	Salvation Army
Mary Laurel Castle	Deputy Director	Northern Virginia Hospital Alliance
Ralph Nazzaro	Director of Public Safety and Emergency Management	Inova Fair Oaks Campus
	Administrator	Northern Virginia Regional Park Authority
Harry Gruenspecht	Training and Exercise Coordinator	Northern Virginia Hospital Alliance
Scott Boggs	Managing Director	Metropolitan Washington Council of Governments, Department of Homeland Security and Public Safety

NORTHERN VIRGINIA HAZARD MITIGATION PLAN – 2022 UPDATE
Planner's Meeting/Teams
February 1, 2022
2:00 p.m.

Name	Position	Agency
Elizabeth Adams	VEDEM	Virginia Department of Emergency Management
Joe Dame	Emergency Manager	Town of Leesburg EM
Amelia Gagnon	Emergency Management Specialist	Loudoun County Emergency Management
Normand Goulet	Environmental & Resiliency Planner	Northern Virginia Regional Planning Commission
Cara Howard	Lead Planner	Fairfax County PSC & EM
Taylor Jones	Senior Emergency Management Specialist	Prince William County EM
Sydney McKenna	Emergency Preparedness Manager	Arlington County, Dept. of Public Safety Communication and Emergency Management
Elizabeth Moore	Emergency Preparedness Specialist	Fairfax County
Kathleen Murphy		
Kelly Myers	Assistant Coordinator	Loudon County Emergency Management
John Moore		
Sean Odenthall		MWAA, CCTA
Ry Whatley	Emergency Management Coordinator	City of Alexandria OEM
Jonet Prevost-White		
Greg Zebrowski	Assistant Coordinator, Planning and Policy	Fairfax County PSC & EM
Elizabeth Burnett	Jr. Planner	IEM
Nancy Freeman	Senior Mitigation Planner	IEM
Sheila Hascall	Project Manager	IEM
Jessica Mason	Hazard Mitigation Planner	IEM

Welcome - Jessica opened the meeting

- Initial Draft workshop to explain how to review the document, use the links, document input, etc.

Jessica provided a brief overview of the plan components:

Volume 1: BASE PLAN

Appendix A: The Planning Process

- Two PDF documents
- One Word Document for each annex, except county that got county and town annex documents
- Part 1
    - Introduction
    - Planning Process
    - Plan Maintenance
- Part 2 Hazard Analysis
    - HIRA Methodology
    - Hazard Profiles (characteristics, risk assessment, vulnerability analysis
    - Climate Change section
- Part 3 Mitigation Strategy
    - Capabilities Assessment
    - Mitigation Action
    - Action Plan for Implementation

Comment Form was sent with the email to use for provide feedback (matrix)

- Reference section, page number and comments. Contractor will complete how comments were addressed

This review is only for Planners to review the format, content accuracy, and provide feedback

- NOT looking at format, colors, etc.; graphics is working on that now.
- Identify any information that should be redacted.
    - Volume II will be fully redacted, not released to the public.

BASE PLAN – Outline/Table of Contents

VOLUME II

- Section 1 Introduction, Planning Process and Plan Maintenance
- Section 2: Hazard Profiles
- Section 3: Mitigation Actions and Implementation
    - Planner only review for content – share only with those who need to see it
    - Use Comment Form to provide feedback
    - Visual scan – won't be sent to VDEM or FEMA, not required for LHMP approval.

JURISDICTION ANNEXES

- Word document – Don't open the document and make changes within SP – use the open to Open in Desktop Application as a Word document.
- Use Track Changes or use the Comment Form
- If multiple people look at it, integrate changes into one document to return to us.
- Identify any information to be redacted
- IEM staff available for one-on-one workshop to go through any part of the plan.
- A few annexes are not yet complete because information was submitted after document was prepared, or pending data not yet received.
    - They will be completed as soon as possible and sent out. Will adjust timeline for review based on when they are sent out.

Review Timeline – Asking return of comments within two weeks

- Timeline was adjusted to address concerns about review time, etc.

    - General comments – asking for 3 weeks for review, e.g., week of 2/21 – **ALL COMMENTS MUST BE RECEIVED BY FEB. 25, 2022**
    - Can send input in pieces
- After we receive comments – make any changes needed to the plan
    - Release for public comments
    - Submit to VDEM for review
    - Respond to VDEM – submit to FEMA for review
    - Respond to FEMA
    - FEMA determination of APA
    - Plan adoption by all jurisdictions

Q: (Taylor Jones) Can we get word version document to track changes?
A: (Jessica Mason) We wanted to limit access to the document so we wouldn't get 21 different version of the plan back.

Jessica will research to see if there is a way to send out the Word document so that we won't receive multiple documents in return.

- Email Received from Katie Kitzmiller during meeting (2/1/2022, 2:17 p.m.):

  I am concerned about not using tracked changes for the base plan. We had discussed a few weeks ago using tracked changes as well as having the option of a matrix due to the significant amount of time it takes to put comments in a matrix vs. tracked changes. Is there a way to offer that option as well like we had discussed and agreed to?

- Sheila Hascall responded to email (2/1/2022, 2:19 pm)

  Jessica, If you can provide the word version(s), once all the comments come back, if they are in multiple documents, we can merge them all into one document.

Ray Whatley would like a one-on-one sometime after Feb. 14 when he has two new staff members.

Jessica reminded planners to contact us if they have any questions or need clarification on anything.

A-3: Public Engagement

NORTHERN VIRGINIA HAZARD MITIGATION PLAN – 2022 UPDATE

ENGAGEMENT STRATEGY

Purpose:

- Required by 44 CFR Part 201.4
- Develop on-going support for the plan and its strategies
- Enhance “buy-in” from state and federal agencies, stakeholders, local jurisdictions and organizations resulting in greater success in implementing mitigation actions and projects to reduce risk.
- Integrate mitigation planning into state planning and resiliency practices
- Provide an on-going opportunity for public agencies, non-governmental and community-based organizations, private sector, and residents to participate in and support mitigation planning, activities and initiatives.

Participation Tiers:

Tier/Role	Responsibilities	Participation Level	Key Milestos
Emergency Managers/Emergency Management Planners (Planning Group)) • *The Emergency Managers will make decisions, and provide oversight of the project. Emergency Management Planners will guide the planning process and review and provide input upon the final contents of the plan. Designated Agenc/ Jurisdiction Representatives* • *Project Coordinator (PC): Prince William County*	Participate in all planning activities; assist in identifying and collecting information and data; identify and assist in development of projects; coordinate with other agencies; review and approve plan drafts and final plan; participate in plan maintenance	Participation begins with Kick-Off meeting and continues throughout the planning process, plan adoption and plan maintenance cycle.	• Hazard and Risk Analysis • Capabilities Assessment • Mitigation Strategy (goals, objectives, actions, implementation plan) • Draft Plan • Final Plan • Plan Adoption

Tier/Role	Responsibilities	Participation Level	Key Milestos
Stakeholders/Technical Specialists: *Person, Group or institution that can affect or be affected by a course of action identified in the mitigation plan:* • *Local elected officials and local agencies* • *Regional, State and Federal Agencies* • *Special Districts and Authorities* • *Non-Governmental Organizations* • *Educational Institutions* • *Major Employers* • *Land Use and Development Agencies* • *Professional Associations* • *Historical and Cultural Institutions* • *Access and functional eds agencies or organizations* • *Neighboring Jurisdictions*	Inform the Planning Group on specific topics or provide input from specific points of view • Provide technical assistance and expertise • Provide input on the draft mitigation plan	• Invited to Kick-Off Meeting • Engagement activities (requests for information and/or participation) • Action/Project development and plan support (resources, partnerships and technical expertise) • Plan review - comments and input • Plan Maintenance (provide updated information as requested)	• Hazard and Risk Analysis • Capabilities Assessment • Mitigation Strategy (goals, objectives, actions, implementation plan) • Draft Plan • Final Plan
Public: *Become informed about mitigation and community priorities, issues and opportunities; provide support for the plan and its related activities*	Involvement in the planning process through information sharing and opportunities to review the plan and provide input.	Respond to opportunities to review and provide input through multiple venues • Media releases • Surveys • Community meetings • Presentations	• Information/media releases • Educational Publications • Surveys • Draft Plan • Final Plan

Engagement Methods and Schedule

Topic/Activity	Method	Participants (1st listed is Lead)	Start Date	End Date	Phase
Planning Meeting 1 - Kick-off, April 19, 2021	Email invitation for virtual meeting	PC, Planning Group, Contractor			P3*
Hazard Risk Assessment	Contractor will coordinate with PC and Planning Group to identify and implement methodology	Contractor, PC	April 2021	July 2021	P3
Emergency Managers Meeting	Review and approve: • Plan Format and Components • Hazard Risk Ranking Methodology • Scope of hazards	PC, EM Managers, Contractor	May 25, 2021	June 4, 2021	P2
Planning Meeting 2 – Hazard Identification and Risk Assessment – Jun 22, 2021	(1) Email invitation & materials for virtual meeting (2) Meeting hosted by PC or designee with Contractor presentation; Participant discussion & input (3) Follow-up emails and phone calls to non-participating agencies and jurisdictions	Contractor PC Planning Group Stakeholders	June 1, 2021	June 22, 2021	P3
Jurisdiction Meetings	Contractor will coordinate directly with jurisdiction/agency representatives to conduct one-on-one virtual meetings for data collection & verification	Contractor, Planning Group	May 2021	July 2021	P3
Planning Meeting 3– Mitigation Strategy 1, July 6, 2021	(1) Email invitation & materials for virtual meeting (2) Meeting hosted by PC or designee with Contractor presentation; Participant discussion & input (3) Contractor Follow-up - emails and phone calls to non-participating jurisdictions/agencies	Contractor PC Planning Group Stakeholders	June 23, 2021	July 6, 2021	P3
Jurisdiction Meetings – Strategy/Actions	Contractor will coordinate directly with agency representatives to conduct one-on-one virtual meetings to develop Mitigation Action Worksheets	Contractor, Planning Group	July 1, 2021	July 31, 2021	P3

Topic/Activity	Method	Participants (1st listed is Lead)	Start Date	End Date	Phase
Planning Meeting 4 – Mitigation Strategy 2, July 20, 2021TBD]	(1) Email invitation & materials for virtual meeting (2) Meeting hosted by PC or designee with Contractor presentation; Participant discussion and input (3) Contractor Follow-up - emails and phone calls to non-participating jurisdictions, agencies	Contractor PC Planning Group Stakeholders	July 7, 2021	July 20, 2021	P3
Planning Meeting 4 – Mitigation Strategy 3, August 3, 2021	1) Email invitation & materials for virtual meeting (2) Meeting hosted by PC or designee with Contractor presentation; Participant discussion and input (3) Contractor Follow-up - emails and phone calls to non-participating jurisdictions, agencies	Contractor PC Planning Group Stakeholders	July 21, 2021	August 3, 2021	P3
Planning Meeting 5– Initial Draft Plan Review Process, Input & Approval [Date TBD]	Email invitation with meeting materials for virtual meeting, including agenda, draft plan, review comment sheets	Contractor PC Planning Group Stakeholders	Sept. 1, 2021	Sept. 1, 2021	P4
Jurisdiction Meetings – Plan Review & Input	Contractor will coordinate virtually with jurisdiction planning teams for review of draft plan and input	Contractor, Planning Group	As requested	As requested	P4
Final Plan Review	Email distribution of Final Plan	Contractor PC Planning Group Stakeholders	TBD	TBD	P5
Adopted Plan	Contractor will coordinate with PC and Jurisdiction Representatives for Plan Adoption resolutions	Contractor PC Planning Group Jurisdiction Representatives	TBD	TBD	P4
Documentation of Engagement	Contractor will develop a system to collect & maintain all documentation related to engagements	Contractor PC	TBD	TBD	P4, P5

Topic/Activity	Method	Participants (1st listed is Lead)	Start Date	End Date	Phase
Plan Maintenance Cycle	Implement plan monitoring, evaluation and update process: *(1) Conduct semi-annual meetings, at a minimum* *(2) Conduct annual hazard and project progress updates* *(3) Ensure participation and plan integration with other planning processes* *(4) Conduct on-going public engagement activities*	PC, Planning Group Jurisdictions Stakeholders	[Upon FEMA final approval of Adopted 2022 Plan]	2027	O

Phase: P1 = Project Kick Off; P2 = Project Scoping; P3 = Plan Update/Revision; P4 = Final Review, Adoption and Implementation; P5 = Project Closeout; O= Outside scope of current contract

A-3.1. Public Information Flyer

Hazard Mitigation Planning for Northern Virginia*

This is your community's plan!

To have value, the plan must represent the current needs and values of your community and be useful for officials, stakeholders and citizens. Consider the critical importance of mitigation to:

- Protect public safety and prevent loss of life and injury.
- Reduce harm to existing and future development.
- Prevent damage to a community's unique economic, cultural, historical, and environmental assets.

**This planning project is funded by a FEMA grant provided through the Virginia Department of Emergency Management(VDEM).*

Disasters can happen any time, any where, and any place.

They can cause loss of life; damage buildings and infrastructure; and have devastating consequences on a community's economic, social, and environmental well-being. Hazard mitigation planning is a process that identifies hazards and their risks to your community, and analyzes the vulnerability of people, property, the environment and the economy. The outcome of the planning process is a comprehensive mitigation strategy that presents sustained actions to reduce or eliminate disaster damages and the long-term risks that result from these hazards. In addition, many of these actions will build community resilience to withstand future hazard events.

In March 2021, the four counties, and 15 cities and towns comprising the Northern Virginia region will initiate a collaborative planning effort to develop the 2022 update of the Northern Virginia Hazard Mitigation Plan. The benefits gained during this planning process, and the mitigation actions that will ultimately implement the Plan, will have great significance to your community's future sustainability.

Your participation is needed!

You can support the planning effort by:

- Learning how hazards impact your community and how to reduce your vulnerability to various hazards such as flood, severe weather, and earthquake.
- Participating in the Hazard Mitigation Survey, providing information about hazard events and their impacts.
- Verifying information related to community assets and vulnerabilities.
- Reviewing the plan components and providing input to ensure relevancy to your community.

A-3.2. Public Survey & Posts

Northern Virginia Hazard Mitigation Plan – 2022 Update

Northern Virginia Hazard Mitigation Public Survey

We need your assistance!

The jurisdictions of Northern Virginia are preparing an update to the 2017 Northern Virginia Hazard Mitigation Plan. The regional plan will identify local policies and actions for reducing risk and future losses from hazards such as floods, severe storms, wildfires, winter weather, and more.

The plan will meet key federal planning regulations that require local governments to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance, including funding for hazard mitigation projects.

This survey provides an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that help lessen the impacts of future disasters. Participation in the survey is voluntary and none of the information you provide will be attributed to you.

If you have any questions regarding this survey, or if you would like to learn more about how you can participate in the update of our hazard mitigation plan, please contact your local emergency management agency.

This product was funded by the Federal Emergency Management Agency through the Virginia Department of Emergency Management, via Grant Agreement Number PDMC-PL-03-VA-2018-003 for $250,000.

1. Please name the county(s) and city(s), or town(s) in which you live. *

   *This is a required question.

   Live: Select County Select City Select Town

2. If applicable, please name the county(s), city(s), or town(s) in which you work.

   Work: Select County Select City Select Town

3. Using the list provided, identify all natural hazards that you or someone in your household have directly experienced in the past five (5) years.

   ☐ Climate change
   ☐ Dam failure
   ☐ Drought
   ☐ Earthquake
   ☐ Extreme heat or cold
   ☐ Flood/Flash flood
   ☐ High wind (severe storm, including thunderstorm, hail, and lightning)
   ☐ Landslide
   ☐ Sinkhole/Land subsidence
   ☐ Tornado
   ☐ Wildfire
   ☐ Winter storm
   ☐ Other – Please identify: Click or tap here to enter text.

4. Using the list provided, identify all non-natural hazards that you or someone in your household have directly experienced in the past five (5) years.

   ☐ Active violence
   ☐ Civil unrest
   ☐ Communication disruption

☐ Cyber attacks

☐ Hazardous materials

☐ Pandemic/Public health

☐ Terrorism

☐ Other – Please identify: Click or tap here to enter text.

5. How concerned are you about the following natural hazards affecting your community? Using the list provided, indicate the level of your concern on a scale from 1 through 5, where 1 is very concerned and 5 is not concerned about the impacts each hazard presents to people, businesses, or properties in your community. *

   *This is a required question.

   1-5 Climate change
   1-5 Dam failure
   1-5 Drought
   1-5 Earthquake
   1-5 Extreme heat or cold
   1-5 Flood/Flash flood
   1-5 High wind (severe storm, including thunderstorm, hail, and lightning)
   1-5 Landslide
   1-5 Sinkhole/Land subsidence
   1-5 Tornado
   1-5 Wildfire
   1-5 Winter storm
   1-5 Other – Please identify: Click or tap here to enter text.

6. How concerned are you about the following non-natural hazards affecting your community? Using the list provided, indicate the level of your concern on a scale from 1 through 5, where 1 is very concerned and 5 is not concerned about the impacts each hazard presents to people, businesses, or properties in your community. *

   1-5 Active violence
   1-5 Civil unrest
   1-5 Communication disruption
   1-5 Cyber attack
   1-5 Hazardous materials
   1-5 Pandemic/Public health
   1-5 Terrorism
   1-5 Other – Please identify: Click or tap here to enter text.

7. What are the most effective ways for you to receive information about hazard mitigation, preparedness, response, and recovery? Please select all that apply.

   ☐ Community organization

   ☐ County/City/Town website

☐ Email

☐ Emergency management agency

☐ Facebook/Other social media

☐ Fact sheet/Brochure

☐ Faith-based organization

☐ Fire/Rescue department

☐ Library

☐ Mail

☐ Newspaper

☐ Phone call

☐ Public workshop/Meeting

☐ Radio

☐ School

☐ Television

☐ Text message

☐ Word of mouth

☐ Other – Please identify: Click or tap here to enter text.

8. Using the list provided, rank what you are most worried about being impacted by hazards in your community on a scale from 1 through 6, where 1 is most worried and 6 is least worried.

   1-6 Economic – Business closures or job loss.
   1-6 Environmental – Damage to or loss of waterways or other natural resources.
   1-6 Governance – Ability to maintain order and/or provide amenities and services.
   1-6 Human – Loss of life and/or injuries.
   1-6 Infrastructure – Damage to or loss of bridges, utilities, schools, etc.
   1-6 Other – Please identify: Click or tap here to enter text.

9. Using the list provided, rank the community assets and resources in order of importance to you on a scale from 1 through 15, where 1 is most important and 15 is least important.

   1-15 College/University campuses
   1-15 Dams
   1-15 Elder care
   1-15 Faith-based facilities
   1-15 Government facilities

1-15 Historical sites (e.g., cemeteries, battlefields)
1-15 Hospitals/Other healthcare
1-15 Major employees
1-15 Museums/Historical buildings
1-15 Parks/Recreation areas/Facilities
1-15 Police/Fire stations
1-15 Schools (K–12)
1-15 Significant bridges
1-15 Small businesses
1-15 Other – Please identify: Click or tap here to enter text.

10. Using the list provided, indicate the level of importance each of the following activities have in protecting your community from hazards on a scale from 1 through 5, where 1 is very important and 5 is not important. *

    *This is a required question.

    1-5 Prevention – Administrative/Regulatory actions such as building codes that influence construction and development and planning activities such as emergency and resilience planning, strategic planning, and integrating hazard planning into jurisdiction policies and procedures.
    1-5 Protection of natural resources – Actions that minimize damage and preserve or restore the function of natural systems.
    1-5 Public education and awareness – Actions to inform residents about hazards and steps they can take to protect themselves and their property.
    1-5 Structural projects – Actions designed to lessen the impact of hazards to existing facilities, buildings, and infrastructure, such as elevating homes and buildings.
    1-5 Other – Please identify: Click or tap here to enter text.

11. Additional comments: _____

Northern Virginia Hazard Mitigation Plan – 2022 Update

Public Engagement Web Resources

General Mitigation Information and Resources

- Centers for Disease Control and Prevention, Disaster Resources: https://www.cdc.gov/disasters/disaster_resources.html (education materials in 23 languages, social media, PSAs)
- FEMA Fact Sheet, Natural Hazard Mitigation Saves Interim Report: https://www.fema.gov/sites/default/files/2020-07/fema_mitsaves-factsheet_2018.pdf
- The Journal of the American Institute of Architects, Investing in Resilience Pays Off More Than Thought, New NIBS Study Finds: https://www.architectmagazine.com/technology/investing-in-resilience-pays-off-more-than-thought-new-nibs-study-finds_o
- National Institute of Building Sciences, Natural Hazard Mitigation Saves 2019 Report: https://www.nibs.org/projects/natural-hazard-mitigation-saves-2019-report
-

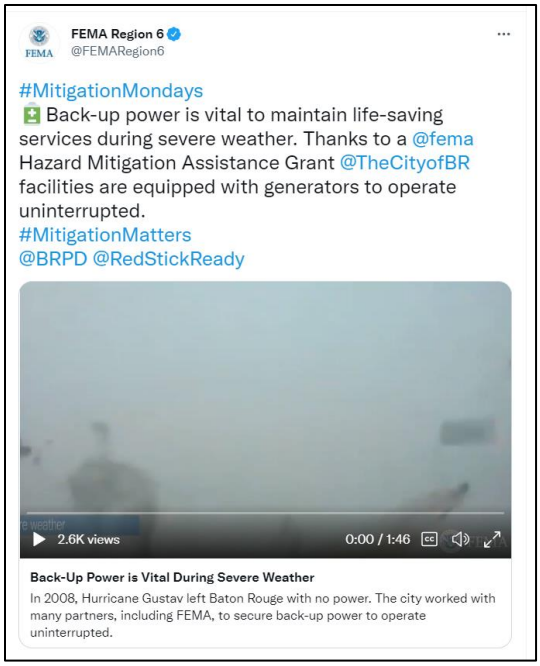
Social Media

Plan update: https://twitter.com/NCEmergency/status/1425797396181786625?s=20

Plan update and virtual public workshop:
https://twitter.com/CityofMenloPark/status/1425241817554030607?s=20

Story Map: https://twitter.com/CamdenCountyOEM/status/1424744795692539908?s=20

Mitigation awareness and education:
https://twitter.com/FEMARegion6/status/1424772205586563073?s=20



Using stakeholders to spread the word: https://twitter.com/FloodsOrg/status/1424768937368203268?s=20

Prepare with Pedro: https://twitter.com/femaregion5/status/1408059651506192385?s=20

Los Aguas de Inundaciones Son Peligrosas (Floodwaters are Dangerous): https://twitter.com/FEMAespanol/status/1425851940806828041?s=20

- Other FEMA social media resources: FEMA and FEMA en español on Facebook, FEMA on Instagram

Preparedness

- Build a kit: https://www.ready.gov/kit; https://www.redcross.org/get-help/how-to-prepare-for-emergencies/survival-kit-supplies.html
- KnoWhat2Do: https://knowhat2do.com/
- Pet preparedness:

  - The Humane Society of the United States: https://www.humanesociety.org/resources/make-disaster-plan-your-pets
  - ASPCA: https://www.aspca.org/pet-care/general-pet-care/disaster-preparedness

Mitigation Game (not just for kids!)

- UN Office for Disaster Risk Reduction, Stop Disasters game: https://www.stopdisastersgame.org/

Kids

- American Red Cross Pillowcase Project: https://www.redcross.org/get-help/how-to-prepare-for-emergencies/teaching-kids-about-emergency-preparedness/pillowcase-project.html
- Ready Kids: https://www.ready.gov/kids

Property Owners and Renters

- FEMA, Property Owners and the Hazard Mitigation Grant Program: https://www.fema.gov/grants/mitigation/hazard-mitigation/property-owners#businesses
  - https://s29422.pcdn.co/wp-content/uploads/2018/12/Homeowners-Guide-to-the-Hazard-Mitigation-Grant-Program.pdf
- National Flood Insurance Program: https://www.floodsmart.gov/
- FEMA, Homeowners Guide to Retrofitting: https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf (flooding retrofits)
- FEMA, An Overview of the Retrofitting Methods: https://www.fema.gov/pdf/rebuild/mat/sec3.pdf (flooding retrofits)
- This Old House, How to Retrofit a Home for an Earthquake: https://www.thisoldhouse.com/natural-disasters/21124729/how-to-retrofit-a-home-for-an-earthquake (video and article)
  - https://www.youtube.com/watch?v=KtZUZIRDr1Y (video only)
- Renters insurance education:
  - https://www.nerdwallet.com/article/insurance/renters-insurance-coverage#what-does-renters-insurance-cover
  - https://www.allstate.com/tr/renters-insurance/renters-insurance-storm-damage.aspx (Note: Allstate, note it is not an endorsement)
- Car insurance and natural disasters: https://www.caranddriver.com/car-insurance/a36320336/does-car-insurance-cover-natural-disasters/
- Social media example: https://twitter.com/citizens_fla/status/1424805187848396806?s=20

Businesses

- Forbes, Natural Disaster Protection: 5 Ways to Prepare Your Business: https://www.forbes.com/sites/allbusiness/2019/08/21/natural-disaster-protection-business-preparation/?sh=47b77de25bc1
- FEMA, Property Owners and the Hazard Mitigation Grant Program: https://www.fema.gov/grants/mitigation/hazard-mitigation/property-owners#businesses
    - https://s29422.pcdn.co/wp-content/uploads/2018/12/Homeowners-Guide-to-the-Hazard-Mitigation-Grant-Program.pdf

Videos

- FEMA, A Customer Experience Video Toolkit: https://youtu.be/mmAsy3PbYes
- FEMA, Flood Insurance Advocate Explains When Flood Insurance is Required: https://youtu.be/TxnU2AVdYFk
- FEMA, When the Fire Starts: https://youtu.be/tWhTdfHQWqs (wildfire)
- FEMA, When the Storm Comes: https://youtu.be/GsjUfdaW67k (severe storm)
- FEMA, When the Waves Swell: https://youtu.be/STiMKEYZ3Q4 (hurricane)
- FEMA, When the Sky Turns Gray: https://youtu.be/XVpGJ_Xl__w (winter weather)
- FEMA, When the Clouds Form: https://youtu.be/LmCnXWN0Dwc (flood)
- FEMA, When the Earth Shakes: https://youtu.be/MKILThtPxQs (earthquake)
- FEMA, Flood Risk: What is Coastal Flooding? https://youtu.be/QiF9V1lO9WA (flood insurance)
- FEMA, Flood Risk: What is Flash Flooding? https://youtu.be/Ay0yAQIaKKQ (flood insurance)
- FEMA, Flood Insurance Advocate Explains Flood Claims: https://youtu.be/OeaI973gFjo
- FEMA, Mitigation Success: https://youtu.be/yT3gYkRObAE (house elevation and Hurricane Sandy)
- Cal OES, State Hazard Mitigation Plan: https://youtu.be/LBL7444aPOo
- Minnesota Department of Public Safety, Reducing the Risk: Hazard Mitigation at Work: https://youtu.be/jNIajqZ4Ykw
- Build With Strength, Hazard Mitigation: https://youtu.be/6jRGdHVczWs (Note: A Coalition of the National Ready Mixed Concrete Association video)

- Planetizen Courses, What is Hazard Mitigation? https://youtu.be/e5AhODT_-Eo (15-minute lecture style video)

A-3.3. Survey Results

Q1 Please indicate where you live.

ANSWER CHOICES	RESPONSES	#
Arlington County	4.02%	45
Fairfax County	53.44%	598
Loudoun County	21.63%	242
Prince William County	1.79%	20
City of Alexandria	0.63%	7
City of Fairfax	3.40%	38
City of Falls Church	3.57%	40
City of Manassas	0.18%	2
City of Manassas Park	0.45%	5
Town of Dumfries	0.00%	0
Town of Hamilton	0.00%	0
Town of Haymarket	0.27%	3
Town of Herndon	1.43%	16
Town of Hillsboro	0.18%	2
Town of Haymarket	0.00%	0
Town of Leesburg	2.59%	29
Town of Lovettsville	1.16%	13
Town of Middleburg	0.00%	0
Town of Occoquan	0.27%	3
Town of Purcellville	2.06%	23

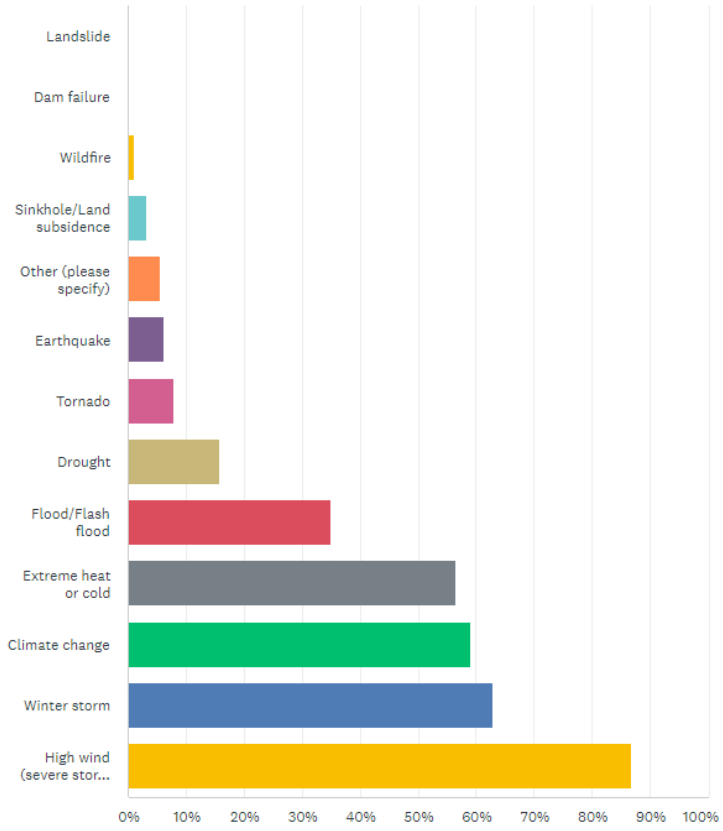
Town of Quantico	0.00%	0
Town of Round Hill	0.45%	5
Town of Vienna	2.50%	28
TOTAL		1,119

Q2 Please indicate where you work, if applicable.

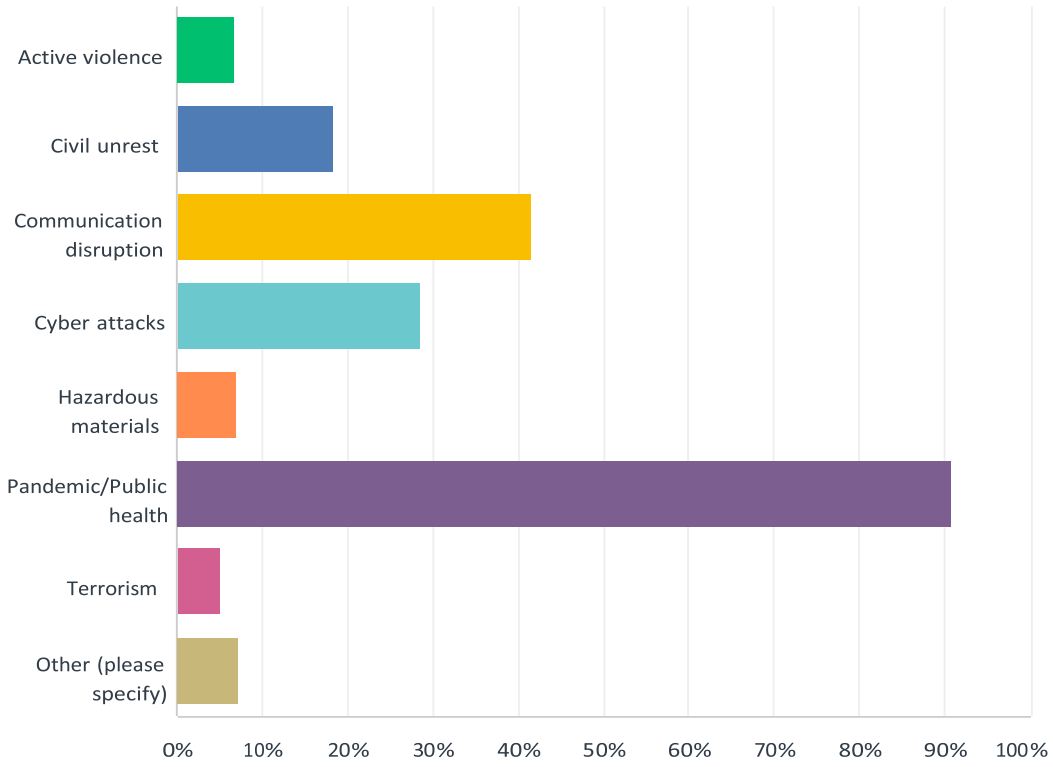
ANSWER CHOICES	RESPONSES	#
Arlington County	8.22%	56
Fairfax County	49.63%	338
Loudoun County	18.94%	129
Prince William County	2.06%	14
City of Alexandria	2.20%	15
City of Fairfax	2.94%	20
City of Falls Church	3.52%	24
City of Manassas	0.59%	4
City of Manassas Park	0.15%	1
Town of Dumfries	0.15%	1
Town of Hamilton	0.00%	0
Town of Haymarket	0.29%	2
Town of Herndon	1.17%	8
Town of Hillsboro	0.00%	0
Town of Leesburg	4.70%	32
Town of Lovettsville	1.32%	9

ANSWER CHOICES	RESPONSES	#
Town of Middleburg	0.15%	1
Town of Occoquan	0.15%	1
Town of Purcellville	1.47%	10
Town of Quantico	0.00%	0
Town of Round Hill	0.00%	0
Town of Vienna	2.35%	16
TOTAL		681

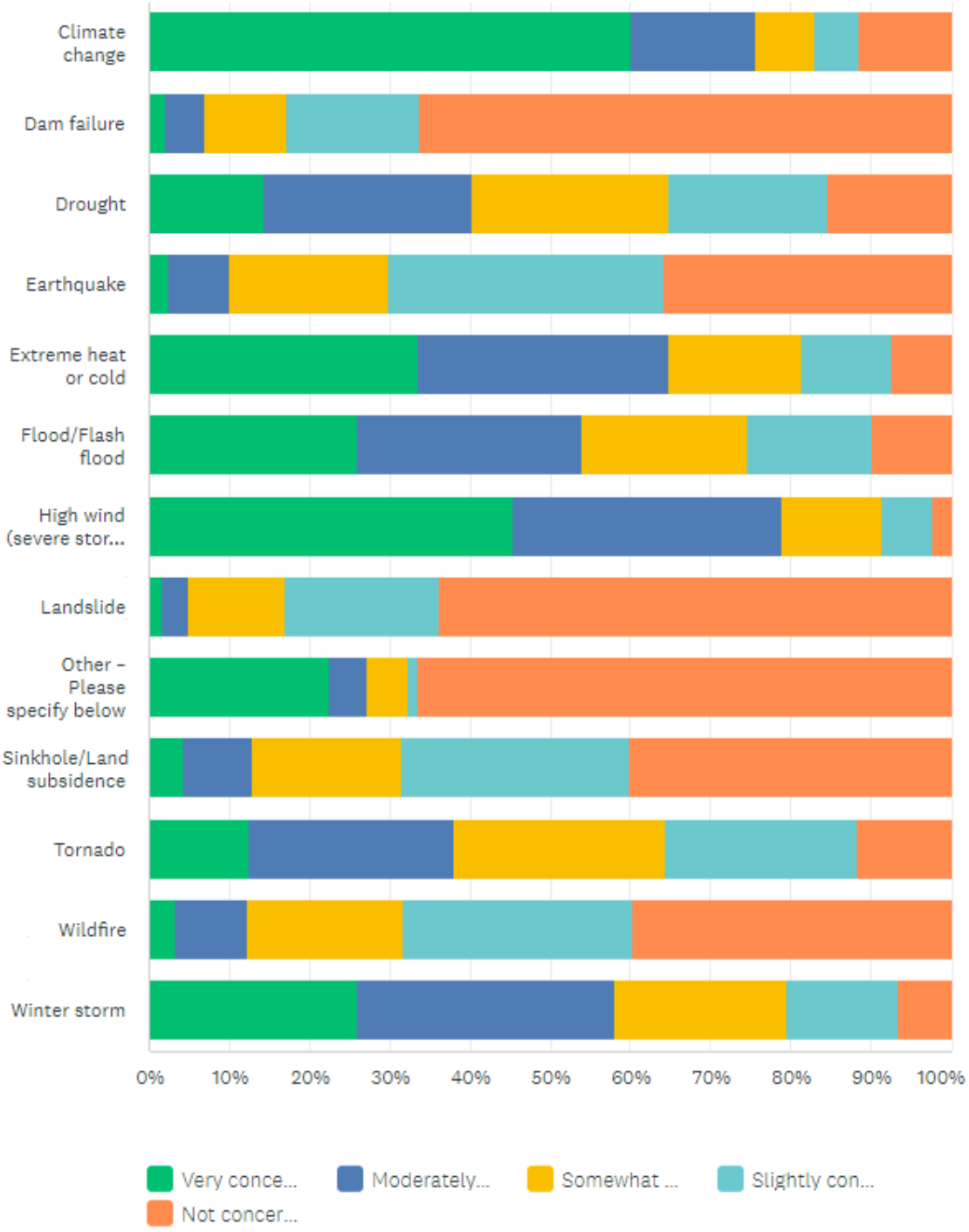
Q3 Using the list provided, identify all the natural hazards that you or someone in your household have directly experienced in the past five (5) years.



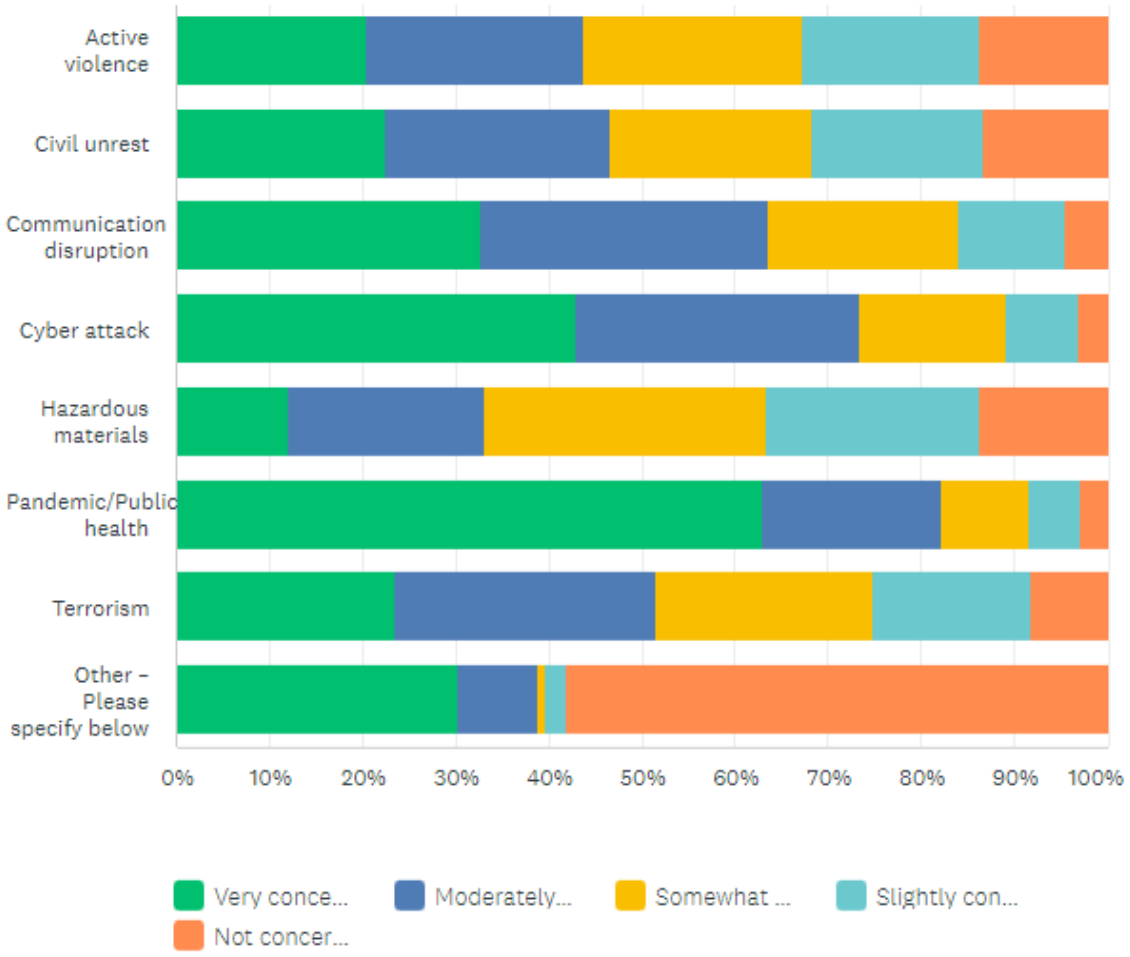
Q4 Using the list provided, identify all non-natural hazards that you or someone in your household have directly experienced in the past five (5) years.



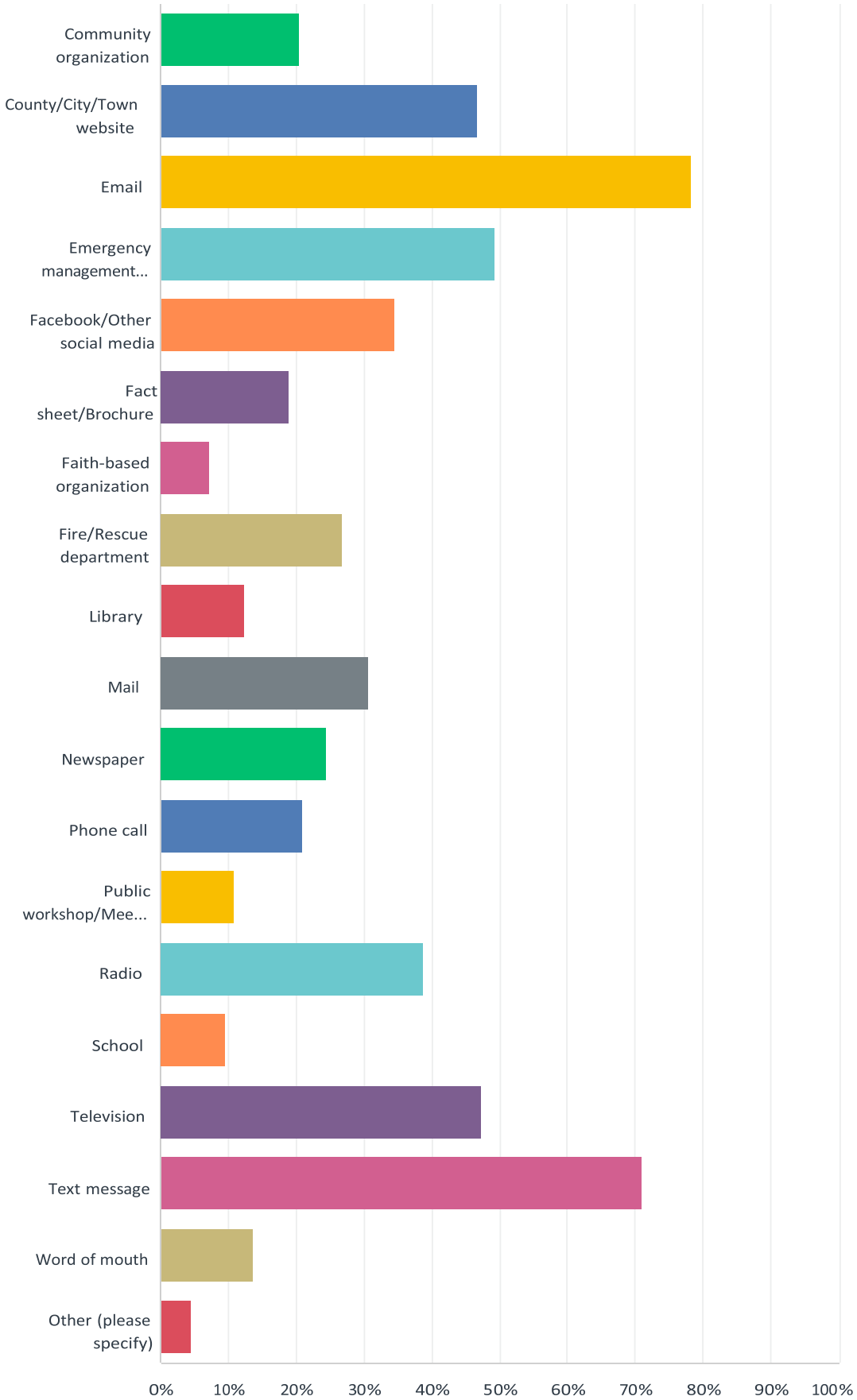
Q5 How concerned are you about the following natural hazards affecting your community? Using the list provided, indicate the level of your concern on a scale from very concerned to not concerned about the impacts each hazard presents to people, businesses, or properties in your community.


Climate change
Dam failure
Drought
Earthquake
Extreme heat or cold
Flood/Flash flood
High wind (severe stor...
Landslide
Other – Please specify below
Sinkhole/Land subsidence
Tornado
Wildfire
Winter storm
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Very conce...
Moderately...
Somewhat ...
Slightly con...
Not concer...

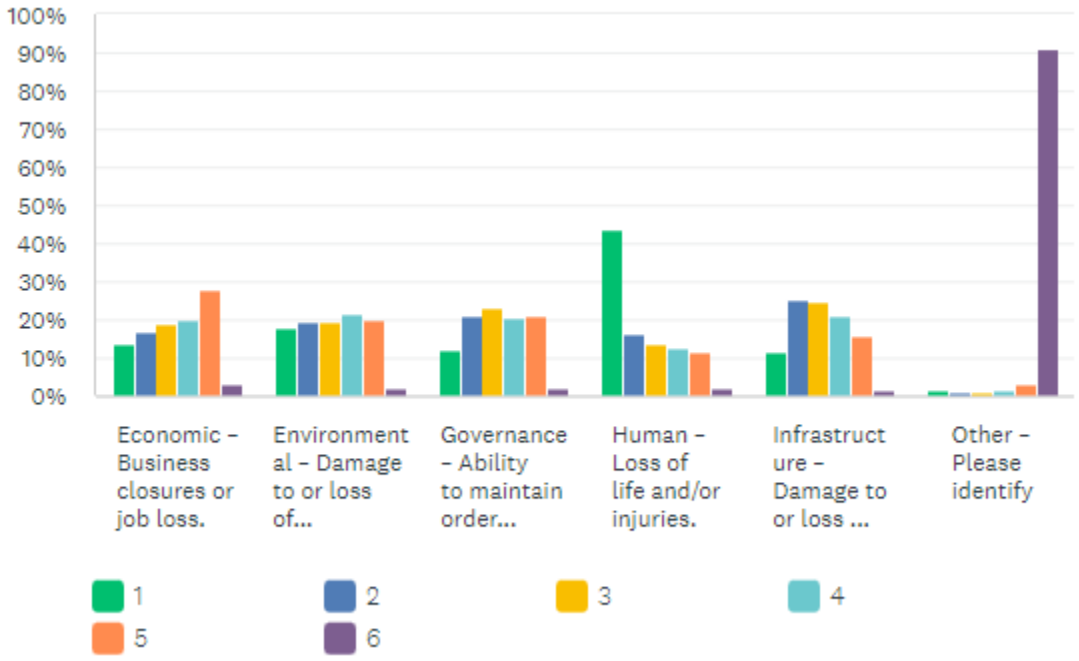
Q6 How concerned are you about the following non-natural hazards affecting your community? Using the list provided, indicate the level of your concern on a scale from very concerned to not concerned about the impacts each hazard presents to people, businesses, or properties in your community.



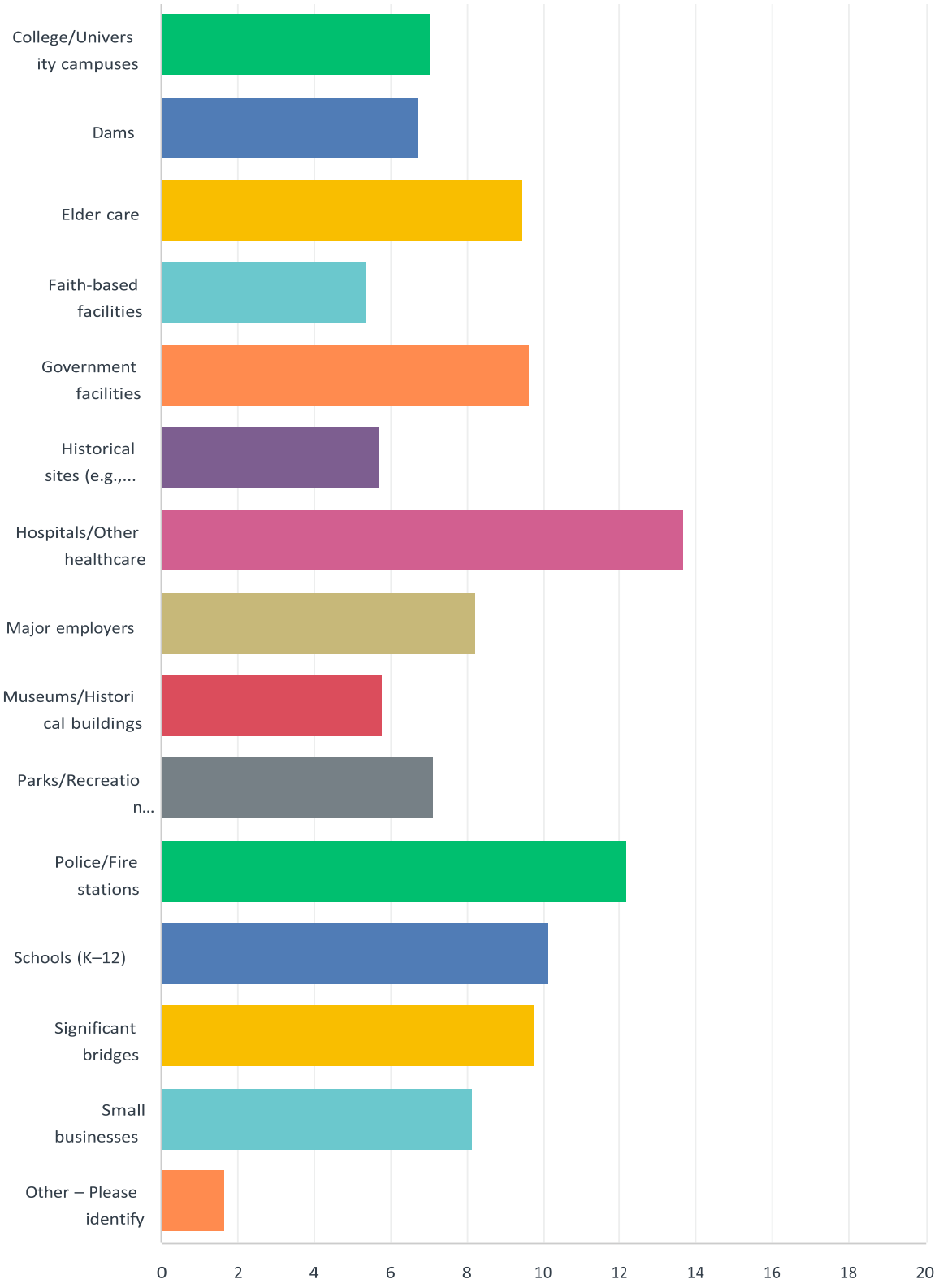
Q7 What are the most effective ways for you to receive information about hazard mitigation, preparedness, response, and recovery? Please select all that apply.


Community organization
County/City/Town website
Email
Emergency management...
Facebook/Other social media
Fact sheet/Brochure
Faith-based organization
Fire/Rescue department
Library
Mail
Newspaper
Phone call
Public workshop/Mee...
Radio
School
Television
Text message
Word of mouth
Other (please specify)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

Q8 Using the list provided, rank what you are most worried about being impacted by hazards in your community on a scale from 1 through 6, where 1 is most worried and 6 is least worried.



Q9 Using the list provided, rank the community assets and resources in order of importance to you on a scale from 1 through 15, where 1 is most important and 15 is least important.


College/University campuses
Dams
Elder care
Faith-based facilities
Government facilities
Historical sites (e.g.,...
Hospitals/Other healthcare
Major employers
Museums/Historical buildings
Parks/Recreation...
Police/Fire stations
Schools (K–12)
Significant bridges
Small businesses
Other – Please identify
0
2
4
6
8
10
12
14
16
18
20

Q10 Using the list provided, indicate the level of importance each of the following activities have in protecting your community from hazards on a scale from very important to not important.

	VERY IMPORTANT	MODERATELY IMPORTANT	SOMEWHAT IMPORTANT	SLIGHTLY IMPORTANT	NOT IMPORTANT	TOTAL
Prevention – Administrative/Regulatory actions such as building codes that influence construction and development and planning activities such as emergency and resilience planning, strategic planning, and integrating hazard planning into jurisdiction policies and procedures.	73.77% 824	17.55% 196	6.36% 71	1.52% 17	0.81% 9	1,117
Protection of natural resources – Actions that minimize damage and preserve or restore the function of natural systems.	66.34% 741	22.56% 252	8.06% 90	2.33% 26	0.72% 8	1,117
Public education and awareness – Actions to inform residents about hazards and steps they can take to protect themselves and their property.	56.14% 626	30.85% 344	10.31% 115	2.42% 27	0.27% 3	1,115
Structural projects – Actions designed to lessen the impact of hazards to existing facilities, buildings, and infrastructure, such as elevating homes and buildings.	57.64% 641	28.96% 322	10.88% 121	2.25% 25	0.27% 3	1,112
Other – Please specify below	40.91% 63	6.49% 10	5.19% 8	0.65% 1	46.75% 72	154

Q11 Additional Comments: (91 comments)

1. This information is very helpful to me. Thank you.
2. Reduce government spending. Let the market allocate labor where it is most needed. Nothing should be too big to fail. Preserve property rights, enforce contracts, and hold businesses accountable for reckless endangerment. End abortion.
3. Thank you for helping to maintain my safe little bubble. I think about that fact when I read/watch the news.
4. If we don't address climate change (environmental justice as well), then most of the other priorities will not be meaningful in the long run. If we don't address infrastructure and social justice issues, then portions of our communities will be left out and preparedness will not reach all those who will need to be reached and need a voice in these issues. Thank you!
5. Please include food security - grocery stores remaining stocked and no one being hungry
6. Understand cell phones have largely replaced sirens/physical comms outside but I am a huge proponent
7. pan handlers are a hazard to traffic and harass the public.
8. A major threat to Lovettsville is the increased intensity of storms and the town government's unwillingness to address drainage & water issues. Flooding of streets, businesses & homes is happening because the town won't address the aging drainage & water systems. Instead continue to build, circumventing county & state regulations all the while creating a bigger, more dangerous situation for its residents & those who commute through town. It has taken a toll on our roads causing them crumble. While the town cannot be blamed for climate change, where they are investing money is misguided and is causing serious damage to the safety of the community and those who visit.
9. My "other" in question #9 is Libraries
10. I think that as part of resilience and prevention education there also needs to be a little bit of acceptance/expectation that as we recover and prepare for disasters and emergencies, some things may change drastically ; we're not just trying to preserve how things are, we're trying to minimize loss or major impact over all.
11. you should look at main arteries and consider what it would take to reduce impact on access to include reconsideration of where people are living when the pandemic is more under control how do you connect people, but keep them safe?
12. Please let me know where the results will be published and the subsequent use of the data.
13. Bury the lines.
14. Taking this survey, I realized I don't know much about the flood zones or dams in our area.
15. It cripples our community
16. Irresponsible land-use decisions in Arlington have created many of these problems
17. Mother Nature is sending us some pretty strong messages. We ignore her at our own peril.
18. I am impressed by what I know of Arlington's planning for future hardships, but we depend on many resources from outside of our region. I hope we can work to plan with those partners, both governmental and commercial, so that essentials like food, water, and power will be safeguarded at every point in their life cycle and in transit.
19. The more often this survey is provided, the more residents can bring these issues into their own thoughtful perspective.
20. Springfield area is a mess, a lot worth than DC now and county does do enough to protect residents from crime, street beggars, homeless people, street crime, noise, gun shot,
21. Include internet and power grid as significant risk areas.
22. Considering the increasing population density surrounding Dulles Airport, enhanced planning preparation should be conducted to support response to an aviation disaster.
23. Thank you for seeking Community input. And thanks for the steps being taken to prevent a wide range of potential harm to local residents.
24. i would like to see less new buildings, no more destruction of green areas to build apartments and other structures.
25. Thank you

26. "Civil unrest" is not a "disaster" to me - it's usually a necessary way to demand change from broken institutions. A better term might be "hate crimes" (i.e. the Trump supporters that were here protesting the inauguration), where I don't feel safe walking around; BLM protestors don't make me feel unsafe.
27. Ordering 15 things in survey monkey is asking for inaccuracy.
28. This is a pretty poor survey to be giving out to the public. Something with concrete examples would be a better way of doing a comparative analysis for prioritization. I also would have liked to see a link to a form in Spanish.
29. Why doing nothing to protect from an EMP strike?
30. Policies and regulations are useless unless they're enforced (see: building codes and lack of enforcement in Fairfax County).
31. A climate readiness plan is needed in Loudoun that aligns with the Metropolitan Washington Council of Governments plan. Extreme weather events such as flooding and heat events are projected to increase. Loudoun needs to to require data centers to transition to renewables as our Greenhouse gas emissions that are are polluting and heating the atmosphere (causing flooding and heat events) are increasing whereas in the other counties around us they are decreasing.
32. No money for Illegals. More money for the elderly and truly needy that have contributed to building Fairfax.
33. With the extreme weather that now comes our way more often, the large number of older and often diseased or dead trees has become a serious hazard to people and property. Something should be done to require property owners to timely remove trees that are obviously dead or hanging over other properties.
34. There was not a comment section for question 9 - that is "Electrical Power"
35. These questions and answers could be used to justify just about any actions. I have little confidence that this survey will be used to actually lessen dangers to the community.
36. More needs to be done to preserve trees and green spaces, especially natives. This is a key component of fighting climate change. Zoning needs to reflect this.
37. Storm water management! Cross drains, culverts, bridges, etc.
38. Survey seemed very subjective
39. For climate change, create an "action list" for residents who want to contribute: plant trees, divest from fossil fuels, use renewable resources, buy hybrid, etc.
40. I'm a CFM if you need help
41. Thank you for conducting this survey.
42. Question 9 Other: Water sources for drinking, Grocery stores.
43. On #9, there is no place to identify the "Other" option. I would like to identify "Water/Wastewater Infrastructure" as Item #6.
44. Q.9 - where is the option to say protect our clean water sources? Also, I know dams are in a terrible state in this country, but it shouldn't be on the public to identify where they should rank in infrastructure priority. I also would like to say that I consider providing cooling centers, during heatwaves, that we know are going to be more severe and frequent, is my #1 priority.
45. More comprehensive pandemic response mechanisms should be somewhere in this survey.
46. Question 9 answered solely as to personal importance/usage; not based on perceived importance to overall community.
47. Stop killing trees and erecting housing!
48. Rt 15, rt 9 and rt. 7 west of Leesburg need 4 more lanes each
49. We need a full, all out effort on stamping out misinformation and conspiracy theories. People need to learn how to think critically and make decisions based on facts and evidence. The county should offer courses on how to determine the validity of information, how to research, and how to improve critical thinking skills. Not only do we need to encourage people to verify what they hear, we need to do a better job at making people understand the consequences of not following recommended guidelines and facts. I am sick and tired of being the "team player" subjected to the idiocy by those that aren't!
50. Roads and airports not listed on 9. Rank #2.
51. Greater public awareness of threats to our community needed even to respond effectively to this survey. I do not know whether dams are important to life in Loudoun County. Also, should have listed DC as an option for the question "where do you work?" I work in Loudoun (at home) some days, and in DC half the week.
52. Thank you for working to help protect our communities!

53. Newvalley Church Road and Taylorstown Road need significant safety improvements. Tree limbs frequently fall onto the roadway and the power lines. Lack of shoulders makes these hazards even harder to avoid.
54. Electric, water, and gas facilities and date centers should have been included.
55. #9. Libraries - Assumes public libraries are part of government facilities.
56. For #9 other = utilities, data centers
57. Electric wires need to be buried. No longer on antiquated light poles that get knocked down every time there is a storm.
58. Please know that I have lived in NOVA only since June 2021. Thank you for your efforts and for doing this very important work.
59. Need much more investment in public transportation
60. Ranking 15 items is a lot. Too much to do accurately.
61. The fact this survey omitted hurricanes and tropical storms is likely to skew the results.
62. This survey doesn't function well on mobile iOS.
63. Infrastructure and daily life are so interconnected with natural systems. Education and planning are critical to reshape our relationship to risks and hazards in order to avoid major consequences like loss of life and damage to road and communication networks. We really need to take design of landscapes seriously -- don't build in the floodplain, reduce and do not support more impervious surface, do not support the use of hazardous materials when nonhazardous alternative actions and materials are appropriate, etc. We have to totally rethink the way the do things, and act now.
64. Of course preparedness in this area is very important. HOWEVER, if this is used to play politics as has been done with COVID and climate change, NO ONE WILL LISTEN TO YOU. We should be dealing with realistic threats, and reasoned responses. Not fear-mongering.
65. Water quantity and quality - groundwater sustainability are extremely important - A 2-year drought will devastate the region
66. Question #9 #15 is lesser infrastructure projects, like roads
67. Many of the please specify options don't work. This survey should have been copy edited and pretested.
68. Thanks for compiling and disseminating this survey.
69. Don't Tread On Me!!!
70. NA
71. Financial responsibility in only spending money we can afford is most important. The important question is what can we afford to do
72. thank you
73. Thanks!!
74. Not a particularly good or useful survey. It could provide very misleading results. Because of this online surveys are dangerous as it fails to reflect real relative preferences. God forbid that this is used to identify priorities!
75. Loudoun County is fortunate to have caring and competent elected officials, school boards, and public servants.
76. We have never been a weak nation. We have not yet felt the impact of illegal entry to our country but it is coming.
77. The ranking tool above (especially the 1-15 one) does not work well, I would be very concerned that the data is not good
78. Flooding is a major problem in western Loudoun. Houses being built in towns like Lovettsville cause flooding to others property and there is a huge need for proper drainage throughout the county.
79. In Q9 above, I think you meant to say major employers vs. major employees.
80. Thank you for this survey
81. Ranking importance of community assets is utter insanity, where a community to function in a healthy manner requires a balance between law and order, the environment, the economy, education and health. What a waste of time to try to prioritize whether a small business or a large employee, or what level of education takes precedence over another.
82. In item 9, I wasn't sure what "major employees" signified. I probably would have ranked that higher, if I knew what it meant.
83. Infrastructure is aging and will need to be updated and protected to prevent a major disaster, especially with the amount of people and road traffic in this area. Also cyber attacks is another major

issue that is not being prioritized enough as it can affect infrastructure and public and private areas. It's in everyone's best interest to prevent and mitigate what we can today through regulations, policy, structural projects and public buy-in for support.
84. I do contingency planning/emergency management for a living. I took this survey from my perspective of 15+ years in this industry. Thank you for sending out this surgery.
85. For 'other' on question 8–failure of the electrical grid
86. Note in #9 should read "major employers" not "employees". My other there is "watershed/waterways" there was no clear way to identify other.
87. Mantua Fairfax needs utilities buried underground and serious attention to trees by arborists.
88. Food and water supply should be on the agenda too.
89. In item 9, my top priority category, "Other" is "Infrastructure", including transportation infrastructure (roads, rail, [bridges], etc.) and utility infrastructure (electricity, gas, water, wastewater, stormwater and internet).
90. I live in Falls Church City and work here during the pandemic, though my office is in Washington DC. I chose Fairfax as my residence because Falls Church City was not available
91. Cut down ….. trees that are near power lines or that can fall on people's houses....stupid let a tree fall on ur house then scream climate change....morons

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A-3.4. Final Draft HMP Public Comment Outreach

The following was sent in an email and in a press release and placed on the NVER website along with other participating jurisdictional websites:

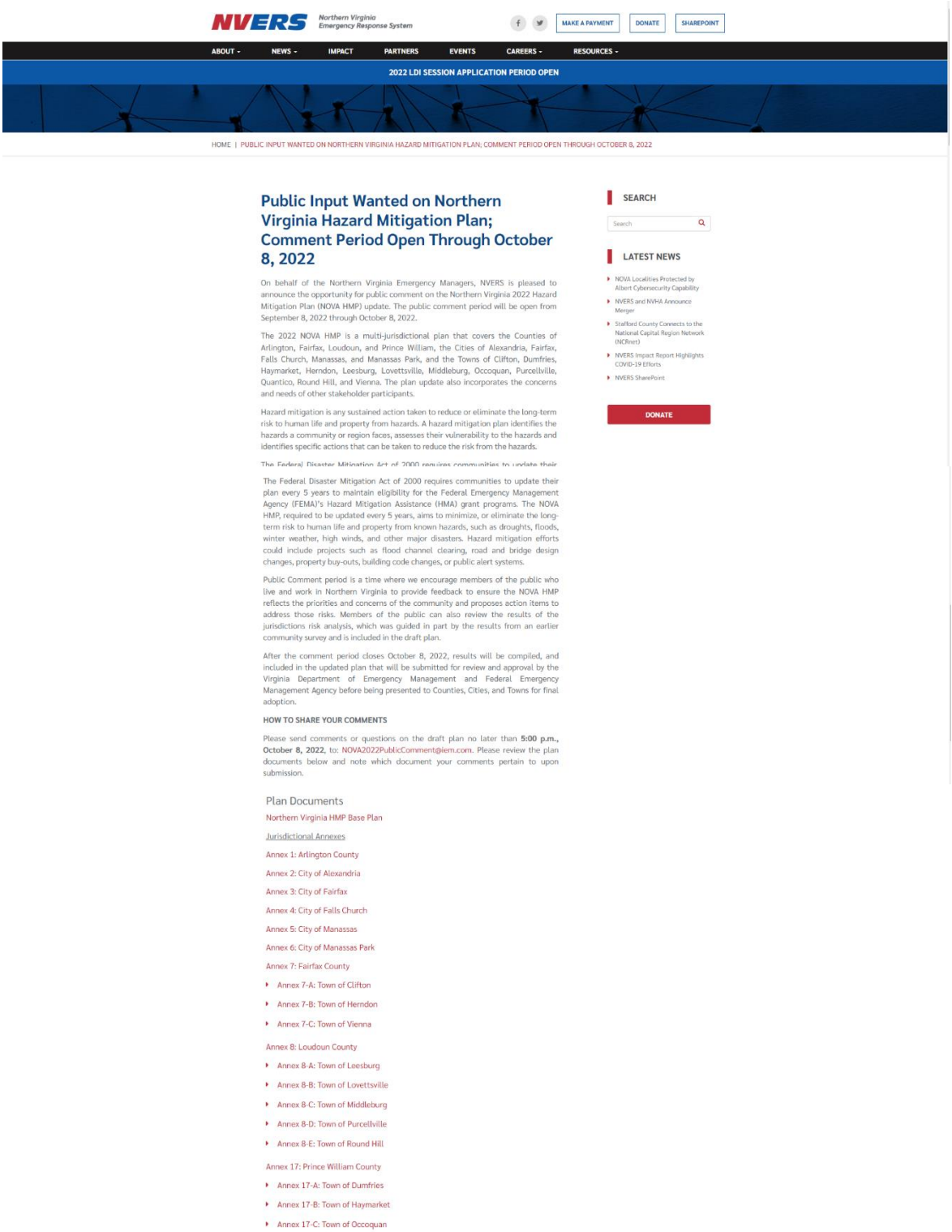
The Northern Virginia Emergency Managers and staff have been working on the 2022 update to the Northern Virginia Hazard Mitigation Plan. The plan is in final draft form and is now available for regional stakeholder and public comment. We invite all regional stakeholders to review the Base Plan and any relevant annexes to provide comment NLT October 8th. To access the planning documents, visit https://www.nvers.org/hmp. Please complete the attached stakeholder review comment form and email to NOVA2022PublicComment@iem.com.

The 2022 NOVA Hazard Mitigation Plan is a multi-jurisdictional plan that covers the Counties of Arlington, Fairfax, Loudoun, and Prince William, the Cities of Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park, and the Towns of Clifton, Dumfries, Haymarket, Herndon, Leesburg, Lovettsville, Middleburg, Occoquan, Purcellville, Quantico, Round Hill, and Vienna. The plan update also incorporates the concerns and needs of other stakeholder participants.

Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. A hazard mitigation plan identifies the hazards a community or region faces, assesses their vulnerability to the hazards and identifies specific actions that can be taken to reduce the risk from the hazards.

The Federal Disaster Mitigation Act of 2000 requires communities to update their plan every 5 years to maintain eligibility for the Federal Emergency Management Agency (FEMA)'s Hazard Mitigation Assistance (HMA) grant programs. The NOVA HMP, required to be updated every 5 years, aims to minimize, or eliminate the long-term risk to human life and property from known hazards, such as droughts, floods, winter weather, high winds, and other major disasters. Hazard mitigation efforts could include projects such as flood channel clearing, road and bridge design changes, property buy-outs, building code changes, or public alert systems.

How it appeared on the NVERS website



NVERS Northern Virginia Emergency Response System

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2022 LDI SESSION APPLICATION PERIOD OPEN

HOME | PUBLIC INPUT WANTED ON NORTHERN VIRGINIA HAZARD MITIGATION PLAN; COMMENT PERIOD OPEN THROUGH OCTOBER 8, 2022

Public Input Wanted on Northern Virginia Hazard Mitigation Plan; Comment Period Open Through October 8, 2022

On behalf of the Northern Virginia Emergency Managers, NVERS is pleased to announce the opportunity for public comment on the Northern Virginia 2022 Hazard Mitigation Plan (NOVA HMP) update. The public comment period will be open from September 8, 2022 through October 8, 2022.

The 2022 NOVA HMP is a multi-jurisdictional plan that covers the Counties of Arlington, Fairfax, Loudoun, and Prince William, the Cities of Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park, and the Towns of Clifton, Dumfries, Haymarket, Herndon, Leesburg, Lovettsville, Middleburg, Occoquan, Purcellville, Quantico, Round Hill, and Vienna. The plan update also incorporates the concerns and needs of other stakeholder participants.

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Public Comment period is a time where we encourage members of the public who live and work in Northern Virginia to provide feedback to ensure the NOVA HMP reflects the priorities and concerns of the community and proposes action items to address those risks. Members of the public can also review the results of the jurisdictions risk analysis, which was guided in part by the results from an earlier community survey and is included in the draft plan.

After the comment period closes October 8, 2022, results will be compiled, and included in the updated plan that will be submitted for review and approval by the Virginia Department of Emergency Management and Federal Emergency Management Agency before being presented to Counties, Cities, and Towns for final adoption.

HOW TO SHARE YOUR COMMENTS

Please send comments or questions on the draft plan no later than **5:00 p.m., October 8, 2022**, to: NOVA2022PublicComment@iem.com. Please review the plan documents below and note which document your comments pertain to upon submission.

Plan Documents

Northern Virginia HMP Base Plan

Jurisdictional Annexes

Annex 1: Arlington County

Annex 2: City of Alexandria

Annex 3: City of Fairfax

Annex 4: City of Falls Church

Annex 5: City of Manassas

Annex 6: City of Manassas Park

Annex 7: Fairfax County

- Annex 7-A: Town of Clifton
- Annex 7-B: Town of Herndon
- Annex 7-C: Town of Vienna

Annex 8: Loudoun County

- Annex 8-A: Town of Leesburg
- Annex 8-B: Town of Lovettsville
- Annex 8-C: Town of Middleburg
- Annex 8-D: Town of Purcellville
- Annex 8-E: Town of Round Hill

Annex 17: Prince William County

- Annex 17-A: Town of Dumfries
- Annex 17-B: Town of Haymarket
- Annex 17-C: Town of Occoquan

SEARCH

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LATEST NEWS

- NOVA Localities Protected by Albert Cybersecurity Capability
- NVERS and NVHA Announce Merger
- Stafford County Connects to the National Capital Region Network (NCRnet)
- NVERS Impact Report Highlights COVID-19 Efforts
- NVERS SharePoint

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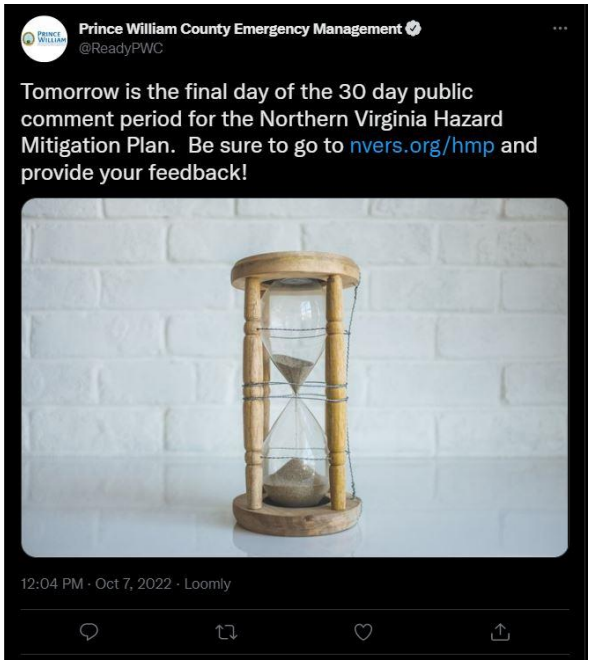
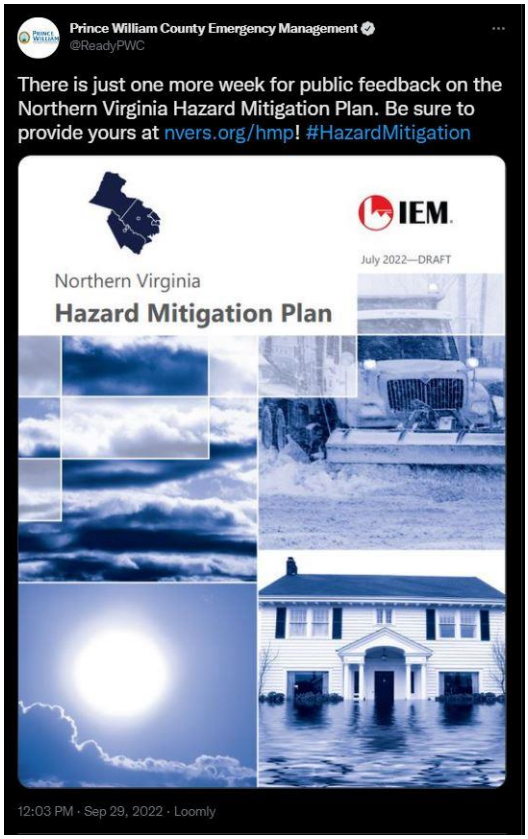
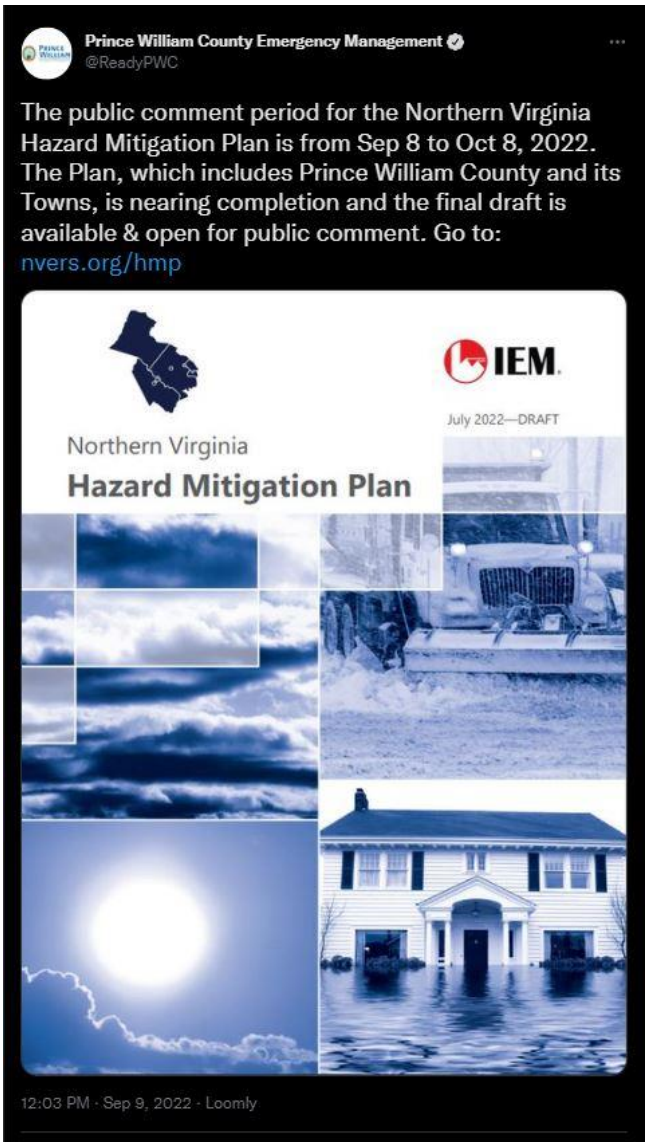
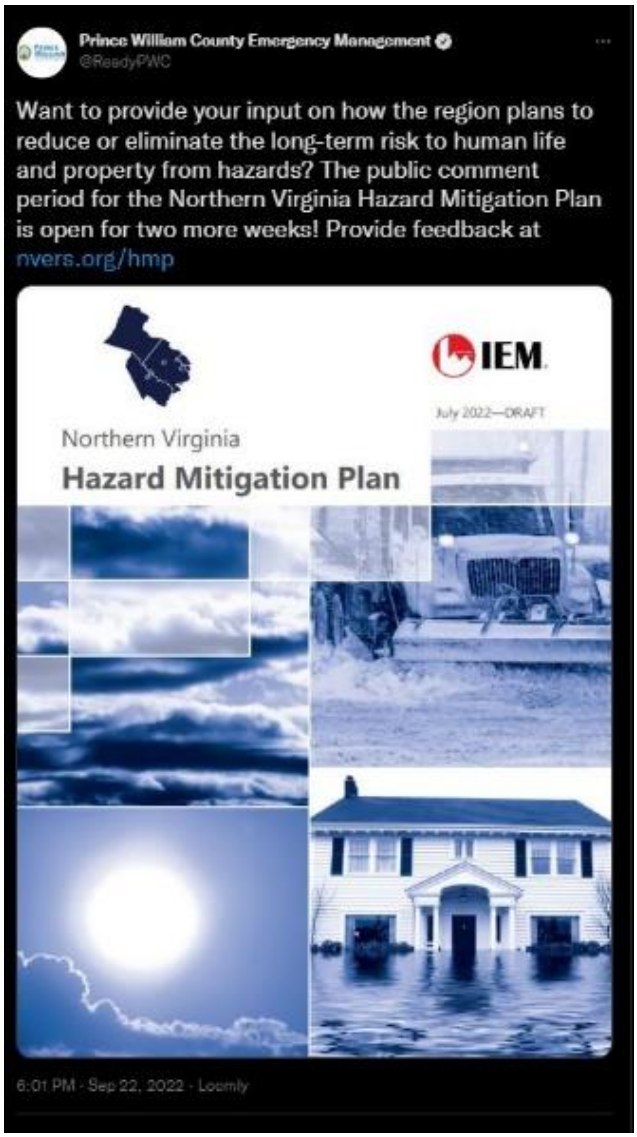
The following are screenshots of the various jurisdictions outreach for final public comment:

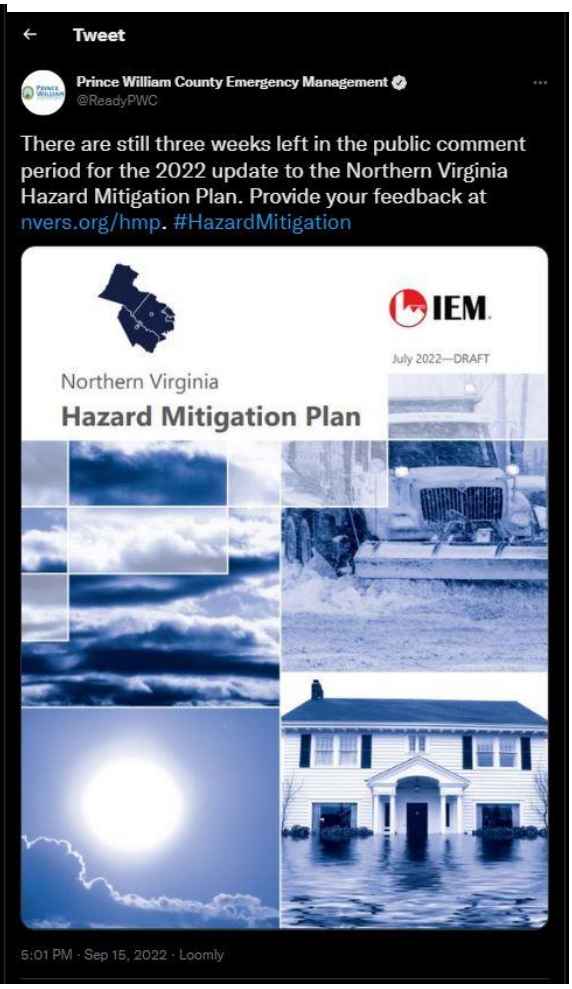

Prince William County Emergency Management
@ReadyPWC
Tomorrow is the final day of the 30 day public comment period for the Northern Virginia Hazard Mitigation Plan. Be sure to go to nvers.org/hmp and provide your feedback!
12:04 PM · Oct 7, 2022 · Loomly


Prince William County Emergency Management
@ReadyPWC
There is just one more week for public feedback on the Northern Virginia Hazard Mitigation Plan. Be sure to provide yours at nvers.org/hmp! #HazardMitigation
IEM
July 2022—DRAFT
Northern Virginia
Hazard Mitigation Plan
12:03 PM · Sep 29, 2022 · Loomly


Prince William County Emergency Management
@ReadyPWC
The public comment period for the Northern Virginia Hazard Mitigation Plan is from Sep 8 to Oct 8, 2022. The Plan, which includes Prince William County and its Towns, is nearing completion and the final draft is available & open for public comment. Go to: nvers.org/hmp
IEM
July 2022—DRAFT
Northern Virginia
Hazard Mitigation Plan
12:03 PM · Sep 9, 2022 · Loomly


Prince William County Emergency Management
@ReadyPWC
Want to provide your input on how the region plans to reduce or eliminate the long-term risk to human life and property from hazards? The public comment period for the Northern Virginia Hazard Mitigation Plan is open for two more weeks! Provide feedback at nvers.org/hmp
IEM
July 2022—DRAFT
Northern Virginia
Hazard Mitigation Plan
6:01 PM · Sep 22, 2022 · Loomly


Prince William County Emergency Management
@ReadyPWC
Today is the last day to provide feedback on the Northern Virginia Hazard Mitigation Plan! Be sure give yours at nvers.org/hmp! #HazardMitigation
IEM
July 2022—DRAFT
Northern Virginia
Hazard Mitigation Plan
8:01 AM · Oct 8, 2022 · Loomly


Tweet
Prince William County Emergency Management
@ReadyPWC
There are still three weeks left in the public comment period for the 2022 update to the Northern Virginia Hazard Mitigation Plan. Provide your feedback at nvers.org/hmp. #HazardMitigation
IEM
July 2022—DRAFT
Northern Virginia
Hazard Mitigation Plan
5:01 PM · Sep 15, 2022 · Loomly


12:29
5G 74%
Office of Emergency Manageme...
Office of Emergency Management, City of Alexandria, VA
11 minutes ago
Your feedback on the Northern Virginia Hazard Mitigation Plan (NOVA HMP) is needed to help identify the necessary steps to minimize damage from natural disasters. Learn more about the plan and provide feedback: alexandriava.gov/go/3954
alexandriava.gov
Public Input Wanted on Northern Virginia Hazard ...
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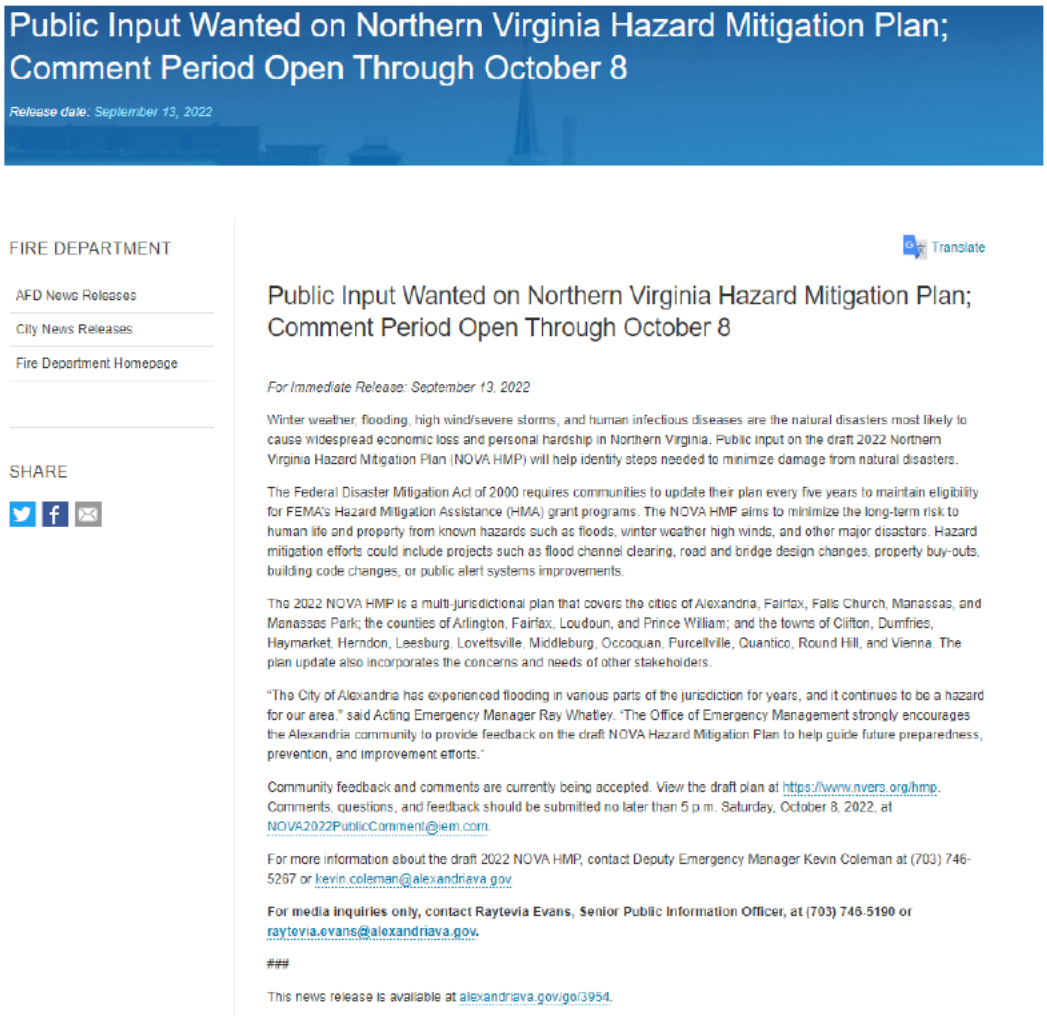
Prince William County Emergency Management
@ReadyPWC
The 2022 Northern Virginia Hazard Mitigation Plan is nearing its completion and the final draft is now available and open for public comment. Hazard mitigation allows communities to reduce the impact of disasters and save lives. Learn more here: nvers.org/public-input-w...
6:22 PM · Sep 8, 2022 · Loomly
1 Retweet 2 Likes

Alexandria, VA 2022 HMP Public Comment documentation



Public Input Wanted on Northern Virginia Hazard Mitigation Plan; Comment Period Open Through October 8

Release date: September 13, 2022

FIRE DEPARTMENT

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Public Input Wanted on Northern Virginia Hazard Mitigation Plan; Comment Period Open Through October 8

For Immediate Release: September 13, 2022

Winter weather, flooding, high wind/severe storms, and human infectious diseases are the natural disasters most likely to cause widespread economic loss and personal hardship in Northern Virginia. Public input on the draft 2022 Northern Virginia Hazard Mitigation Plan (NOVA HMP) will help identify steps needed to minimize damage from natural disasters.

The Federal Disaster Mitigation Act of 2000 requires communities to update their plan every five years to maintain eligibility for FEMA's Hazard Mitigation Assistance (HMA) grant programs. The NOVA HMP aims to minimize the long-term risk to human life and property from known hazards such as floods, winter weather high winds, and other major disasters. Hazard mitigation efforts could include projects such as flood channel clearing, road and bridge design changes, property buy-outs, building code changes, or public alert systems improvements.

The 2022 NOVA HMP is a multi-jurisdictional plan that covers the cities of Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park; the counties of Arlington, Fairfax, Loudoun, and Prince William; and the towns of Clifton, Dumfries, Haymarket, Herndon, Leesburg, Lovettsville, Middleburg, Occoquan, Purcellville, Quantico, Round Hill, and Vienna. The plan update also incorporates the concerns and needs of other stakeholders.

"The City of Alexandria has experienced flooding in various parts of the jurisdiction for years, and it continues to be a hazard for our area," said Acting Emergency Manager Ray Whatley. "The Office of Emergency Management strongly encourages the Alexandria community to provide feedback on the draft NOVA Hazard Mitigation Plan to help guide future preparedness, prevention, and improvement efforts."

Community feedback and comments are currently being accepted. View the draft plan at https://www.nvers.org/hmp. Comments, questions, and feedback should be submitted no later than 5 p.m. Saturday, October 8, 2022, at NOVA2022PublicComment@iem.com.

For more information about the draft 2022 NOVA HMP, contact Deputy Emergency Manager Kevin Coleman at (703) 746-5267 or kevin.coleman@alexandriava.gov.

For media inquiries only, contact Raytevia Evans, Senior Public Information Officer, at (703) 746-5190 or raytevia.evans@alexandriava.gov.

###

This news release is available at alexandriava.gov/go/3954.

https://www.alexandriava.gov/news-afd/2022-09-13/public-input-wanted-on-northern-virginia-hazard-mitigation-plan-comment-period

From: Alexandria eNews
To: Kevin Coleman
Subject: Public Input Wanted on Northern Virginia Hazard Mitigation Plan; Comment Period Open Through October 8
Date: Tuesday, September 13, 2022 12:05:12 PM

Public Input Wanted on Northern Virginia Hazard Mitigation Plan; Comment Period Open Through October 8

For Immediate Release: September 13, 2022

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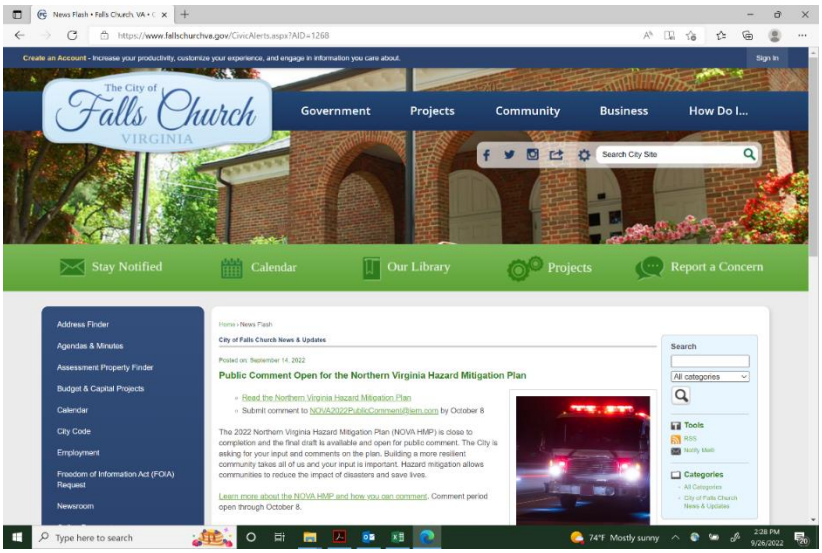
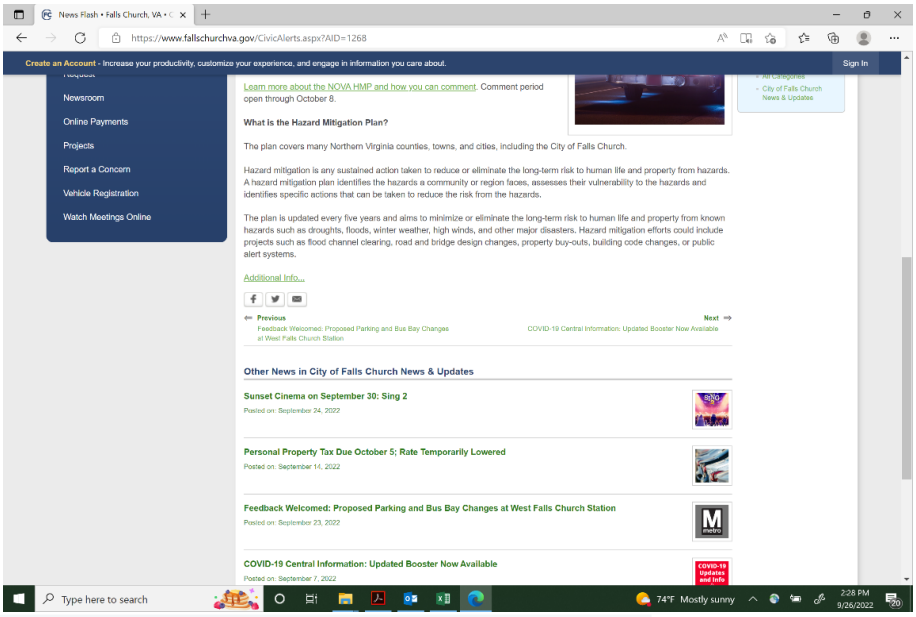
This news release is available at alexandriava.gov/go/3954.





Digital Equity Broadband Study eCheckup - Feedback Form through Sept. 30: Share your input as a resident and/ or business on the broadband study to help the County better understand the community's internet use and broadband access. Learn about this study by visiting the project page.

Draft Forestry and Natural Resources Plan - Feedback Form through Oct. 3: Share your feedback on the Draft Forestry and Natural Resources Plan to help assure the future benefits of nature. Visit the project page to learn about the plan and leave a comment directly.

Northern Virginia Hazard Mitigation Plan Public Comment Period - Feedback Opportunity through Oct. 8: Share your input with Northern Virginia Emergency Response Managers on the 2022 Hazard Mitigation Draft Plan. The plan will aim to minimize impact from hazards that affect our community, such as flooding, winter weather, and other disasters. Visit their project page to learn more and review documents to help guide your comments.

- The County Board will host community conversations on Missing Middle Housing from September to October 2022. Register here and submit questions in advance for upcoming information sessions.
- Join the first Missing Middle Housing Information Session on Housing Development and Economics virtually on Wed., September 14, at 7 p.m. Submit your questions in advance to this and other upcoming information sessions.
- County transportation staff will host a virtual meeting on Thurs., September 15, at 7 p.m. to review the proposed design and share your feedback on the proposal to reconstruct 23rd Street South between Route 1 and Crystal Drive.
- Provide feedback on how the General Land Use Plan (GLUP) designation for the Sunrise Senior Living property at North Glebe Road and 20th Street North could change in the future, now through September 19.
- Do your current broadband internet services meet your needs? Share your input through September 30 for the Digital Equity Broadband Study eCheckup as a resident or as a business to help the County better understand the community's internet access and use.
- Provide your feedback on the Draft Forestry and Natural Resources Plan through October 3 (formulario en español). Arlington's Forestry and Natural Resources Plan is designed to address environmental challenges and ensure Arlington's natural resources for current and future generations.
- The 2022 Northern Virginia Hazard Mitigation Plan is open for public comment! This plan aims to minimize impact from hazards that affect our community, such as flooding, winter weather, and other disasters. Learn more and share you feedback through October 8.

For more information on engagement opportunities, check the Engage Page.

Ready Arlington @ReadyArlington · Sep 9

Fires, floods, hurricanes and blizzards - oh my! The Northern Virginia Hazard Mitigation plan is officially open for public comment. Check it out and let us know what you think by October 8: nvers.org/hmp

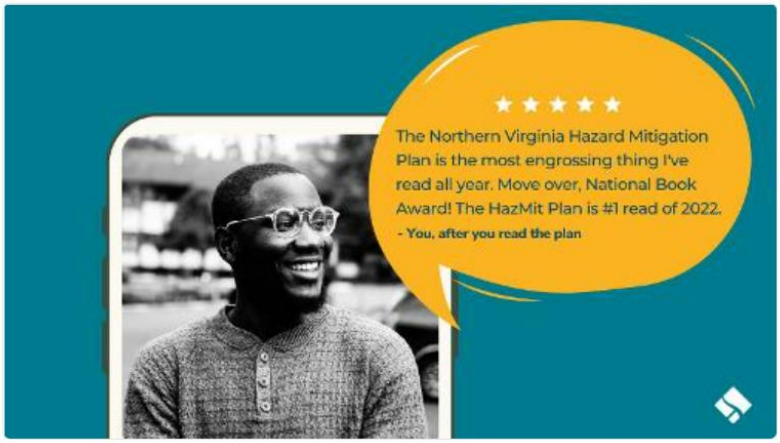
Email questions + comments to NOVA2022PublicComment@iem.com.

Ready Arlington @ReadyArlington · Sep 15

If you're looking for some quality bedtime reading then we sure have the link for you.

Check out the Northern Virginia Hazard Mitigation Plan (www.nvers.org/hmp) and let us know what you think about it by emailing NOVA2022PublicComment@iem.com.

#nova #arlingtonva



Ready Arlington @ReadyArlington · Oct 3
Embrace #spookyszn and #scares by reading about the greatest hazards facing Northern Virginia (and our plans to mitigate them): www.nvers.org/hmp

Let us know what you think by Oct 8. Email questions and comments to NOVA2022PublicComment@iem.com.

#arlingtonva #nova #dmv

Manassas VA @CityofManassas · 2m
Bad things happen and so we plan. Please take a moment to give your input on the Northern Virginia Hazard Mitigation Plan; Comment Period Open Through October 8, 2022 - nvers.org/hmp

City of Manassas, VA - Government
12m ·
Bad things happen and so we plan. Please take a moment to give your input on the Northern Virginia Hazard Mitigation Plan; Comment Period Open Through October 8, 2022 -

NVERS.ORG
Public Input Wanted on Northern Virginia Hazard Mitigation Plan; Comment Period Open Through October 8, 2022 | NVERS

Like Comment Share

Ready Fairfax
@ReadyFairfax

The 2022 Northern Virginia Hazard Mitigation Plan is nearing completion and the final draft is available and open for public comment. Hazard mitigation allows communities to reduce the impact of disasters & save lives. Review and provide input by Oct. 8th: nvers.org/hmp

9:09am · 9 Sep 2022 · Hootsuite Inc.


Ready Fairfax
Published by Hootsuite · 1m ·
The 2022 Northern Virginia Hazard Mitigation Plan is nearing completion and the final draft is available and open for public comment. Hazard mitigation allows communities to reduce the impact of disasters and save lives. Review and provide input by October 8, 2022 at, www.nvers.org/hmp
NORTHERN VIRGINIA
HAZARD MITIGATION PLAN
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PUBLIC COMMENT PERIOD OPEN UNTIL: 10/8/22
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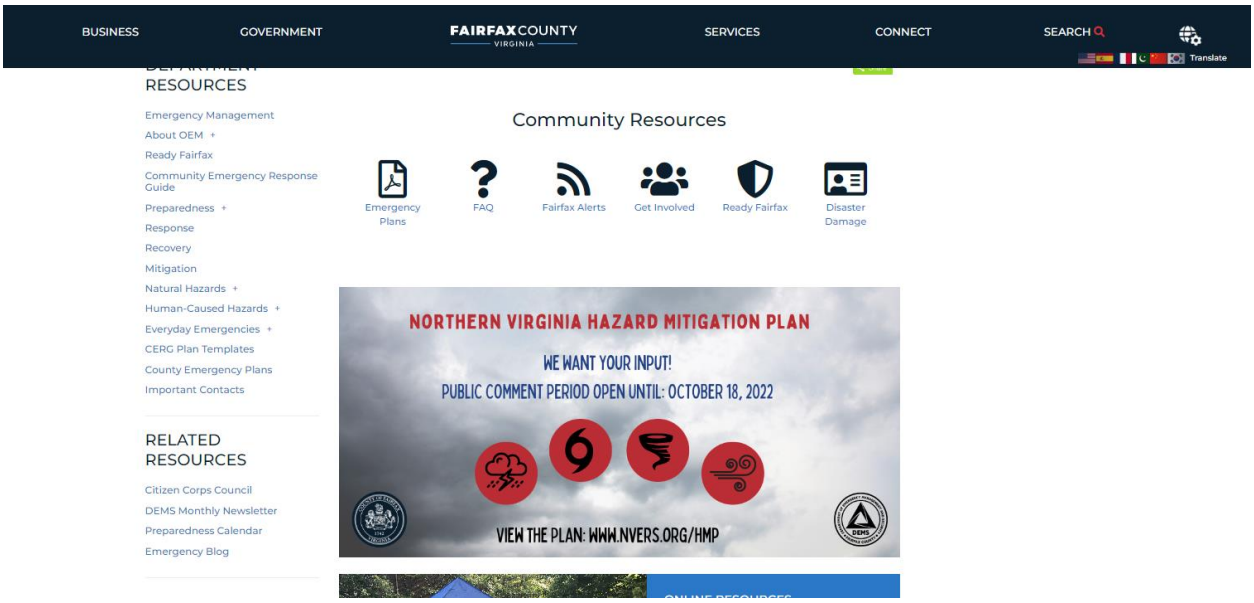
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Natural Hazards +
Human-Caused Hazards +
Everyday Emergencies +
CERG Plan Templates
County Emergency Plans
Important Contacts
RELATED RESOURCES
Citizen Corps Council
DEMS Monthly Newsletter
Preparedness Calendar
Emergency Blog
Community Resources
Emergency Plans
FAQ
Fairfax Alerts
Get Involved
Ready Fairfax
Disaster Damage
NORTHERN VIRGINIA HAZARD MITIGATION PLAN
WE WANT YOUR INPUT!
PUBLIC COMMENT PERIOD OPEN UNTIL: OCTOBER 18, 2022
VIEW THE PLAN: WWW.NVERS.ORG/HMP

Keeping it Moving Along the Pipeline

The next time you see Vienna public works staff huddled around a manhole, remember, there's usually no cause for alarm. Each year, the Department of Public Works assesses sanitary sewers, identifies those that are showing signs of deterioration and relines them as needed. The preventive maintenance helps assure trouble-free service to the town's homes and businesses.

"It's all about customer service in the end," said project engineer Frank Torre. "Relining the pipes only requires one day of work and can save weeks of construction impacts, traffic disruption, costs, and headaches if we were to dig and replace the pipes every time they needed repair."

Each sewer location and relining project is carefully planned and executed through a process known as the cured-in-place pipe-lining process (CIPP). CIPP creates a new interior surface inside existing sewer mains, with little noise and disruptions associated with traditional sewer line replacements.

Before any work is done, crews check for obstructions in the public portion of drain system. If there aren't any obstructions, a liner made of fabric and felt resin is inserted underground. As this happens, hot steam is pumped throughout the 8-inch sewer, which helps to unroll and then harden the liner inside the existing sewer pipe. The liner unrolls itself in the sewer pipe, much like putting on a sock. It takes three to four hours for the new liner to cure and cool, after which the crew uses a robotic cutter guided by a special camera to cut openings for private sewer lateral connections to homes or businesses. Residents are then free to use their sewer systems again.

Of course, if pipes are beyond repair, they are replaced. But with annual assessments, the Department of Public Works can often identify priorities before they become sewer emergencies and address problem areas with this cost-effective and efficient sewer lining process - CIPP.

Friendly Reminder: Mind your Manners

The Freeman Store and Museum is one of the most treasured historic landmarks in town. It's listed on the Virginia Landmarks Register and on the National Register of Historic Places. But more and more these days, children left unsupervised have created front-step scenes like this, which is not only disrespectful, but it also creates unsafe conditions for visitors who may slip and fall on the unstable surface. The pebble-throwing happens so frequently, thinly stretched park crews are having a tough time keeping the steps clean. When visiting the Freeman Store with children, please be mindful of their activities and discourage throwing pebbles on the front steps of this 163-year-old treasure!

Public Meetings Move

Due to Town Hall elevator construction, all regular Town Council meetings, Planning Commission meetings and several other public meetings will be held at the Community Center beginning Oct. 11 through the end of 2022. Council conference sessions and some other public meetings will be held at the police department community room. For location details, visit the online Town Calendar: www.viennava.gov/calendar.

Help Mitigate Hazards!

The best time to plan for a disaster is before it happens. That's why the Town of Vienna Police Department is partnering with the Fairfax County Office of Emergency Management to update the Northern Virginia Hazard Mitigation Plan, and the planners need your help! The goal is to minimize or eliminate long-term risks to human life and property from known hazards such as droughts, floods, winter weather, high winds and other major disasters. The final draft of the plan is done, and now the public safety officers want to know what you think! Please review the Vienna portion of the plan at this link: www.nvers.org/hmp and email feedback to NOVA2022PublicComment@iem.com by 5 p.m. on Oct. 8. Your comments will help inform the plan for disaster mitigation and response for the next five years!

Subject: News Release: Loudoun Community Encouraged to Comment on Regional Hazard Mitigation Plan

For Immediate Release Media Contact: Glen Barbour, Public Affairs and Communications Officer
September 12, 2022 703-771-5086, Glen.Barbour@loudoun.gov

Loudoun Community Encouraged to Comment on Regional Hazard Mitigation Plan

The Loudoun County Office of Emergency Management encourages residents and business owners in Loudoun County to help build community resilience to disasters by providing comments on the proposed Northern Virginia Hazard Mitigation Plan.

The plan is a multi-jurisdictional plan that includes Loudoun County and its incorporated towns as well as other Northern Virginia jurisdictions, including Arlington, Fairfax and Prince William counties.

The plan identifies strategies for reducing or eliminating loss of life, injury and property damage caused by disasters as well as the long-term risks that result from hazards such as floods, severe storms, tornadoes, wildfires and winter weather.

In addition to preventing loss of life and injury and damage to buildings and infrastructure, hazard mitigation can prevent damage to a community's economic, social and environmental well-being.

Members of the community can participate in the mitigation planning process by submitting their comments on the plan by 5:00 p.m., October 8, 2022, by email at NOVA2022PublicComment@iem.com.

A-3.5: Final Draft HMP Public Comments

Public Comment Feedback	
Date	Comment
9/30/2022	I have focused on Fairfax City (where I live) and Prince William County (where I own a business and work). Most importantly, I do not see where the impact of climate change is factored into any of these plans. I see a note somewhere that there is a "goal [to]... allow for the identification and mitigation of climate change-related issues in future planning cycles." Considering the next planning cycle is 5 years away, that is much too far off, and too vague. We need a plan now. Climate change has well underway. The Intergovernmental Panel on Climate Change (IPCC) has issued five likely outcomes for 2050 and beyond, which range from a 2.4% increase in global average annual precipitation over land, to an 8.3% increase. Are our floodways prepared for such an increase? (https://eciu.net/analysis/infographics/ipcc-science-of-climate-change) (https://www.wri.org/insights/ipcc-climate-report) The PWC report shows a good deal more demographic information than does Fairfax City (Sections 1.3), but neither addresses the homeless population. PWC does report 4.9% of the population is below the poverty line, 7.8% receive SNAP benefits, and 2.5% do not have a vehicle. I think this would be important information to have about Fairfax City. For all reports, I think we need a plan to reach people that are homeless. They are more likely to live in a flood zone, where buildings are not. I appreciated the map in Fairfax City's Section 5.4, which showed flood zones and community facilities. I would really like to see a map of Prince William County's flood zones. Is that accessible elsewhere?
9/28/2020	Annex 2: City of Alexandria • Figure 10: Community Resilience Estimate, City of Alexandria. The map is confusing, with estimated population shading over the Potomac River. The map is also skewed to the east, showing Maryland while the west end of Alexandria seems to be cut off. And there is no description of the map for the Section 508 compliance. Base Plan • Appendix A is missing. There is a reference to this in the City of Alexandria annex in Section 11.2: Documentation of Public Participation: "A detailed summary of the survey is available in Appendix A of the Base Plan."

9/18/2022	Dear Mr. English: I applaud all the work that has gone into this mitigation plan. It's good to know that civil servants like you are looking to protect citizens against potential disasters. I did not read every page as it is so lengthy, but I scanned a good deal of it. Since my husband and I just recently moved to northern Virginia, there is much that we are not familiar with but will remedy that as time passes. My major concern, one that was not addressed in this plan, is the subject of evacuation. The DC metropolitan area is so densely populated and the beltway is so congested even on the best of days that evacuation from the area seems near to impossible. I've wondered why other passages (bridges) have not been constructed across the Potomac to head north into Maryland. Given the high level of attraction to terrorists to attack our nation's capital, I would think that the level of risk would warrant a solid and effective evacuation plan. Having moved out of the New York area with terrible memories of the September 11 attack, we are very mindful of such a threat. Even without disaster, though, such construction out of DC and across the river would ease normal commuting and other travel in and out of the DC area. If this topic is not under your jurisdiction, perhaps you could advise me as to a better agency for addressing my concerns.
9/15/2022	Good afternoon, I have the following comments: • Section 1. Jurisdiction Profile - Lists persons per square mile as 871. Using the 2020 Census data this should be 810 (Correctly noted in Section 1.3). • Table 8: Urban County Executive Governance - While there are 11 Congressional districts in Virginia, there is only one (VA-10) which Loudoun has representation from • Section 1.4.8 Education - on page 9 (19/90 in pdf) the second paragraph notes a diverse student population of 178,000 (where did this number come from?). The K-12 LCPS student enrollment is correctly listed in Table 10, which is the number that should probably be used here. • Section 5.2 Population - on page 3 (39/90 in pdf) the second paragraph notes 5.8% of the population and lists that as being 147,490 residents, which is impossible. Best regards, Matt
9/12/2022	I live in Loudoun County - 20152 zip code - Chantilly, VA. I do not see us represented anywhere in this plan. Please advise. Thank you!

10/6/2022	Document attached Please find the attached comments from the Loudoun County Floodplain Management Team. Thank you Maggie Auer, CFM | Floodplain Management Team Leader Building and Development | Loudoun County 1 Harrison Street, S.E. | Leesburg, VA 20175 | 3rd Floor, MSC #60 Maggie.Auer@loudoun.gov | (O) 703-777-0222 | (C) 571-420-1863
10/7/2022	Please find attached our completed form. Best Regards, Renee' Shook on behalf of Lauren Mollerup Lauren Mollerup, P.E., CCM District Maintenance Engineer / NOVA Administration Virginia Department of Transportation O 703-259-1798 C 571-749-7002 Lauren.Mollerup@VDOT.Virginia.gov

10/8/2022	Vienna is listed as high hazard for flash floods. What existing structures help mitigate flooding at little or no cost? Mature trees. Mature trees is exactly what the Town of Vienna is targeting for destruction in the Robinson sidewalk initiative - all in the name of safety. Many quiet residential streets don't need to be sidewalked, especially cul-de-sacs, especially both sides of a street. To provide safe streets, we have better options than bulldozing trees for sidewalks. Speed bumps, and a stepped-up police presence have been shown to reduce speeding. And where sidewalks are to be constructed, why a default of 5 feet? 3-foot wide sidewalks are still ADA-compliant provided some wider areas are provided for turning. Replanting with young trees is no solution. It will take decades for such trees to reach maturity. NOVA is also a hazardous region for high summer temperature. What existing structures help mitigate heat at little or no cost? Again, mature trees. Trees cool ambient temperatures. A study in Valencia, Spain, found that a temperature monitor exposed to direct sunlight warmed to about 104°F in midday sun, while a shaded monitor at the same site registered below 80°F (Gomez et al. 2004). When air conditioning systems fail, our tree canopy helps cool buildings. Trees are the best carbon sinks we have. Let's keep them! Avril Garland
10/8/2022	I am a resident of the City of Falls Church and serve as a member of the City of Falls Church's Environmental Sustainability Council. The comments in the attached document are my own and not necessarily those of the ESC nor it's other members. I greatly appreciate the opportunity to comment on this important document. John Ferris
10/4/2022	SPAM/Phishing
9/19/2022	SPAM/Phishing
9/22/2022	SPAM/Phishing

10/3/2022	SPAM/Phishing
10/5/2022	SPAM/Phishing
10/6/2022	SPAM/Phishing

A-4: Mitigation Action Monitoring Worksheet

As a step in the monitoring process for the plan, the following form will be used to collect current information related to mitigation actions included in the current plan.

Progress Report Period	**From Date:**	**To Date:**
Action/Project Title		
Responsible Agency		
Contact Name		
Contact Phone/Email		
Project Status	□ Project Completed □ Project deleted □ Project in progress □ Anticipated completion date _____ □ Project delayed Explain: _____	

Summary of Progress on Current Project for this Report Period

1. What was accomplished for this project during this reporting period?

2. What obstacles, problems, or delays did the project encounter?

3. If uncompleted, is the project still relevant? Should the project be changed or revised?

4. Other comments:

A-5: Plan Evaluation Checklist

Plan Component Being Evaluated	Yes	No
Goals		
Goal Statement – "*Our goals are to protect life and reduce bodily harm from the natural and non-natural hazards identified in this plan, and to lessen the impacts of these hazards on property, the environment, and the community.*"		
Is this goal still comprehensive and relevant?		
Policies, Regulations, and Studies		
Are there any new or updated laws, policies, regulations, initiatives, and studies that contribute to the hazard risk assessment or identified mitigation actions been approved and/or adopted within the past year and should be addressed in the Plan?		
By adding this information to the plan, would it initiate the amendment process?		
Funding Programs and Planning Mechanisms		
Have there been any changes in local, commonwealth, and/or federal agencies and their funding procedures, new grant programs or areas of focus, and potential integration into existing planning mechanisms?		
By adding this information to the plan, would it initiate the amendment process?		
Hazard Risks and Vulnerabilities		
Is there new or updated data and information that can contribute to risk assessments, loss estimates, or vulnerabilities in assets for participating jurisdictions?		
By adding this information to the plan, would it initiate the amendment process?		
Mitigation Actions		
Has progress been made in previously implemented actions that reduce vulnerability and losses? and any new opportunities for mitigation actions.		
Are there any new opportunities for mitigation actions?		
By adding this information to the plan, would it initiate the amendment process?		

Comments

A-6: Planning Considerations Worksheet

	Addresses Current Needs?	
	Yes	**No**
Has the nature or magnitude of the hazard risks identified in the plan changed? If yes, comment below.		
Are resources adequate for implementing the plan? If no, comment below.		
Have there been any implementation difficulties such as social, technical, political, legal, economic, environmental, or coordination issues for the proposed mitigation actions? If yes, select "project delayed" on the *Mitigation Action Monitoring Worksheet* (Appendix A-4) with a comment describing the implementation issue.		
Should personnel/agency changes be made to the NOVA HMP planning group? If yes, describe recommended changes to the planning structure and/or membership, including contact information, below.		
Have there been changes to jurisdictional capabilities that improve or impair the progress of the mitigation strategies identified in the plan? If yes, please comment below.		

A-7: Plan Adoption Sample Resolution

Resolution # _____

Adopting the

2022 NORTHERN VIRGINIA HAZARD MITIGATION PLAN and

[JURISDICTION NAME] ANNEX

***Whereas**, the [JURISDICTION NAME] recognizes the threat that natural hazards pose to people and property within our community; and*

***Whereas**, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and*

***Whereas**, an adopted Local Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and*

***Whereas**, the [JURISDICTION NAME] resides within the Planning Area, and fully participated in the mitigation planning process to prepare this Local Hazard Mitigation Plan; and*

***Whereas**, the Virginia Department of Emergency Management and Federal Emergency Management Agency, Region 3, officials have reviewed the Northern Virginia Hazard Mitigation Plan and approved it contingent upon this official adoption of the participating governing body; and*

***Now, therefore, be it resolved**, that the [JURISDICTION NAME] hereby adopts the Northern Virginia Hazard Mitigation Plan and the [JURISDICTION NAME] Annex as an official plan; and*

***Be it further resolved**, [JURISDICTION NAME] will submit this Adoption Resolution to the Virginia Department of Emergency Management and the Federal Emergency Management Agency, Region 3, officials to enable the Plan's final approval.*

Passed: ____(date)____

_____

[Certifying Official (printed)

_____

Certifying Official (signature)

A-8: Plan Adoption – Jurisdiction Resolutions

[PENDING]

A-9: FEMA Plan Review Tool

[PENDING]

APPENDIX B: NATURAL HAZARD ANALYSIS

B-1 HAZUS Reports for Earthquake, Flood, and Hurricane

Table of Contents

Earthquake

Flood

Hurricane

B-2: Natural Hazard Risk Analysis Worksheets

Hazus: Earthquake Global Risk Report

Region Name: NOVA_EQ_FL_HU_Test

Earthquake Scenario: NOVA 100 Year 5.0 Magnitude

Print Date: August 03, 2021

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 9 county(ies) from the following state(s):

Virginia

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,321.37 square miles and contains 520 census tracts. There are over 823 thousand households in the region which has a total population of 2,230,623 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 663 thousand buildings in the region with a total building replacement value (excluding contents) of 341,515 (millions of dollars). Approximately 92.00 % of the buildings (and 84.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 16,956 and 11,570 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 663 thousand buildings in the region which have an aggregate total replacement value of 341,515 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 70% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 19 hospitals in the region with a total bed capacity of 3,149 beds. There are 846 schools, 110 fire stations, 46 police stations and 14 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes 69 hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 28,526.00 (millions of dollars). This inventory includes over 652.44 miles of highways, 1,639 bridges, 32,295.76 miles of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	1,639	8191.9167
	Segments	556	7725.3901
	Tunnels	2	28.9598
		Subtotal	**15946.2666**
Railways	Bridges	71	312.0291
	Facilities	8	21.3040
	Segments	201	230.8566
	Tunnels	0	0.0000
		Subtotal	**564.1897**
Light Rail	Bridges	0	0.0000
	Facilities	33	92.8176
	Segments	35	184.5443
	Tunnels	0	0.0000
		Subtotal	**277.3619**
Bus	Facilities	3	4.2189
		Subtotal	**4.2189**
Ferry	Facilities	1	1.3310
		Subtotal	**1.3310**
Port	Facilities	11	30.5524
		Subtotal	**30.5524**
Airport	Facilities	6	53.0888
	Runways	2	79.8653
		Subtotal	**132.9541**
		Total	**16,956.90**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	645.8251
	Facilities	9	278.7210
	Pipelines	0	0.0000
		Subtotal	**924.5461**
Waste Water	Distribution Lines	NA	387.4950
	Facilities	56	7038.6734
	Pipelines	0	0.0000
		Subtotal	**7426.1684**
Natural Gas	Distribution Lines	NA	258.3300
	Facilities	5	7.6908
	Pipelines	31	186.0842
		Subtotal	**452.1050**
Oil Systems	Facilities	2	0.1860
	Pipelines	0	0.0000
		Subtotal	**0.1860**
Electrical Power	Facilities	6	2766.0720
		Subtotal	**2766.0720**
Communication	Facilities	18	1.6740
		Subtotal	**1.6740**
		Total	**11,570.80**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	NOVA 100 Year 5.0 Magnitude
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-77.80
Latitude of Epicenter	38.03
Earthquake Magnitude	5.00
Depth (km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Direct Earthquake Damage

Building Damage

Hazus estimates that about 27,518 buildings will be at least moderately damaged. This is over 4.00 % of the buildings in the region. There are an estimated 553 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

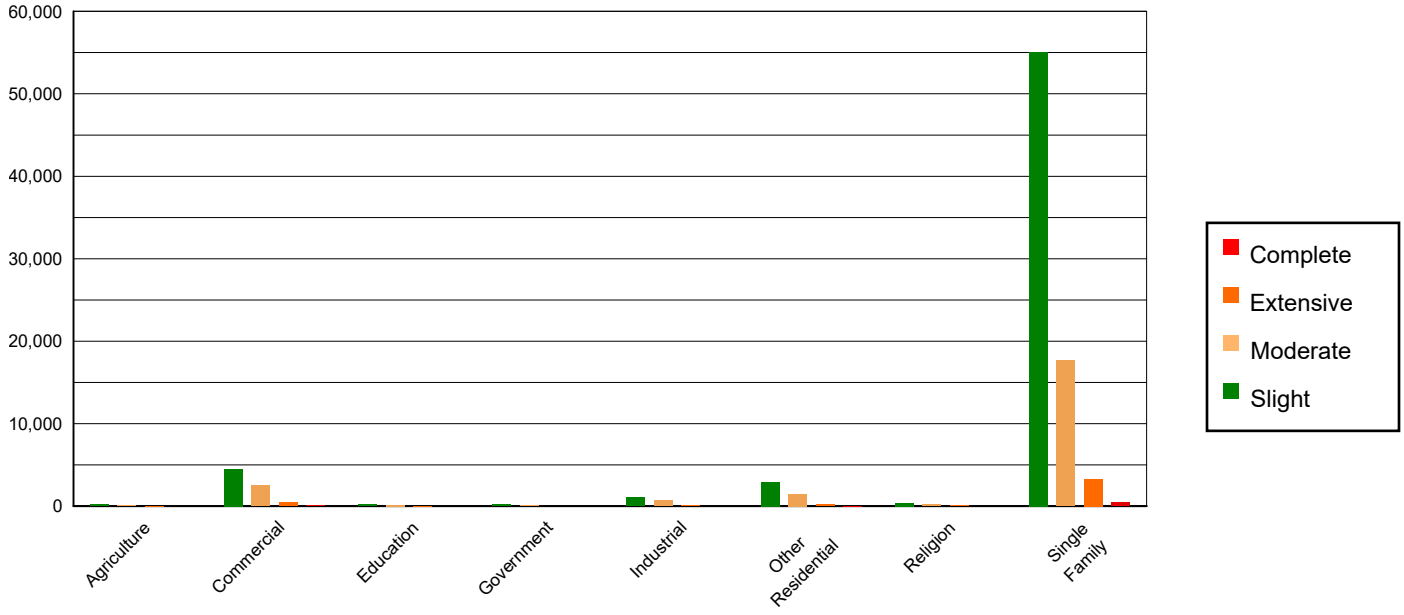


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	1311.38	0.23	218.96	0.34	99.32	0.44	18.76	0.45	1.58	0.29
Commercial	26687.93	4.67	4501.83	6.97	2523.42	11.06	463.93	11.16	50.89	9.19
Education	1458.55	0.26	236.71	0.37	134.07	0.59	21.74	0.52	2.94	0.53
Government	918.41	0.16	154.48	0.24	93.31	0.41	14.98	0.36	1.82	0.33
Industrial	6280.76	1.10	1072.40	1.66	663.08	2.91	116.29	2.80	12.47	2.25
Other Residential	21475.78	3.76	2923.84	4.53	1481.63	6.50	200.54	4.82	18.21	3.29
Religion	2919.86	0.51	395.14	0.61	202.87	0.89	40.99	0.99	5.14	0.93
Single Family	510550.99	89.32	55059.17	85.28	17609.54	77.21	3280.70	78.90	460.60	83.19
Total	**571,604**		**64,563**		**22,807**		**4,158**		**554**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	421160.33	73.68	35659.90	55.23	5601.76	24.56	336.81	8.10	0.47	0.08
Steel	17253.31	3.02	3033.96	4.70	2024.75	8.88	322.01	7.74	34.20	6.18
Concrete	3055.93	0.53	516.24	0.80	340.58	1.49	38.24	0.92	2.90	0.52
Precast	1167.61	0.20	172.10	0.27	159.22	0.70	45.47	1.09	1.02	0.18
RM	5011.01	0.88	465.18	0.72	351.36	1.54	75.65	1.82	0.54	0.10
URM	120507.33	21.08	23777.42	36.83	13643.17	59.82	3278.51	78.85	512.04	92.48
MH	3448.16	0.60	937.74	1.45	686.38	3.01	61.24	1.47	2.49	0.45
Total	**571,604**		**64,563**		**22,807**		**4,158**		**554**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 3,149 hospital beds available for use. On the day of the earthquake, the model estimates that only 2,386 hospital beds (76.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 89.00% of the beds will be back in service. By 30 days, 98.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	19	0	0	19
Schools	846	0	0	846
EOCs	14	0	0	14
PoliceStations	46	0	0	46
FireStations	110	0	0	110

Transportation Lifeline Damage

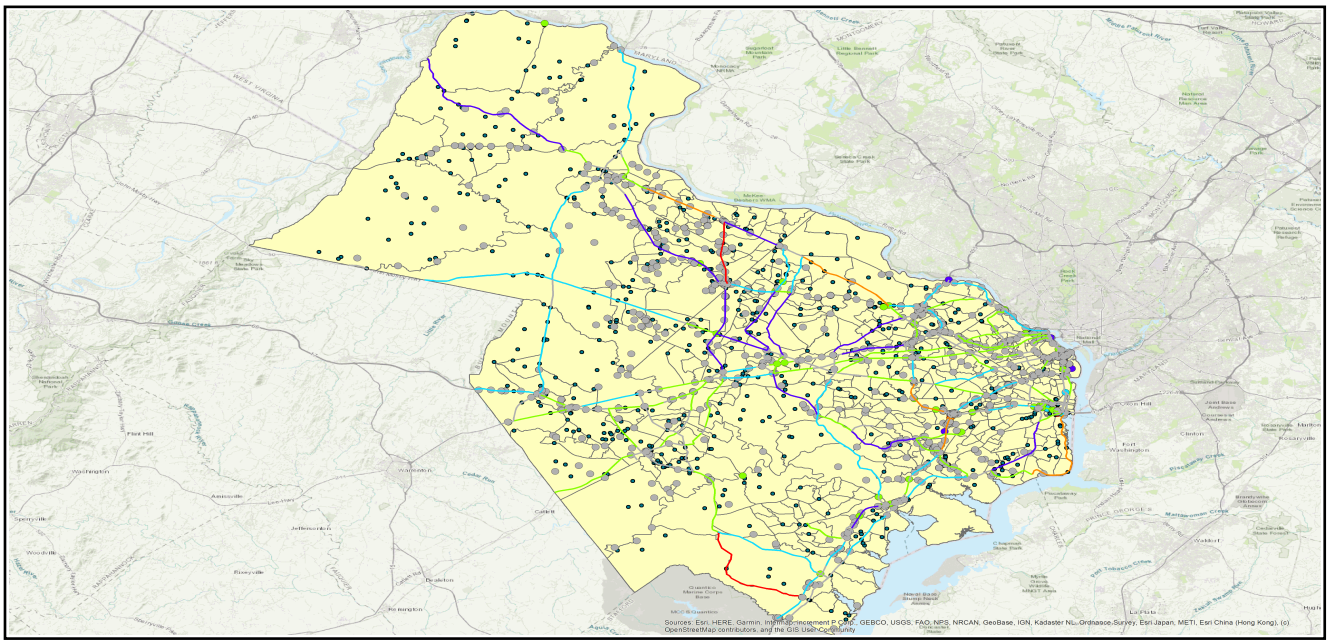


Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	556	0	0	556	556
	Bridges	1,639	1	0	1,638	1,638
	Tunnels	2	0	0	2	2
Railways	Segments	201	0	0	201	201
	Bridges	71	0	0	71	71
	Tunnels	0	0	0	0	0
	Facilities	8	0	0	8	8
Light Rail	Segments	35	0	0	35	35
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	33	0	0	33	33
Bus	Facilities	3	0	0	3	3
Ferry	Facilities	1	0	0	1	1
Port	Facilities	11	0	0	11	11
Airport	Facilities	6	0	0	6	6
	Runways	2	0	0	2	2

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	9	0	0	9	9
Waste Water	56	0	0	56	56
Natural Gas	5	0	0	5	5
Oil Systems	2	0	0	2	2
Electrical Power	6	0	0	6	6
Communication	18	0	0	18	18

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	20,065	1438	359
Waste Water	12,039	722	181
Natural Gas	193	5	1
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	823,609	1,437	153	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

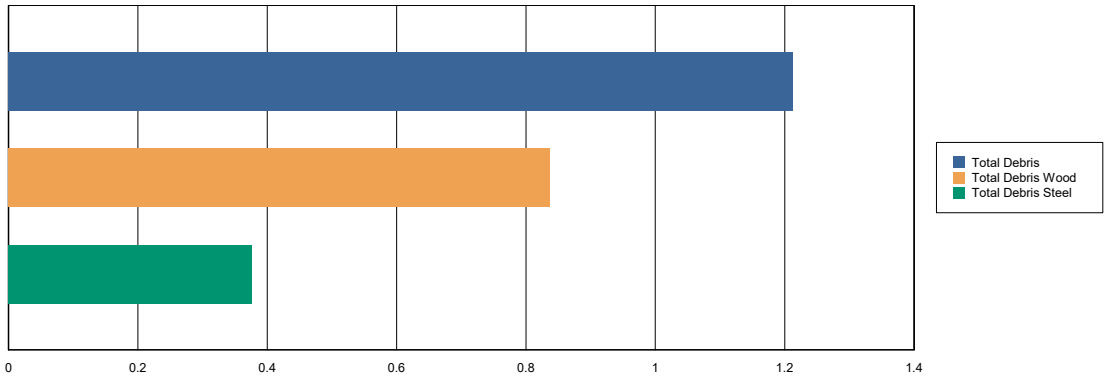
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 10 ignitions that will burn about 0.05 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 445 people and burn about 44 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,213,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 69.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 48,520 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



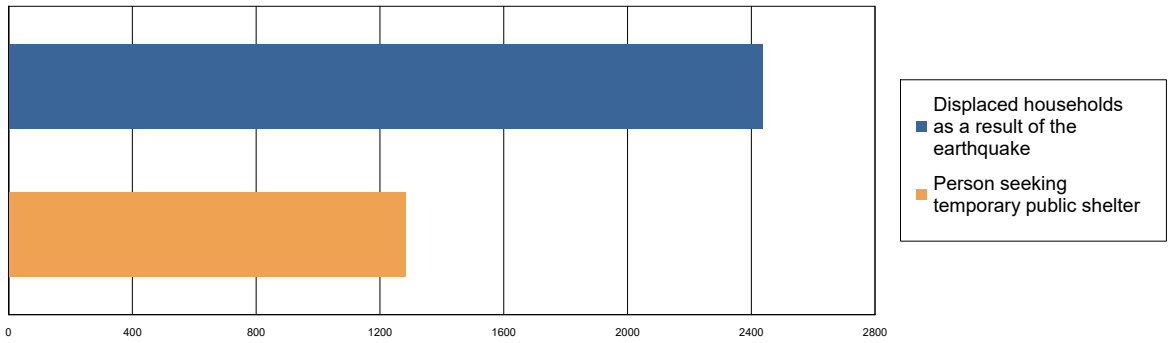
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.84	0.38	1.21	48,520 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 2,436 households to be displaced due to the earthquake. Of these, 1,283 people (out of a total population of 2,230,623) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
2,436	1,283

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	11.72	1.84	0.18	0.34
	Commuting	0.04	0.05	0.08	0.02
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	7.37	1.14	0.11	0.21
	Other-Residential	158.55	24.49	2.45	4.72
	Single Family	628.86	102.04	11.07	21.36
	Total	**807**	**130**	**14**	**27**
2 PM	Commercial	641.32	100.74	9.80	18.87
	Commuting	0.32	0.45	0.74	0.14
	Educational	184.42	30.05	3.09	5.92
	Hotels	0.00	0.00	0.00	0.00
	Industrial	54.31	8.44	0.79	1.52
	Other-Residential	24.41	3.89	0.41	0.75
	Single Family	104.97	17.60	2.00	3.70
	Total	**1,010**	**161**	**17**	**31**
5 PM	Commercial	453.54	71.87	7.12	13.48
	Commuting	7.09	9.44	15.96	3.09
	Educational	17.75	2.89	0.30	0.57
	Hotels	0.00	0.00	0.00	0.00
	Industrial	33.94	5.28	0.50	0.95
	Other-Residential	62.54	9.96	1.05	1.94
	Single Family	250.68	42.04	4.78	8.83
	Total	**826**	**141**	**30**	**29**

Economic Loss

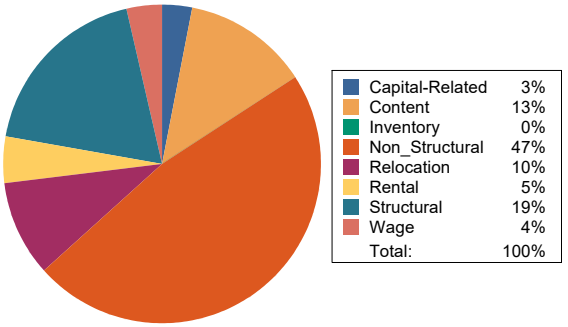
The total economic loss estimated for the earthquake is 4,109.85 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 3,935.17 (millions of dollars); 21 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 69 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

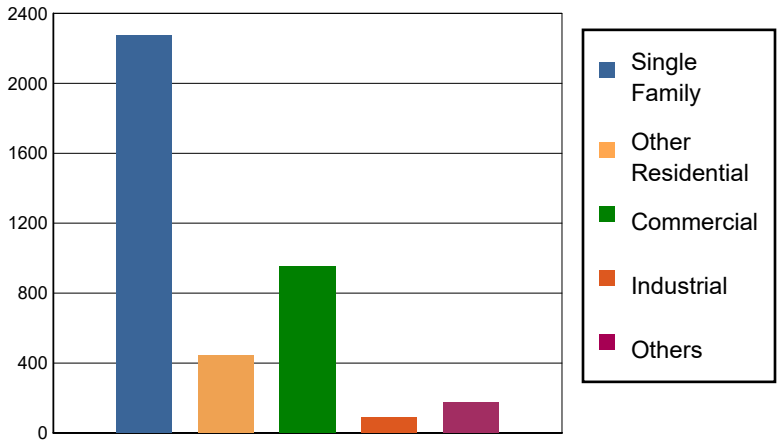


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	9.4744	118.3937	2.4603	8.9449	139.2733
	Capital-Related	0.0000	4.0270	110.2585	1.4677	2.1000	117.8532
	Rental	60.9194	37.0269	80.0021	1.0813	4.3189	183.3486
	Relocation	213.8705	26.7319	113.2496	7.4221	31.8446	393.1187
	Subtotal	**274.7899**	**77.2602**	**421.9039**	**12.4314**	**47.2084**	**833.5938**
Capital Stock Losses							
	Structural	483.1665	64.5777	137.5210	16.6249	30.3726	732.2627
	Non_Structural	1227.2130	252.2005	277.0424	35.3107	67.1336	1,858.9002
	Content	289.2533	52.3684	115.0944	19.7474	28.0299	504.4934
	Inventory	0.0000	0.0000	2.3753	3.2635	0.2773	5.9161
	Subtotal	**1999.6328**	**369.1466**	**532.0331**	**74.9465**	**125.8134**	**3101.5724**
	Total	**2274.42**	**446.41**	**953.94**	**87.38**	**173.02**	**3935.17**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	7725.3901	0.0000	0.00
	Bridges	8191.9167	56.0847	0.68
	Tunnels	28.9598	0.0010	0.00
	Subtotal	**15946.2666**	**56.0857**	
Railways	Segments	230.8566	0.0000	0.00
	Bridges	312.0291	0.2204	0.07
	Tunnels	0.0000	0.0000	0.00
	Facilities	21.3040	1.0012	4.70
	Subtotal	**564.1897**	**1.2216**	
Light Rail	Segments	184.5443	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	92.8176	3.7948	4.09
	Subtotal	**277.3619**	**3.7948**	
Bus	Facilities	4.2189	0.1799	4.26
	Subtotal	**4.2189**	**0.1799**	
Ferry	Facilities	1.3310	0.0408	3.07
	Subtotal	**1.3310**	**0.0408**	
Port	Facilities	30.5524	1.5486	5.07
	Subtotal	**30.5524**	**1.5486**	
Airport	Facilities	53.0888	2.0693	3.90
	Runways	79.8653	0.0000	0.00
	Subtotal	**132.9541**	**2.0693**	
	Total	**16,956.87**	**64.94**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	278.7210	2.3584	0.85
	Distribution Lines	645.8251	6.4689	1.00
	Subtotal	**924.5461**	**8.8273**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	7038.6734	62.5034	0.89
	Distribution Lines	387.4950	3.2495	0.84
	Subtotal	**7426.1684**	**65.7529**	
Natural Gas	Pipelines	186.0842	0.0000	0.00
	Facilities	7.6908	0.0679	0.88
	Distribution Lines	258.3300	1.1132	0.43
	Subtotal	**452.1050**	**1.1811**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.1860	0.0018	0.97
	Subtotal	**0.1860**	**0.0018**	
Electrical Power	Facilities	2766.0720	33.9668	1.23
	Subtotal	**2766.0720**	**33.9668**	
Communication	Facilities	1.6740	0.0154	0.92
	Subtotal	**1.6740**	**0.0154**	
	Total	**11,570.75**	**109.75**	

Appendix A: County Listing for the Region

Arlington,VA

Fairfax,VA

Loudoun,VA

Prince William,VA

Alexandria,VA

Fairfax City,VA

Falls Church,VA

Manassas,VA

Manassas Park,VA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Virginia					
	Arlington	207,627	27,386	6,025	33,412
	Fairfax	1,081,726	144,188	26,638	170,827
	Loudoun	312,311	39,257	6,070	45,327
	Prince William	402,002	48,430	5,936	54,366
	Alexandria	139,966	18,477	5,549	24,027
	Fairfax City	22,565	3,164	1,516	4,681
	Falls Church	12,332	1,766	599	2,365
	Manassas	37,821	3,672	1,274	4,947
	Manassas Park	14,273	1,298	261	1,560
Total Region		**2,230,623**	**287,638**	**53,868**	**341,512**

Hazus: Earthquake Global Risk Report

Region Name: NOVA_EQ_FL_HU_Test

Earthquake Scenario: NOVA 500 Year 5.5 Magnitude

Print Date: August 03, 2021

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 9 county(ies) from the following state(s):

Virginia

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,321.37 square miles and contains 520 census tracts. There are over 823 thousand households in the region which has a total population of 2,230,623 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 663 thousand buildings in the region with a total building replacement value (excluding contents) of 341,515 (millions of dollars). Approximately 92.00 % of the buildings (and 84.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 16,956 and 11,570 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 663 thousand buildings in the region which have an aggregate total replacement value of 341,515 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 70% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 19 hospitals in the region with a total bed capacity of 3,149 beds. There are 846 schools, 110 fire stations, 46 police stations and 14 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes 69 hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 28,526.00 (millions of dollars). This inventory includes over 652.44 miles of highways, 1,639 bridges, 32,295.76 miles of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	1,639	8191.9167
	Segments	556	7725.3901
	Tunnels	2	28.9598
		Subtotal	**15946.2666**
Railways	Bridges	71	312.0291
	Facilities	8	21.3040
	Segments	201	230.8566
	Tunnels	0	0.0000
		Subtotal	**564.1897**
Light Rail	Bridges	0	0.0000
	Facilities	33	92.8176
	Segments	35	184.5443
	Tunnels	0	0.0000
		Subtotal	**277.3619**
Bus	Facilities	3	4.2189
		Subtotal	**4.2189**
Ferry	Facilities	1	1.3310
		Subtotal	**1.3310**
Port	Facilities	11	30.5524
		Subtotal	**30.5524**
Airport	Facilities	6	53.0888
	Runways	2	79.8653
		Subtotal	**132.9541**
		Total	**16,956.90**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	645.8251
	Facilities	9	278.7210
	Pipelines	0	0.0000
		Subtotal	**924.5461**
Waste Water	Distribution Lines	NA	387.4950
	Facilities	56	7038.6734
	Pipelines	0	0.0000
		Subtotal	**7426.1684**
Natural Gas	Distribution Lines	NA	258.3300
	Facilities	5	7.6908
	Pipelines	31	186.0842
		Subtotal	**452.1050**
Oil Systems	Facilities	2	0.1860
	Pipelines	0	0.0000
		Subtotal	**0.1860**
Electrical Power	Facilities	6	2766.0720
		Subtotal	**2766.0720**
Communication	Facilities	18	1.6740
		Subtotal	**1.6740**
		Total	**11,570.80**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	NOVA 500 Year 5.5 Magnitude
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-77.80
Latitude of Epicenter	38.03
Earthquake Magnitude	5.50
Depth (km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Direct Earthquake Damage

Building Damage

Hazus estimates that about 27,518 buildings will be at least moderately damaged. This is over 4.00 % of the buildings in the region. There are an estimated 553 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

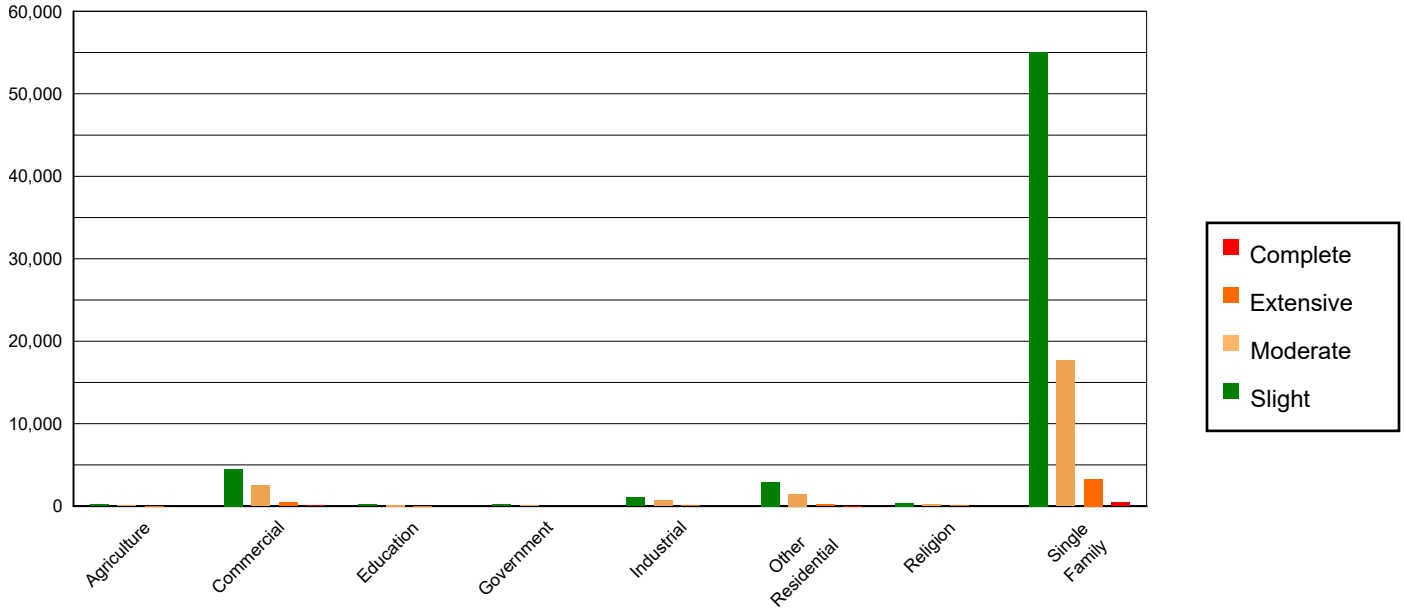


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	1311.38	0.23	218.96	0.34	99.32	0.44	18.76	0.45	1.58	0.29
Commercial	26687.93	4.67	4501.83	6.97	2523.42	11.06	463.93	11.16	50.89	9.19
Education	1458.55	0.26	236.71	0.37	134.07	0.59	21.74	0.52	2.94	0.53
Government	918.41	0.16	154.48	0.24	93.31	0.41	14.98	0.36	1.82	0.33
Industrial	6280.76	1.10	1072.40	1.66	663.08	2.91	116.29	2.80	12.47	2.25
Other Residential	21475.78	3.76	2923.84	4.53	1481.63	6.50	200.54	4.82	18.21	3.29
Religion	2919.86	0.51	395.14	0.61	202.87	0.89	40.99	0.99	5.14	0.93
Single Family	510550.99	89.32	55059.17	85.28	17609.54	77.21	3280.70	78.90	460.60	83.19
Total	**571,604**		**64,563**		**22,807**		**4,158**		**554**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	421160.33	73.68	35659.90	55.23	5601.76	24.56	336.81	8.10	0.47	0.08
Steel	17253.31	3.02	3033.96	4.70	2024.75	8.88	322.01	7.74	34.20	6.18
Concrete	3055.93	0.53	516.24	0.80	340.58	1.49	38.24	0.92	2.90	0.52
Precast	1167.61	0.20	172.10	0.27	159.22	0.70	45.47	1.09	1.02	0.18
RM	5011.01	0.88	465.18	0.72	351.36	1.54	75.65	1.82	0.54	0.10
URM	120507.33	21.08	23777.42	36.83	13643.17	59.82	3278.51	78.85	512.04	92.48
MH	3448.16	0.60	937.74	1.45	686.38	3.01	61.24	1.47	2.49	0.45
Total	**571,604**		**64,563**		**22,807**		**4,158**		**554**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 3,149 hospital beds available for use. On the day of the earthquake, the model estimates that only 2,386 hospital beds (76.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 89.00% of the beds will be back in service. By 30 days, 98.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	19	0	0	19
Schools	846	0	0	846
EOCs	14	0	0	14
PoliceStations	46	0	0	46
FireStations	110	0	0	110

Transportation Lifeline Damage

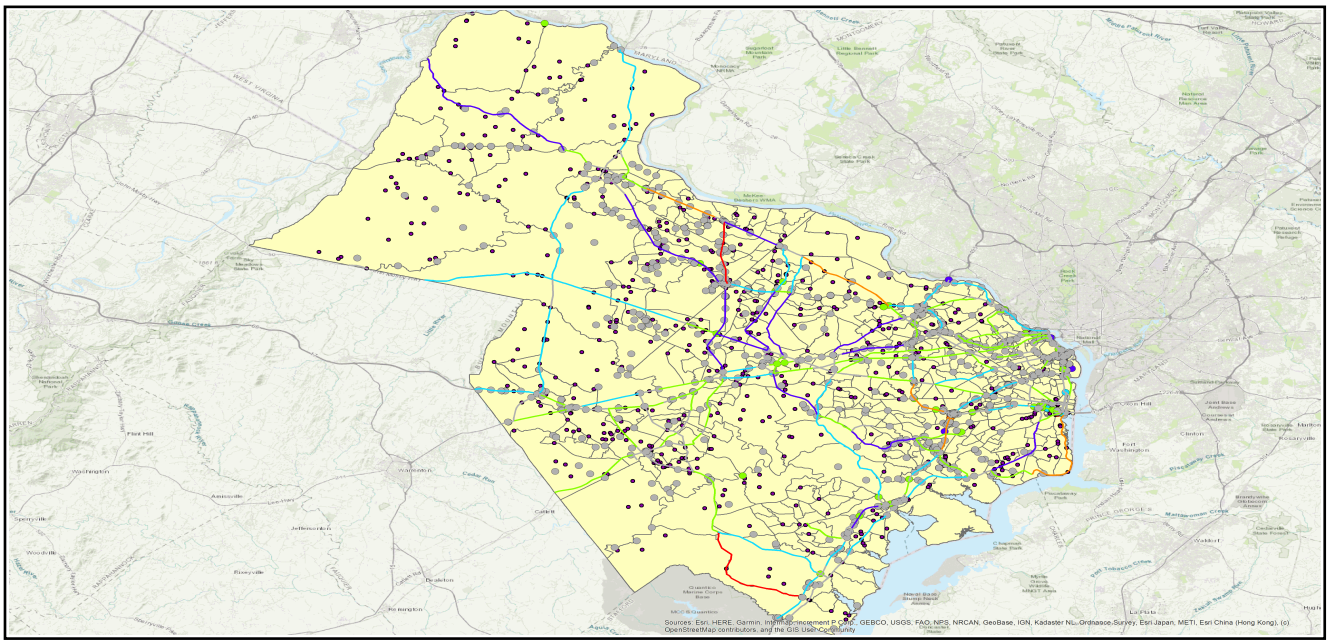


Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	556	0	0	556	556
	Bridges	1,639	1	0	1,638	1,638
	Tunnels	2	0	0	2	2
Railways	Segments	201	0	0	201	201
	Bridges	71	0	0	71	71
	Tunnels	0	0	0	0	0
	Facilities	8	0	0	8	8
Light Rail	Segments	35	0	0	35	35
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	33	0	0	33	33
Bus	Facilities	3	0	0	3	3
Ferry	Facilities	1	0	0	1	1
Port	Facilities	11	0	0	11	11
Airport	Facilities	6	0	0	6	6
	Runways	2	0	0	2	2

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	9	0	0	9	9
Waste Water	56	0	0	56	56
Natural Gas	5	0	0	5	5
Oil Systems	2	0	0	2	2
Electrical Power	6	0	0	6	6
Communication	18	0	0	18	18

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	20,065	1438	359
Waste Water	12,039	722	181
Natural Gas	193	5	1
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	823,609	1,437	153	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

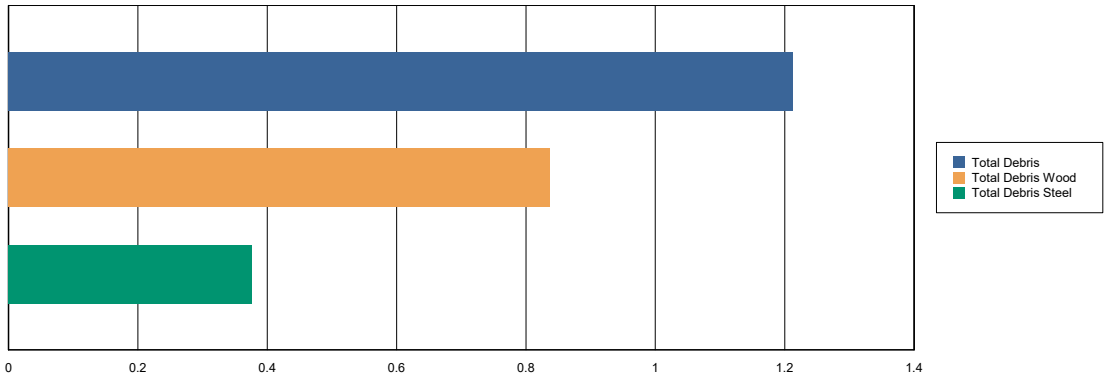
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 10 ignitions that will burn about 0.05 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 445 people and burn about 44 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,213,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 69.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 48,520 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



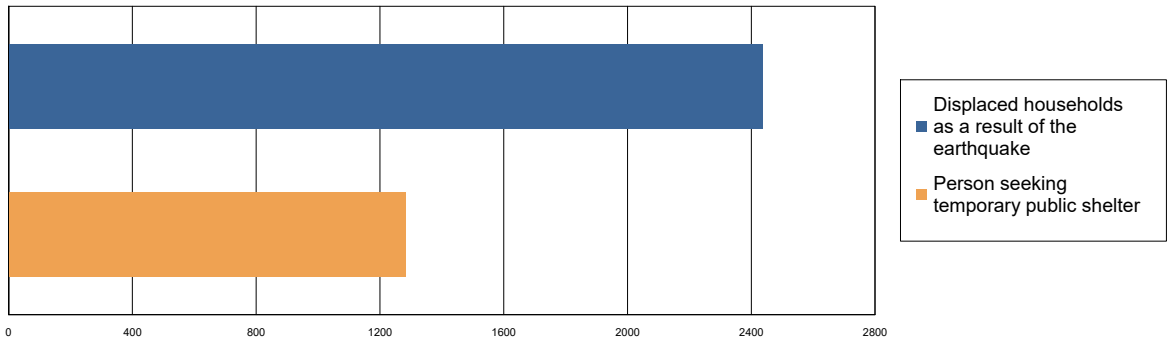
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.84	0.38	1.21	48,520 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 2,436 households to be displaced due to the earthquake. Of these, 1,283 people (out of a total population of 2,230,623) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
2,436	1,283

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	11.72	1.84	0.18	0.34
	Commuting	0.04	0.05	0.08	0.02
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	7.37	1.14	0.11	0.21
	Other-Residential	158.55	24.49	2.45	4.72
	Single Family	628.86	102.04	11.07	21.36
	Total	**807**	**130**	**14**	**27**
2 PM	Commercial	641.32	100.74	9.80	18.87
	Commuting	0.32	0.45	0.74	0.14
	Educational	184.42	30.05	3.09	5.92
	Hotels	0.00	0.00	0.00	0.00
	Industrial	54.31	8.44	0.79	1.52
	Other-Residential	24.41	3.89	0.41	0.75
	Single Family	104.97	17.60	2.00	3.70
	Total	**1,010**	**161**	**17**	**31**
5 PM	Commercial	453.54	71.87	7.12	13.48
	Commuting	7.09	9.44	15.96	3.09
	Educational	17.75	2.89	0.30	0.57
	Hotels	0.00	0.00	0.00	0.00
	Industrial	33.94	5.28	0.50	0.95
	Other-Residential	62.54	9.96	1.05	1.94
	Single Family	250.68	42.04	4.78	8.83
	Total	**826**	**141**	**30**	**29**

Economic Loss

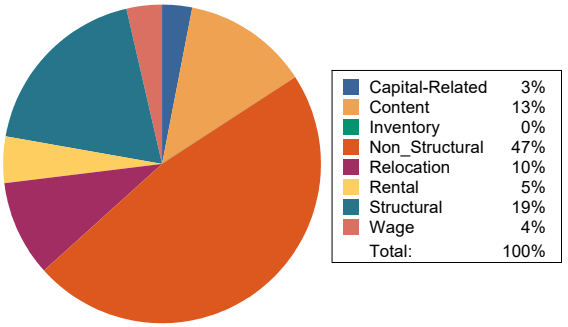
The total economic loss estimated for the earthquake is 4,109.85 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 3,935.17 (millions of dollars); 21 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 69 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

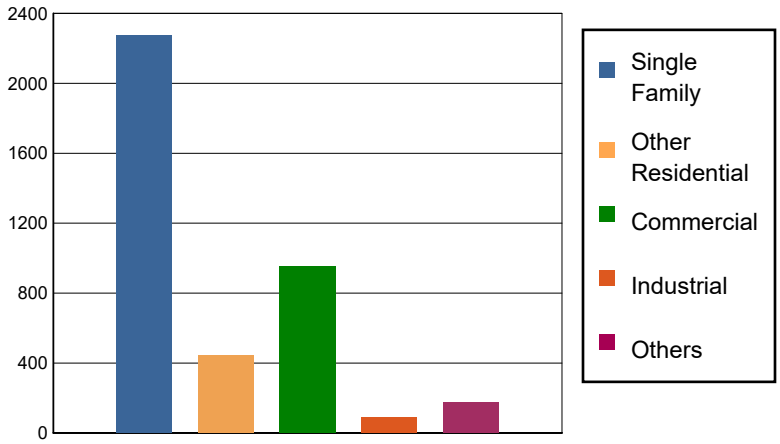


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	9.4744	118.3937	2.4603	8.9449	139.2733
	Capital-Related	0.0000	4.0270	110.2585	1.4677	2.1000	117.8532
	Rental	60.9194	37.0269	80.0021	1.0813	4.3189	183.3486
	Relocation	213.8705	26.7319	113.2496	7.4221	31.8446	393.1187
	Subtotal	**274.7899**	**77.2602**	**421.9039**	**12.4314**	**47.2084**	**833.5938**
Capital Stock Losses							
	Structural	483.1665	64.5777	137.5210	16.6249	30.3726	732.2627
	Non_Structural	1227.2130	252.2005	277.0424	35.3107	67.1336	1,858.9002
	Content	289.2533	52.3684	115.0944	19.7474	28.0299	504.4934
	Inventory	0.0000	0.0000	2.3753	3.2635	0.2773	5.9161
	Subtotal	**1999.6328**	**369.1466**	**532.0331**	**74.9465**	**125.8134**	**3101.5724**
	Total	**2274.42**	**446.41**	**953.94**	**87.38**	**173.02**	**3935.17**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	7725.3901	0.0000	0.00
	Bridges	8191.9167	56.0847	0.68
	Tunnels	28.9598	0.0010	0.00
	Subtotal	**15946.2666**	**56.0857**	
Railways	Segments	230.8566	0.0000	0.00
	Bridges	312.0291	0.2204	0.07
	Tunnels	0.0000	0.0000	0.00
	Facilities	21.3040	1.0012	4.70
	Subtotal	**564.1897**	**1.2216**	
Light Rail	Segments	184.5443	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	92.8176	3.7948	4.09
	Subtotal	**277.3619**	**3.7948**	
Bus	Facilities	4.2189	0.1799	4.26
	Subtotal	**4.2189**	**0.1799**	
Ferry	Facilities	1.3310	0.0408	3.07
	Subtotal	**1.3310**	**0.0408**	
Port	Facilities	30.5524	1.5486	5.07
	Subtotal	**30.5524**	**1.5486**	
Airport	Facilities	53.0888	2.0693	3.90
	Runways	79.8653	0.0000	0.00
	Subtotal	**132.9541**	**2.0693**	
	Total	**16,956.87**	**64.94**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	278.7210	2.3584	0.85
	Distribution Lines	645.8251	6.4689	1.00
	Subtotal	**924.5461**	**8.8273**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	7038.6734	62.5034	0.89
	Distribution Lines	387.4950	3.2495	0.84
	Subtotal	**7426.1684**	**65.7529**	
Natural Gas	Pipelines	186.0842	0.0000	0.00
	Facilities	7.6908	0.0679	0.88
	Distribution Lines	258.3300	1.1132	0.43
	Subtotal	**452.1050**	**1.1811**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.1860	0.0018	0.97
	Subtotal	**0.1860**	**0.0018**	
Electrical Power	Facilities	2766.0720	33.9668	1.23
	Subtotal	**2766.0720**	**33.9668**	
Communication	Facilities	1.6740	0.0154	0.92
	Subtotal	**1.6740**	**0.0154**	
	Total	**11,570.75**	**109.75**	

Appendix A: County Listing for the Region

Arlington,VA

Fairfax,VA

Loudoun,VA

Prince William,VA

Alexandria,VA

Fairfax City,VA

Falls Church,VA

Manassas,VA

Manassas Park,VA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Virginia					
	Arlington	207,627	27,386	6,025	33,412
	Fairfax	1,081,726	144,188	26,638	170,827
	Loudoun	312,311	39,257	6,070	45,327
	Prince William	402,002	48,430	5,936	54,366
	Alexandria	139,966	18,477	5,549	24,027
	Fairfax City	22,565	3,164	1,516	4,681
	Falls Church	12,332	1,766	599	2,365
	Manassas	37,821	3,672	1,274	4,947
	Manassas Park	14,273	1,298	261	1,560
Total Region		**2,230,623**	**287,638**	**53,868**	**341,512**

Hazus: Earthquake Global Risk Report

Region Name: NOVA_EQ_FL_HU_Test

Earthquake Scenario: NOVA 1000 Year 5.8 Magnitude

Print Date: August 04, 2021

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 9 county(ies) from the following state(s):

Virginia

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,321.37 square miles and contains 520 census tracts. There are over 823 thousand households in the region which has a total population of 2,230,623 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 663 thousand buildings in the region with a total building replacement value (excluding contents) of 341,515 (millions of dollars). Approximately 92.00 % of the buildings (and 84.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 16,956 and 11,570 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 663 thousand buildings in the region which have an aggregate total replacement value of 341,515 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 70% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 19 hospitals in the region with a total bed capacity of 3,149 beds. There are 846 schools, 110 fire stations, 46 police stations and 14 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes 69 hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 28,526.00 (millions of dollars). This inventory includes over 652.44 miles of highways, 1,639 bridges, 32,295.76 miles of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	1,639	8191.9167
	Segments	556	7725.3901
	Tunnels	2	28.9598
		Subtotal	**15946.2666**
Railways	Bridges	71	312.0291
	Facilities	8	21.3040
	Segments	201	230.8566
	Tunnels	0	0.0000
		Subtotal	**564.1897**
Light Rail	Bridges	0	0.0000
	Facilities	33	92.8176
	Segments	35	184.5443
	Tunnels	0	0.0000
		Subtotal	**277.3619**
Bus	Facilities	3	4.2189
		Subtotal	**4.2189**
Ferry	Facilities	1	1.3310
		Subtotal	**1.3310**
Port	Facilities	11	30.5524
		Subtotal	**30.5524**
Airport	Facilities	6	53.0888
	Runways	2	79.8653
		Subtotal	**132.9541**
		Total	**16,956.90**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	645.8251
	Facilities	9	278.7210
	Pipelines	0	0.0000
		Subtotal	**924.5461**
Waste Water	Distribution Lines	NA	387.4950
	Facilities	56	7038.6734
	Pipelines	0	0.0000
		Subtotal	**7426.1684**
Natural Gas	Distribution Lines	NA	258.3300
	Facilities	5	7.6908
	Pipelines	31	186.0842
		Subtotal	**452.1050**
Oil Systems	Facilities	2	0.1860
	Pipelines	0	0.0000
		Subtotal	**0.1860**
Electrical Power	Facilities	6	2766.0720
		Subtotal	**2766.0720**
Communication	Facilities	18	1.6740
		Subtotal	**1.6740**
		Total	**11,570.80**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	NOVA 1000 Year 5.8 Magnitude
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-77.80
Latitude of Epicenter	38.03
Earthquake Magnitude	5.80
Depth (km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Direct Earthquake Damage

Building Damage

Hazus estimates that about 27,518 buildings will be at least moderately damaged. This is over 4.00 % of the buildings in the region. There are an estimated 553 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

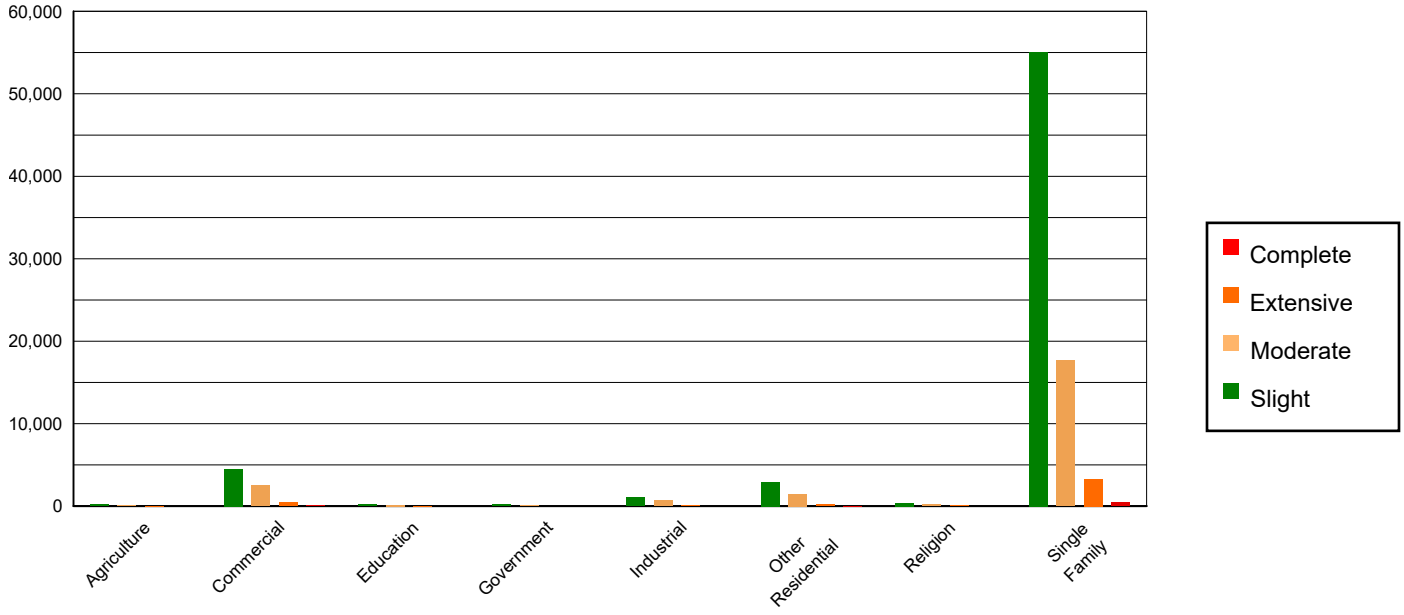


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	1311.38	0.23	218.96	0.34	99.32	0.44	18.76	0.45	1.58	0.29
Commercial	26687.93	4.67	4501.83	6.97	2523.42	11.06	463.93	11.16	50.89	9.19
Education	1458.55	0.26	236.71	0.37	134.07	0.59	21.74	0.52	2.94	0.53
Government	918.41	0.16	154.48	0.24	93.31	0.41	14.98	0.36	1.82	0.33
Industrial	6280.76	1.10	1072.40	1.66	663.08	2.91	116.29	2.80	12.47	2.25
Other Residential	21475.78	3.76	2923.84	4.53	1481.63	6.50	200.54	4.82	18.21	3.29
Religion	2919.86	0.51	395.14	0.61	202.87	0.89	40.99	0.99	5.14	0.93
Single Family	510550.99	89.32	55059.17	85.28	17609.54	77.21	3280.70	78.90	460.60	83.19
Total	**571,604**		**64,563**		**22,807**		**4,158**		**554**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	421160.33	73.68	35659.90	55.23	5601.76	24.56	336.81	8.10	0.47	0.08
Steel	17253.31	3.02	3033.96	4.70	2024.75	8.88	322.01	7.74	34.20	6.18
Concrete	3055.93	0.53	516.24	0.80	340.58	1.49	38.24	0.92	2.90	0.52
Precast	1167.61	0.20	172.10	0.27	159.22	0.70	45.47	1.09	1.02	0.18
RM	5011.01	0.88	465.18	0.72	351.36	1.54	75.65	1.82	0.54	0.10
URM	120507.33	21.08	23777.42	36.83	13643.17	59.82	3278.51	78.85	512.04	92.48
MH	3448.16	0.60	937.74	1.45	686.38	3.01	61.24	1.47	2.49	0.45
Total	**571,604**		**64,563**		**22,807**		**4,158**		**554**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 3,149 hospital beds available for use. On the day of the earthquake, the model estimates that only 2,386 hospital beds (76.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 89.00% of the beds will be back in service. By 30 days, 98.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	19	0	0	19
Schools	846	0	0	846
EOCs	14	0	0	14
PoliceStations	46	0	0	46
FireStations	110	0	0	110

Transportation Lifeline Damage

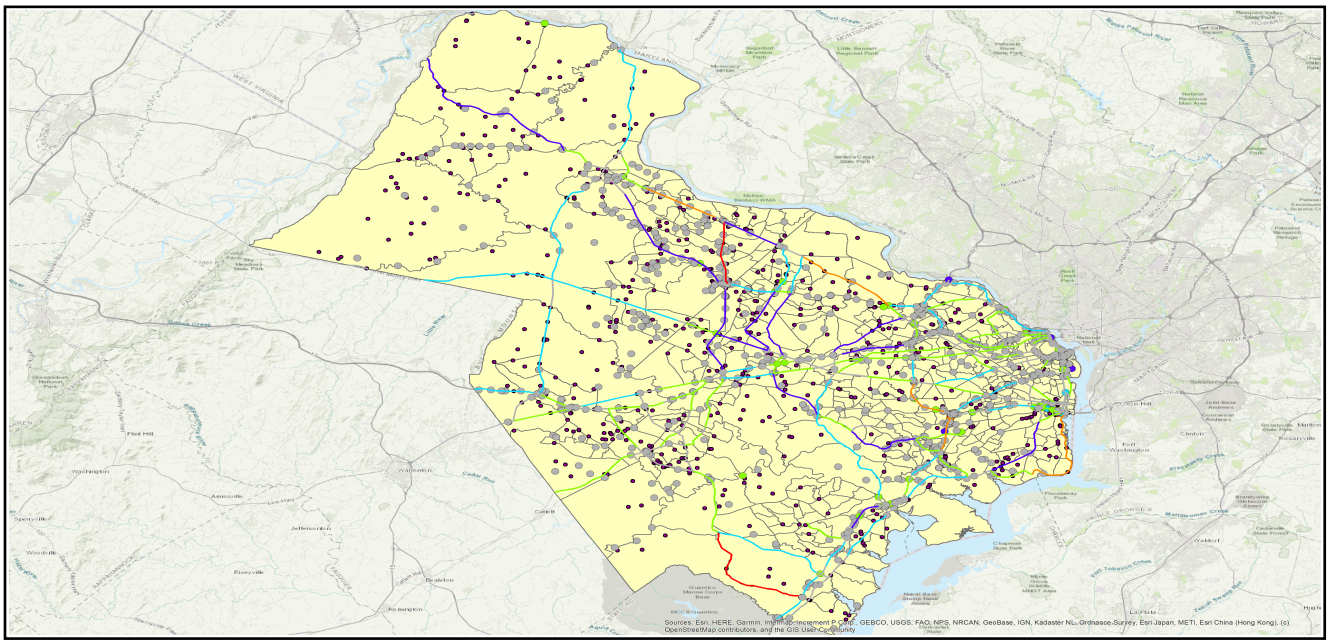


Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	556	0	0	556	556
	Bridges	1,639	1	0	1,638	1,638
	Tunnels	2	0	0	2	2
Railways	Segments	201	0	0	201	201
	Bridges	71	0	0	71	71
	Tunnels	0	0	0	0	0
	Facilities	8	0	0	8	8
Light Rail	Segments	35	0	0	35	35
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	33	0	0	33	33
Bus	Facilities	3	0	0	3	3
Ferry	Facilities	1	0	0	1	1
Port	Facilities	11	0	0	11	11
Airport	Facilities	6	0	0	6	6
	Runways	2	0	0	2	2

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	9	0	0	9	9
Waste Water	56	0	0	56	56
Natural Gas	5	0	0	5	5
Oil Systems	2	0	0	2	2
Electrical Power	6	0	0	6	6
Communication	18	0	0	18	18

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	20,065	1438	359
Waste Water	12,039	722	181
Natural Gas	193	5	1
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	823,609	1,437	153	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

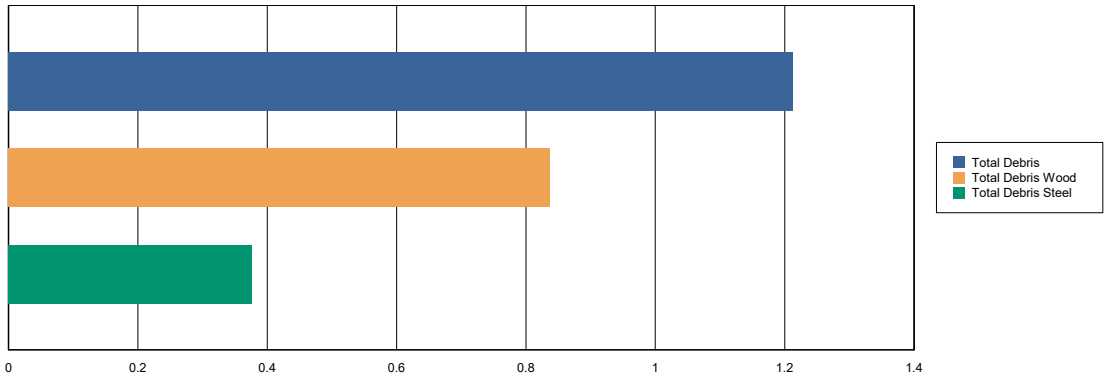
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 10 ignitions that will burn about 0.05 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 445 people and burn about 44 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,213,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 69.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 48,520 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



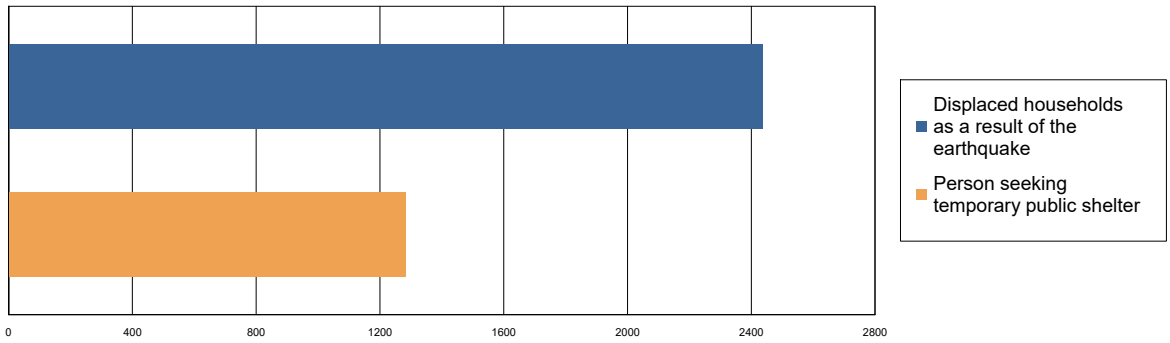
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.84	0.38	1.21	48,520 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 2,436 households to be displaced due to the earthquake. Of these, 1,283 people (out of a total population of 2,230,623) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
2,436	1,283

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	11.72	1.84	0.18	0.34
	Commuting	0.04	0.05	0.08	0.02
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	7.37	1.14	0.11	0.21
	Other-Residential	158.55	24.49	2.45	4.72
	Single Family	628.86	102.04	11.07	21.36
	Total	**807**	**130**	**14**	**27**
2 PM	Commercial	641.32	100.74	9.80	18.87
	Commuting	0.32	0.45	0.74	0.14
	Educational	184.42	30.05	3.09	5.92
	Hotels	0.00	0.00	0.00	0.00
	Industrial	54.31	8.44	0.79	1.52
	Other-Residential	24.41	3.89	0.41	0.75
	Single Family	104.97	17.60	2.00	3.70
	Total	**1,010**	**161**	**17**	**31**
5 PM	Commercial	453.54	71.87	7.12	13.48
	Commuting	7.09	9.44	15.96	3.09
	Educational	17.75	2.89	0.30	0.57
	Hotels	0.00	0.00	0.00	0.00
	Industrial	33.94	5.28	0.50	0.95
	Other-Residential	62.54	9.96	1.05	1.94
	Single Family	250.68	42.04	4.78	8.83
	Total	**826**	**141**	**30**	**29**

Economic Loss

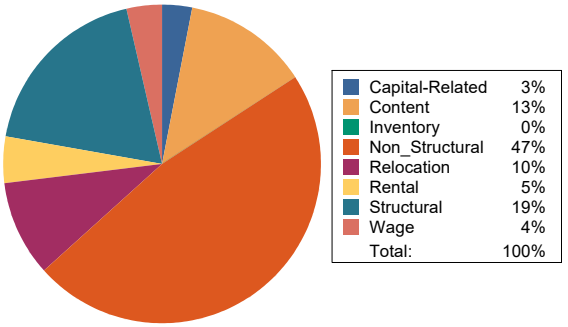
The total economic loss estimated for the earthquake is 4,109.85 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 3,935.17 (millions of dollars); 21 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 69 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

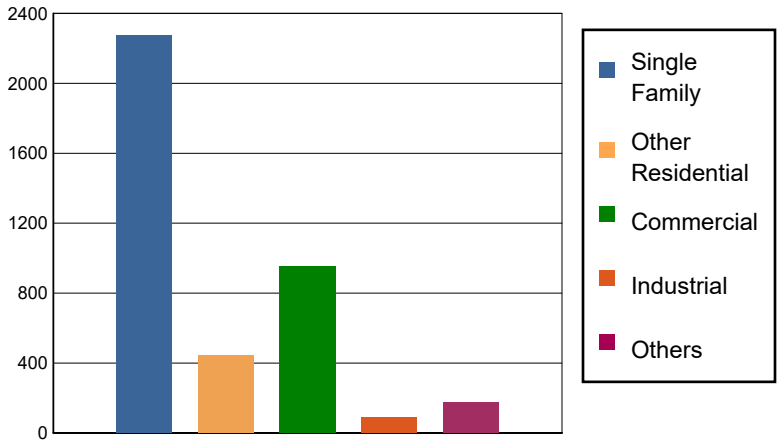


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	9.4744	118.3937	2.4603	8.9449	139.2733
	Capital-Related	0.0000	4.0270	110.2585	1.4677	2.1000	117.8532
	Rental	60.9194	37.0269	80.0021	1.0813	4.3189	183.3486
	Relocation	213.8705	26.7319	113.2496	7.4221	31.8446	393.1187
	Subtotal	**274.7899**	**77.2602**	**421.9039**	**12.4314**	**47.2084**	**833.5938**
Capital Stock Losses							
	Structural	483.1665	64.5777	137.5210	16.6249	30.3726	732.2627
	Non_Structural	1227.2130	252.2005	277.0424	35.3107	67.1336	1,858.9002
	Content	289.2533	52.3684	115.0944	19.7474	28.0299	504.4934
	Inventory	0.0000	0.0000	2.3753	3.2635	0.2773	5.9161
	Subtotal	**1999.6328**	**369.1466**	**532.0331**	**74.9465**	**125.8134**	**3101.5724**
	Total	**2274.42**	**446.41**	**953.94**	**87.38**	**173.02**	**3935.17**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	7725.3901	0.0000	0.00
	Bridges	8191.9167	56.0847	0.68
	Tunnels	28.9598	0.0010	0.00
	Subtotal	**15946.2666**	**56.0857**	
Railways	Segments	230.8566	0.0000	0.00
	Bridges	312.0291	0.2204	0.07
	Tunnels	0.0000	0.0000	0.00
	Facilities	21.3040	1.0012	4.70
	Subtotal	**564.1897**	**1.2216**	
Light Rail	Segments	184.5443	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	92.8176	3.7948	4.09
	Subtotal	**277.3619**	**3.7948**	
Bus	Facilities	4.2189	0.1799	4.26
	Subtotal	**4.2189**	**0.1799**	
Ferry	Facilities	1.3310	0.0408	3.07
	Subtotal	**1.3310**	**0.0408**	
Port	Facilities	30.5524	1.5486	5.07
	Subtotal	**30.5524**	**1.5486**	
Airport	Facilities	53.0888	2.0693	3.90
	Runways	79.8653	0.0000	0.00
	Subtotal	**132.9541**	**2.0693**	
	Total	**16,956.87**	**64.94**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	278.7210	2.3584	0.85
	Distribution Lines	645.8251	6.4689	1.00
	Subtotal	**924.5461**	**8.8273**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	7038.6734	62.5034	0.89
	Distribution Lines	387.4950	3.2495	0.84
	Subtotal	**7426.1684**	**65.7529**	
Natural Gas	Pipelines	186.0842	0.0000	0.00
	Facilities	7.6908	0.0679	0.88
	Distribution Lines	258.3300	1.1132	0.43
	Subtotal	**452.1050**	**1.1811**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.1860	0.0018	0.97
	Subtotal	**0.1860**	**0.0018**	
Electrical Power	Facilities	2766.0720	33.9668	1.23
	Subtotal	**2766.0720**	**33.9668**	
Communication	Facilities	1.6740	0.0154	0.92
	Subtotal	**1.6740**	**0.0154**	
	Total	**11,570.75**	**109.75**	

Appendix A: County Listing for the Region

Arlington,VA

Fairfax,VA

Loudoun,VA

Prince William,VA

Alexandria,VA

Fairfax City,VA

Falls Church,VA

Manassas,VA

Manassas Park,VA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Virginia					
	Arlington	207,627	27,386	6,025	33,412
	Fairfax	1,081,726	144,188	26,638	170,827
	Loudoun	312,311	39,257	6,070	45,327
	Prince William	402,002	48,430	5,936	54,366
	Alexandria	139,966	18,477	5,549	24,027
	Fairfax City	22,565	3,164	1,516	4,681
	Falls Church	12,332	1,766	599	2,365
	Manassas	37,821	3,672	1,274	4,947
	Manassas Park	14,273	1,298	261	1,560
Total Region		**2,230,623**	**287,638**	**53,868**	**341,512**

Hazus: Earthquake Global Risk Report

Region Name: NOVA_EQ_FL_HU_Test

Earthquake Scenario: NOVA 2500 Year 6.5 Magnitude

Print Date: August 03, 2021

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 9 county(ies) from the following state(s):

Virginia

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,321.37 square miles and contains 520 census tracts. There are over 823 thousand households in the region which has a total population of 2,230,623 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 663 thousand buildings in the region with a total building replacement value (excluding contents) of 341,515 (millions of dollars). Approximately 92.00 % of the buildings (and 84.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 16,956 and 11,570 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 663 thousand buildings in the region which have an aggregate total replacement value of 341,515 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 70% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 19 hospitals in the region with a total bed capacity of 3,149 beds. There are 846 schools, 110 fire stations, 46 police stations and 14 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes 69 hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 28,526.00 (millions of dollars). This inventory includes over 652.44 miles of highways, 1,639 bridges, 32,295.76 miles of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	1,639	8191.9167
	Segments	556	7725.3901
	Tunnels	2	28.9598
		Subtotal	**15946.2666**
Railways	Bridges	71	312.0291
	Facilities	8	21.3040
	Segments	201	230.8566
	Tunnels	0	0.0000
		Subtotal	**564.1897**
Light Rail	Bridges	0	0.0000
	Facilities	33	92.8176
	Segments	35	184.5443
	Tunnels	0	0.0000
		Subtotal	**277.3619**
Bus	Facilities	3	4.2189
		Subtotal	**4.2189**
Ferry	Facilities	1	1.3310
		Subtotal	**1.3310**
Port	Facilities	11	30.5524
		Subtotal	**30.5524**
Airport	Facilities	6	53.0888
	Runways	2	79.8653
		Subtotal	**132.9541**
		Total	**16,956.90**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	645.8251
	Facilities	9	278.7210
	Pipelines	0	0.0000
		Subtotal	**924.5461**
Waste Water	Distribution Lines	NA	387.4950
	Facilities	56	7038.6734
	Pipelines	0	0.0000
		Subtotal	**7426.1684**
Natural Gas	Distribution Lines	NA	258.3300
	Facilities	5	7.6908
	Pipelines	31	186.0842
		Subtotal	**452.1050**
Oil Systems	Facilities	2	0.1860
	Pipelines	0	0.0000
		Subtotal	**0.1860**
Electrical Power	Facilities	6	2766.0720
		Subtotal	**2766.0720**
Communication	Facilities	18	1.6740
		Subtotal	**1.6740**
		Total	**11,570.80**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	NOVA 2500 Year 6.5 Magnitude
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-77.80
Latitude of Epicenter	38.03
Earthquake Magnitude	6.50
Depth (km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Direct Earthquake Damage

Building Damage

Hazus estimates that about 27,518 buildings will be at least moderately damaged. This is over 4.00 % of the buildings in the region. There are an estimated 553 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

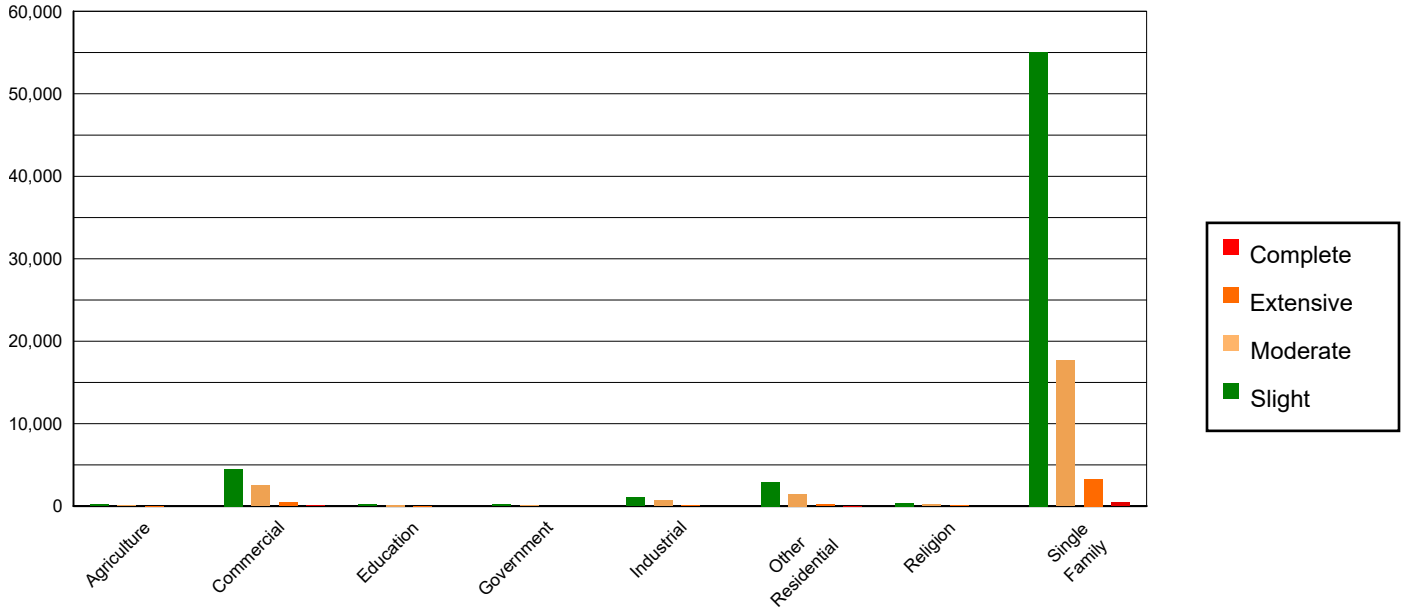


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	1311.38	0.23	218.96	0.34	99.32	0.44	18.76	0.45	1.58	0.29
Commercial	26687.93	4.67	4501.83	6.97	2523.42	11.06	463.93	11.16	50.89	9.19
Education	1458.55	0.26	236.71	0.37	134.07	0.59	21.74	0.52	2.94	0.53
Government	918.41	0.16	154.48	0.24	93.31	0.41	14.98	0.36	1.82	0.33
Industrial	6280.76	1.10	1072.40	1.66	663.08	2.91	116.29	2.80	12.47	2.25
Other Residential	21475.78	3.76	2923.84	4.53	1481.63	6.50	200.54	4.82	18.21	3.29
Religion	2919.86	0.51	395.14	0.61	202.87	0.89	40.99	0.99	5.14	0.93
Single Family	510550.99	89.32	55059.17	85.28	17609.54	77.21	3280.70	78.90	460.60	83.19
Total	**571,604**		**64,563**		**22,807**		**4,158**		**554**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	421160.33	73.68	35659.90	55.23	5601.76	24.56	336.81	8.10	0.47	0.08
Steel	17253.31	3.02	3033.96	4.70	2024.75	8.88	322.01	7.74	34.20	6.18
Concrete	3055.93	0.53	516.24	0.80	340.58	1.49	38.24	0.92	2.90	0.52
Precast	1167.61	0.20	172.10	0.27	159.22	0.70	45.47	1.09	1.02	0.18
RM	5011.01	0.88	465.18	0.72	351.36	1.54	75.65	1.82	0.54	0.10
URM	120507.33	21.08	23777.42	36.83	13643.17	59.82	3278.51	78.85	512.04	92.48
MH	3448.16	0.60	937.74	1.45	686.38	3.01	61.24	1.47	2.49	0.45
Total	**571,604**		**64,563**		**22,807**		**4,158**		**554**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 3,149 hospital beds available for use. On the day of the earthquake, the model estimates that only 2,386 hospital beds (76.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 89.00% of the beds will be back in service. By 30 days, 98.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	19	0	0	19
Schools	846	0	0	846
EOCs	14	0	0	14
PoliceStations	46	0	0	46
FireStations	110	0	0	110

Transportation Lifeline Damage

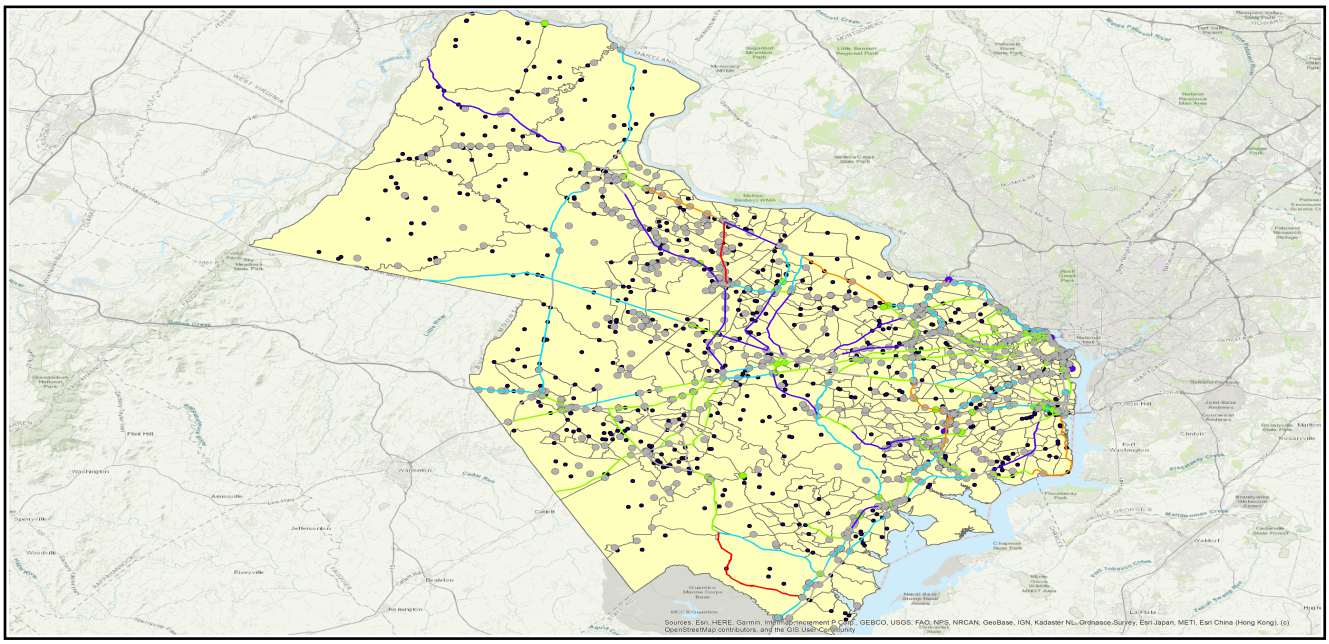


Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	556	0	0	556	556
	Bridges	1,639	1	0	1,638	1,638
	Tunnels	2	0	0	2	2
Railways	Segments	201	0	0	201	201
	Bridges	71	0	0	71	71
	Tunnels	0	0	0	0	0
	Facilities	8	0	0	8	8
Light Rail	Segments	35	0	0	35	35
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	33	0	0	33	33
Bus	Facilities	3	0	0	3	3
Ferry	Facilities	1	0	0	1	1
Port	Facilities	11	0	0	11	11
Airport	Facilities	6	0	0	6	6
	Runways	2	0	0	2	2

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	9	0	0	9	9
Waste Water	56	0	0	56	56
Natural Gas	5	0	0	5	5
Oil Systems	2	0	0	2	2
Electrical Power	6	0	0	6	6
Communication	18	0	0	18	18

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	20,065	1438	359
Waste Water	12,039	722	181
Natural Gas	193	5	1
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	823,609	1,437	153	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

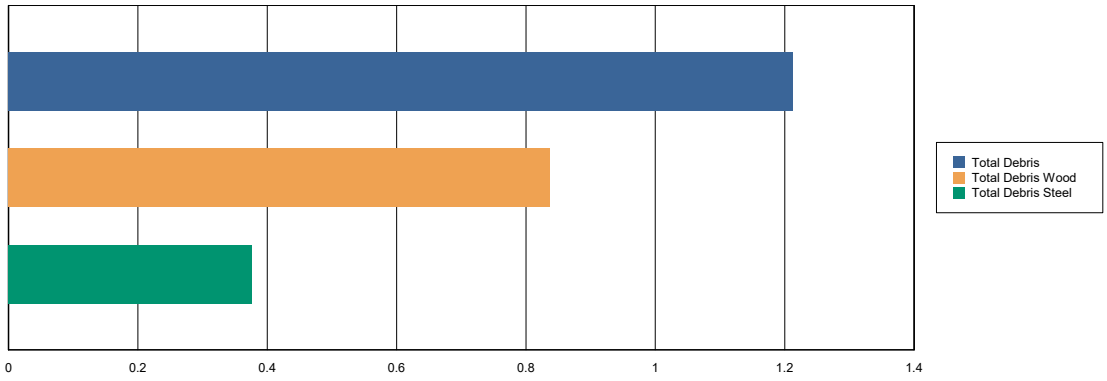
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 10 ignitions that will burn about 0.05 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 445 people and burn about 44 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,213,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 69.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 48,520 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



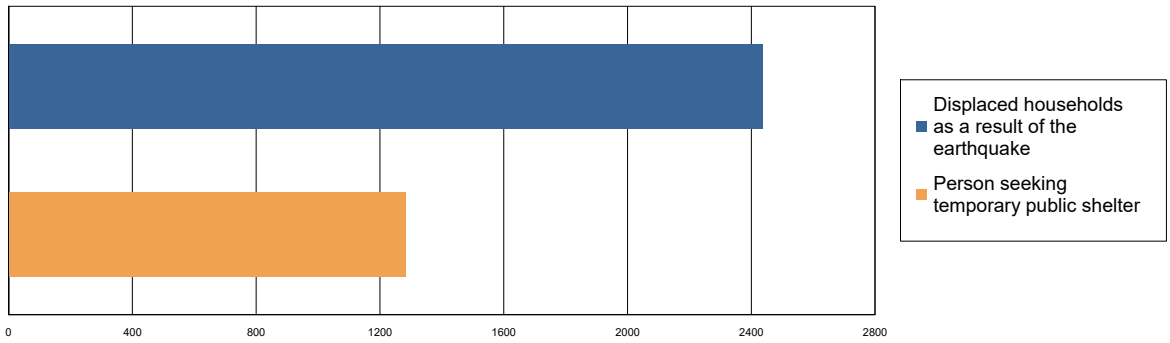
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.84	0.38	1.21	48,520 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 2,436 households to be displaced due to the earthquake. Of these, 1,283 people (out of a total population of 2,230,623) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
2,436	1,283

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	11.72	1.84	0.18	0.34
	Commuting	0.04	0.05	0.08	0.02
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	7.37	1.14	0.11	0.21
	Other-Residential	158.55	24.49	2.45	4.72
	Single Family	628.86	102.04	11.07	21.36
	Total	**807**	**130**	**14**	**27**
2 PM	Commercial	641.32	100.74	9.80	18.87
	Commuting	0.32	0.45	0.74	0.14
	Educational	184.42	30.05	3.09	5.92
	Hotels	0.00	0.00	0.00	0.00
	Industrial	54.31	8.44	0.79	1.52
	Other-Residential	24.41	3.89	0.41	0.75
	Single Family	104.97	17.60	2.00	3.70
	Total	**1,010**	**161**	**17**	**31**
5 PM	Commercial	453.54	71.87	7.12	13.48
	Commuting	7.09	9.44	15.96	3.09
	Educational	17.75	2.89	0.30	0.57
	Hotels	0.00	0.00	0.00	0.00
	Industrial	33.94	5.28	0.50	0.95
	Other-Residential	62.54	9.96	1.05	1.94
	Single Family	250.68	42.04	4.78	8.83
	Total	**826**	**141**	**30**	**29**

Economic Loss

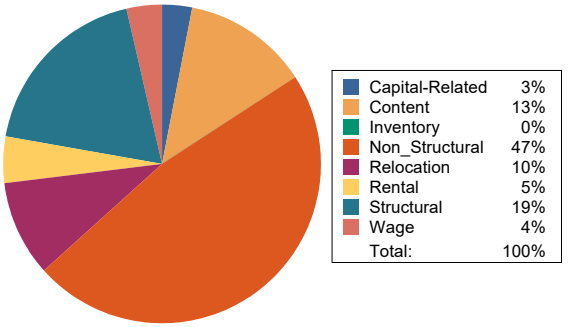
The total economic loss estimated for the earthquake is 4,109.85 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 3,935.17 (millions of dollars); 21 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 69 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

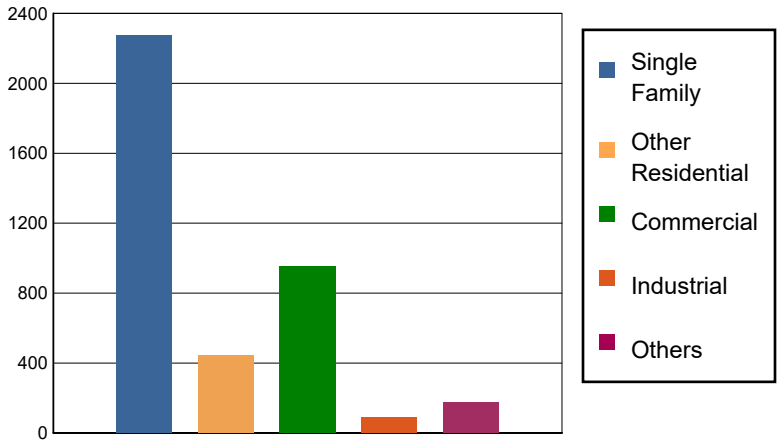


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	9.4744	118.3937	2.4603	8.9449	139.2733
	Capital-Related	0.0000	4.0270	110.2585	1.4677	2.1000	117.8532
	Rental	60.9194	37.0269	80.0021	1.0813	4.3189	183.3486
	Relocation	213.8705	26.7319	113.2496	7.4221	31.8446	393.1187
	Subtotal	**274.7899**	**77.2602**	**421.9039**	**12.4314**	**47.2084**	**833.5938**
Capital Stock Losses							
	Structural	483.1665	64.5777	137.5210	16.6249	30.3726	732.2627
	Non_Structural	1227.2130	252.2005	277.0424	35.3107	67.1336	1,858.9002
	Content	289.2533	52.3684	115.0944	19.7474	28.0299	504.4934
	Inventory	0.0000	0.0000	2.3753	3.2635	0.2773	5.9161
	Subtotal	**1999.6328**	**369.1466**	**532.0331**	**74.9465**	**125.8134**	**3101.5724**
	Total	**2274.42**	**446.41**	**953.94**	**87.38**	**173.02**	**3935.17**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	7725.3901	0.0000	0.00
	Bridges	8191.9167	56.0847	0.68
	Tunnels	28.9598	0.0010	0.00
	Subtotal	**15946.2666**	**56.0857**	
Railways	Segments	230.8566	0.0000	0.00
	Bridges	312.0291	0.2204	0.07
	Tunnels	0.0000	0.0000	0.00
	Facilities	21.3040	1.0012	4.70
	Subtotal	**564.1897**	**1.2216**	
Light Rail	Segments	184.5443	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	92.8176	3.7948	4.09
	Subtotal	**277.3619**	**3.7948**	
Bus	Facilities	4.2189	0.1799	4.26
	Subtotal	**4.2189**	**0.1799**	
Ferry	Facilities	1.3310	0.0408	3.07
	Subtotal	**1.3310**	**0.0408**	
Port	Facilities	30.5524	1.5486	5.07
	Subtotal	**30.5524**	**1.5486**	
Airport	Facilities	53.0888	2.0693	3.90
	Runways	79.8653	0.0000	0.00
	Subtotal	**132.9541**	**2.0693**	
	Total	**16,956.87**	**64.94**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	278.7210	2.3584	0.85
	Distribution Lines	645.8251	6.4689	1.00
	Subtotal	**924.5461**	**8.8273**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	7038.6734	62.5034	0.89
	Distribution Lines	387.4950	3.2495	0.84
	Subtotal	**7426.1684**	**65.7529**	
Natural Gas	Pipelines	186.0842	0.0000	0.00
	Facilities	7.6908	0.0679	0.88
	Distribution Lines	258.3300	1.1132	0.43
	Subtotal	**452.1050**	**1.1811**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.1860	0.0018	0.97
	Subtotal	**0.1860**	**0.0018**	
Electrical Power	Facilities	2766.0720	33.9668	1.23
	Subtotal	**2766.0720**	**33.9668**	
Communication	Facilities	1.6740	0.0154	0.92
	Subtotal	**1.6740**	**0.0154**	
	Total	**11,570.75**	**109.75**	

Appendix A: County Listing for the Region

Arlington,VA

Fairfax,VA

Loudoun,VA

Prince William,VA

Alexandria,VA

Fairfax City,VA

Falls Church,VA

Manassas,VA

Manassas Park,VA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Virginia					
	Arlington	207,627	27,386	6,025	33,412
	Fairfax	1,081,726	144,188	26,638	170,827
	Loudoun	312,311	39,257	6,070	45,327
	Prince William	402,002	48,430	5,936	54,366
	Alexandria	139,966	18,477	5,549	24,027
	Fairfax City	22,565	3,164	1,516	4,681
	Falls Church	12,332	1,766	599	2,365
	Manassas	37,821	3,672	1,274	4,947
	Manassas Park	14,273	1,298	261	1,560
Total Region		**2,230,623**	**287,638**	**53,868**	**341,512**

HAZUS AEBM- Portfolio Buiding Report

8/3/2021

Building Information

Total Number of Buildings Analyzed: 0

Ground Motion & Building Intersection Points

Damage State	Ground Motion and Building Intersection Points		
	Minimum	Maximum	Average
Ground Motion			
SA @ 0.3 seconds (g)			
SA @ 0.1 seconds (g)			
PGA (g)			
Building Intersection Points			
Displacement (in)			
Acceleration (g)			

Building Damage

Damage State	Damage State Probabilities (%) *		
	Structural	Non-Structural Drift	Non-Structural Acceleration
None			
Slight			
Moderate			
Extensive			
Complete			

*Average Damage State Probabilities weighted by the building value of each building.

Casualties

Casualty Level	Estimated Number of Occupants & Casualties		
	Description	Day Time Scenario	Night Time Scenario
Occupants	# of people in building		
Level 1	Requires Medical Attention		
Level 2	Requires Hospitalization		
Level 3	Life Threatening Injury		
Level 4	Death		

Economic Loss

Loss Category	Building Exposure & Economic Loss		
	Exposure($)	Loss ($)	Damage Ratio
Building-Structual			
Building-Nonstructual			
Contents			
Inventory			
Total			

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/states were selected at the time of study region creation.

Disclaimer: *The estimates of economic and social losses contained in this report were produced using HAZUS loss estimation methodology software, which is based on current scientific and engineering knowledge. There is uncertainty inherent in any loss estimation methodology. Therefore, there may be significant differences between modeled results contained in this report and actual economic and social losses associated with earthquakes.*

Direct Economic Losses For Buildings

August 17, 2021

All values are in thousands of dollars

	Capital Stock Losses					Income Losses				
	Cost Structural Damage	Cost Non-struct. Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Virginia										
Loudoun	88,082	210,687	53,764	814	0.66	46,074	10,578	12,637	19,084	441,720
Manassas	13,203	33,433	10,680	254	0.94	8,353	3,018	4,330	3,709	76,980
Fairfax City	11,447	27,132	8,353	164	0.82	6,946	4,360	5,345	3,922	67,670
Fairfax	364,386	911,319	244,752	2,696	0.75	190,822	58,883	67,801	89,073	1,929,731
Prince William	135,663	354,828	100,005	1,164	0.90	69,771	16,023	18,932	28,427	724,815
Falls Church	5,086	12,268	3,504	52	0.73	2,983	1,457	1,779	1,547	28,674
Alexandria	47,783	130,317	36,433	338	0.74	30,639	10,563	13,006	15,750	284,828
Manassas Park	3,859	9,735	2,813	78	0.87	2,206	566	674	902	20,833
Arlington	62,754	169,182	44,190	356	0.69	35,324	12,406	14,771	20,934	359,916

Study Region : NOVA_EQ_FL_HU_Test

Scenario : NOVA 2500 Year 6.5 Magnitude

	Capital Stock Losses					Income Losses				
	Cost Structural Damage	Cost Non-struct. Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Total	732,263	1,858,900	504,494	5,916	0.79	393,119	117,853	139,274	183,349	3,935,168
Region Total	732,263	1,858,900	504,494	5,916	0.79	393,119	117,853	139,274	183,349	3,935,168

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/states were selected at the time of study region creation.

Building Stock Exposure By General Occupancy

August 03, 2021

All values are in thousands of dollars

	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Virginia								
Alexandria	18,477,776	3,608,216	304,079	20,665	567,753	128,869	919,729	24,027,087
Arlington	27,386,560	4,390,075	345,710	26,163	614,708	371,546	277,738	33,412,500
Fairfax	144,188,703	20,116,524	2,464,611	272,032	1,827,947	579,222	1,378,119	170,827,158
Fairfax City	3,164,151	1,210,584	135,723	12,501	110,826	13,954	33,368	4,681,107
Falls Church	1,766,161	461,373	39,966	7,392	58,626	11,611	20,673	2,365,802
Loudoun	39,257,243	4,211,047	886,538	159,244	382,528	134,762	296,612	45,327,974
Manassas	3,672,496	885,410	229,191	11,562	59,555	32,685	56,356	4,947,255
Manassas Park	1,298,379	155,463	64,064	7,422	8,011	5,174	21,671	1,560,184
Prince William	48,430,503	4,155,696	758,100	171,771	396,989	123,270	330,279	54,366,608
Total	**287,641,972**	**39,194,388**	**5,227,982**	**688,752**	**4,026,943**	**1,401,093**	**3,334,545**	**341,515,675**
Region Total	**287,641,972**	**39,194,388**	**5,227,982**	**688,752**	**4,026,943**	**1,401,093**	**3,334,545**	**341,515,675**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/states were selected at the time of study region creation.

Direct Economic Loss For Transportation

August 17, 2021

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Virginia								
Arlington								
Segments	0	0	0					0
Bridges	14,076	5	0					14,081
Tunnels	1	0	0					1
Facilities		0	1,200	49	0	0	0	1,249
Total	**14,077**	**5**	**1,200**	**49**	**0**	**0**	**0**	**15,331**
Fairfax								
Segments	0	0	0					0
Bridges	23,032	108	0					23,140
Tunnels	0	0	0					0
Facilities		353	1,147	59	606	0	1,698	3,863
Total	**23,032**	**462**	**1,147**	**59**	**606**	**0**	**1,698**	**27,003**
Loudoun								
Segments	0	0	0					0
Bridges	4,564	0	0					4,564
Tunnels	0	0	0					0
Facilities		0	0	0	0	41	372	412

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Total	**4,564**	**0**	**0**	**0**	**0**	**41**	**372**	**4,977**
Prince William								
Segments	0	0	0					0
Bridges	8,697	65	0					8,762
Tunnels	0	0	0					0
Facilities		308	632	72	942	0	0	1,955
Total	**8,697**	**373**	**632**	**72**	**942**	**0**	**0**	**10,717**
Alexandria								
Segments	0	0	0					0
Bridges	5,521	36	0					5,557
Tunnels	0	0	0					0
Facilities		203	533	0	0	0	0	737
Total	**5,521**	**239**	**533**	**0**	**0**	**0**	**0**	**6,294**
Fairfax City								
Segments	0	0	0					0
Bridges	127	0	0					127
Tunnels	0	0	0					0
Facilities		0	0	0	0	0	0	0
Total	**127**	**0**	**0**	**0**	**0**	**0**	**0**	**127**
Falls Church								
Segments	0	0	0					0
Bridges	1	0	0					1
Tunnels	0	0	0					0
Facilities		0	0	0	0	0	0	0

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Total	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Manassas								
Segments	0	0	0					0
Bridges	66	7	0					73
Tunnels	0	0	0					0
Facilities		136	144	0	0	0	0	280
Total	**66**	**143**	**144**	**0**	**0**	**0**	**0**	**353**
Manassas Park								
Segments	0	0	0					0
Bridges	0	0	0					0
Tunnels	0	0	0					0
Facilities		0	139	0	0	0	0	139
Total	**0**	**0**	**139**	**0**	**0**	**0**	**0**	**139**
Total	**56,086**	**1,222**	**3,795**	**180**	**1,549**	**41**	**2,069**	**64,941**
Region Total	**56,086**	**1,222**	**3,795**	**180**	**1,549**	**41**	**2,069**	**64,941**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/states were selected at the time of study region creation.

Direct Economic Loss For Utilities

August 17, 2021

All values are in thousands of dollars

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Virginia							
Arlington							
Facilities	0	5,318	0	0	0	3	5,321
Pipelines	285	143	0	0			428
Total	285	5,461	0	0	0	3	5,748
Fairfax							
Facilities	423	11,643	1	16	9,206	6	21,294
Pipelines	2,619	1,315	0	0			3,934
Total	3,042	12,958	1	16	9,206	6	25,228
Loudoun							
Facilities	728	22,678	0	34	5,018	1	28,460
Pipelines	1,606	807	0	0			2,412
Total	2,334	23,485	0	34	5,018	1	30,872
Prince William							
Facilities	1,207	19,035	0	18	14,270	5	34,535

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Pipelines	1,590	798	0	0			2,388
Total	2,797	19,833	0	18	14,270	5	36,923
Alexandria							
Facilities	0	3,830	0	0	1,278	0	5,108
Pipelines	179	90	0	0			269
Total	179	3,920	0	0	1,278	0	5,377
Fairfax City							
Facilities	0	0	1	0	0	1	2
Pipelines	57	29	0	0			86
Total	57	29	1	0	0	1	88
Falls Church							
Facilities	0	0	0	0	0	1	1
Pipelines	23	12	0	0			35
Total	23	12	0	0	0	1	35
Manassas							
Facilities	0	0	0	0	4,194	0	4,194
Pipelines	92	46	0	0			138
Total	92	46	0	0	4,194	0	4,332
Manassas Park							
Facilities	0	0	0	0	0	0	0
Pipelines	19	10	0	0			28

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Total	19	10	0	0	0	0	28
Total	**8,827**	**65,753**	**2**	**68**	**33,967**	**15**	**108,632**
Region Total	**8,827**	**65,753**	**2**	**68**	**33,967**	**15**	**108,632**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/states were selected at the time of study region creation.

Hazus Quick Assessment Report

Estimated Economic Loss ($ Billions)

Category	Description	Range
General Building Stock	Building Damage	1.30 - 5.20
	Building Contents	0.00 - 0.10
	Business Interruption	0.40 - 1.70
Infrastructure	Lifelines Damage	
	Total	2.00 - 7.90

Preliminary Damage Assessment (PDA) Estimates

Description	Residential	Commercial	Other	Total
Affected	58,000	4,500	2,000	64,500
Minor	19,100	2,500	1,100	22,700
Major	3,500	460	210	4,170
Destroyed	480	50	20	550
Total	81,080	7,510	3,330	91,920

Estimated Casualties : Night Time

Severity Level	Description	# Persons
Level 1	Medical Aid	400 - 1,600
Level 2	Hospital Care	70 - 300
Level 3	Life-threatening	10 - 30
Level 4	Fatalities	10 - 50

Estimated Shelter Needs

Type	Households	People
Displaced Households	1,200 - 5,000	3,000 - 12,500
Public Shelter	510	1,280

Comments :

**Hazus damage estimates are presented using FEMA Preliminary Damage Assessment (PDA) categories. These estimates should be used for planning purposes and may not reflect actual observed damages from the PDA process.*

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, goetechnical, and observed ground motion data.

Earthquake Information

Location :

Origin Time:

Magnitude : 6.50

Epicenter Latitude/Longitude :

38.03 / -77.80

Depth & Type : 10.00/A

Name :
NA

Ground Motion /Attenuation :
Central & East US (CEUS 2008)

Maximum PGA: 0.00

Information Sources:

Comments :

Population and Building Exposure (2010 D&B) (2010 Census)

Population: 2,230,623

Building Exposure : ($ Millions)

Residential	287,641
Commercial	39,194
Other	14,679
Total	341,514

Counties :

Major Metro Area :

Hazus Quick Assessment Report

Estimated Economic Loss ($ Billions)

Category	Description	Range
General Building Stock	Building Damage	1.30 - 5.20
	Building Contents	0.00 - 0.10
	Business Interruption	0.40 - 1.70
Infrastructure	Lifelines Damage	
	Total	2.00 - 7.90

Preliminary Damage Assessment (PDA) Estimates

Description	Residential	Commercial	Other	Total
Affected	58,000	4,500	2,000	64,500
Minor	19,100	2,500	1,100	22,700
Major	3,500	460	210	4,170
Destroyed	480	50	20	550
Total	81,080	7,510	3,330	91,920

Estimated Casualties : Day Time

Severity Level	Description	# Persons
Level 1	Medical Aid	500 - 2,000
Level 2	Hospital Care	80 - 300
Level 3	Life-threatening	10 - 30
Level 4	Fatalities	20 - 60

Estimated Shelter Needs

Type	Households	People
Displaced Households	1,200 - 5,000	3,000 - 12,500
Public Shelter	510	1,280

Comments :

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Earthquake Information

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Origin Time:

Magnitude : 6.50

Epicenter Latitude/Longitude :

38.03 / -77.80

Depth & Type : 10.00/A

Name :
NA

Ground Motion /Attenuation :
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Population and Building Exposure (2010 D&B) (2010 Census)

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Building Exposure : ($ Millions)

Residential	287,641
Commercial	39,194
Other	14,679
Total	341,514

Counties :

Major Metro Area :

Hazus Quick Assessment Report

Estimated Economic Loss ($ Billions)

Category	Description	Range
General Building Stock	Building Damage	1.30 - 5.20
	Building Contents	0.00 - 0.10
	Business Interruption	0.40 - 1.70
Infrastructure	Lifelines Damage	
	Total	2.00 - 7.90

Preliminary Damage Assessment (PDA) Estimates

Description	Residential	Commercial	Other	Total
Affected	58,000	4,500	2,000	64,500
Minor	19,100	2,500	1,100	22,700
Major	3,500	460	210	4,170
Destroyed	480	50	20	550
Total	81,080	7,510	3,330	91,920

Estimated Casualties : Commute Time

Severity Level	Description	# Persons
Level 1	Medical Aid	400 - 1,700
Level 2	Hospital Care	70 - 300
Level 3	Life-threatening	20 - 60
Level 4	Fatalities	10 - 60

Estimated Shelter Needs

Type	Households	People
Displaced Households	1,200 - 5,000	3,000 - 12,500
Public Shelter	510	1,280

Comments :

**Hazus damage estimates are presented using FEMA Preliminary Damage Assessment (PDA) categories. These estimates should be used for planning purposes and may not reflect actual observed damages from the PDA process.*

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The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, goetechnical, and observed ground motion data.

Earthquake Information

Location :

Origin Time:

Magnitude : 6.50

Epicenter Latitude/Longitude :

38.03 / -77.80

Depth & Type : 10.00/A

Name :
NA

Ground Motion /Attenuation :
Central & East US (CEUS 2008)

Maximum PGA: 0.00

Information Sources:

Comments :

Population and Building Exposure (2010 D&B) (2010 Census)

Population: 2,230,623

Building Exposure : ($ Millions)

Residential	287,641
Commercial	39,194
Other	14,679
Total	341,514

Counties :

Major Metro Area :

Transportation System Dollar Exposure

August 03, 2021

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Runway	Total
Virginia									
Arlington									
Segments	876,955	5,925	23,914						906,794
Bridges	928,523	8,790	0						937,313
Tunnels	28,960	0	0						28,960
Facilities		0	33,752	1,406	0	0	0	0	35,158
Total	**1,834,438**	**14,714**	**57,666**	**1,406**	**0**	**0**	**0**	**0**	**1,908,225**
Fairfax									
Segments	3,839,512	77,657	88,007						4,005,177
Bridges	4,006,912	153,817	0						4,160,729
Tunnels	0	0	0						0
Facilities		7,989	28,127	1,406	13,887	0	42,014	33,949	93,423
Total	**7,846,425**	**239,463**	**116,134**	**1,406**	**13,887**	**0**	**42,014**	**33,949**	**8,293,279**
Loudoun									
Segments	1,157,715	0	0						1,157,715
Bridges	1,195,951	0	0						1,195,951
Tunnels	0	0	0						0
Facilities		0	0	0	0	1,331	11,075	45,917	12,406
Total	**2,353,666**	**0**	**0**	**0**	**0**	**1,331**	**11,075**	**45,917**	**2,411,988**
Prince William									

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Runway	Total
Virginia									
Segments	1,092,574	80,019	21,525						1,194,117
Bridges	973,815	83,501	0						1,057,316
Tunnels	0	0	0						0
Facilities		5,326	11,251	1,406	16,665	0	0	0	34,648
Total	**2,066,389**	**168,845**	**32,776**	**1,406**	**16,665**	**0**	**0**	**0**	**2,286,081**
Alexandria									
Segments	405,210	45,485	39,556						490,250
Bridges	1,016,569	57,132	0						1,073,701
Tunnels	0	0	0						0
Facilities		5,326	14,063	0	0	0	0	0	19,389
Total	**1,421,779**	**107,943**	**53,619**	**0**	**0**	**0**	**0**	**0**	**1,583,341**
Fairfax City									
Segments	179,249	0	0						179,249
Bridges	10,407	0	0						10,407
Tunnels	0	0	0						0
Facilities		0	0	0	0	0	0	0	0
Total	**189,657**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**189,657**
Falls Church									
Segments	38,978	0	0						38,978
Bridges	831	0	0						831
Tunnels	0	0	0						0
Facilities		0	0	0	0	0	0	0	0
Total	**39,809**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**39,809**
Manassas									
Segments	124,636	18,826	11,542						155,004

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Runway	Total
Virginia									
Bridges	58,637	8,790	0						67,427
Tunnels	0	0	0						0
Facilities		2,663	2,813	0	0	0	0	0	5,476
Total	**183,273**	**30,278**	**14,355**	**0**	**0**	**0**	**0**	**0**	**227,906**
Manassas Park									
Segments	10,561	2,946	0						13,506
Bridges	271	0	0						271
Tunnels	0	0	0						0
Facilities		0	2,813	0	0	0	0	0	2,813
Total	**10,832**	**2,946**	**2,813**	**0**	**0**	**0**	**0**	**0**	**16,590**
Total	**15,946,267**	**564,190**	**277,362**	**4,219**	**30,552**	**1,331**	**53,089**	**79,865**	**16,956,875**
Region Total	**15,946,267**	**564,190**	**277,362**	**4,219**	**30,552**	**1,331**	**53,089**	**79,865**	**16,956,875**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/states were selected at the time of study region creation.

Utility System Dollar Exposure

August 03, 2021

All values are in thousands of dollars

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Virginia							
Arlington							
Facilities	0	754,144	0	0	0	372	754,516
Pipelines	30,173	18,104	0	0			48,277
Total	**30,173**	**772,247**	**0**	**0**	**0**	**372**	**802,793**
Fairfax							
Facilities	61,938	1,005,525	93	1,538	769,086	744	1,838,924
Pipelines	262,366	157,420	0	66,817			486,603
Total	**324,304**	**1,162,944**	**93**	**68,355**	**769,086**	**744**	**2,325,526**
Loudoun							
Facilities	123,876	3,770,718	0	4,615	769,086	93	4,668,387
Pipelines	174,221	104,533	0	71,288			350,042
Total	**298,097**	**3,875,250**	**0**	**75,903**	**769,086**	**93**	**5,018,429**
Prince William							
Facilities	92,907	1,005,525	0	1,538	769,086	279	1,869,335

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Virginia							
Pipelines	142,341	85,405	0	47,979			275,725
Total	**235,248**	**1,090,930**	**0**	**49,517**	**769,086**	**279**	**2,145,060**
Alexandria							
Facilities	0	502,762	0	0	152,938	0	655,701
Pipelines	18,467	11,080	0	0			29,547
Total	**18,467**	**513,842**	**0**	**0**	**152,938**	**0**	**685,247**
Fairfax City							
Facilities	0	0	93	0	0	93	186
Pipelines	5,707	3,424	0	0			9,131
Total	**5,707**	**3,424**	**93**	**0**	**0**	**93**	**9,317**
Falls Church							
Facilities	0	0	0	0	0	93	93
Pipelines	2,401	1,441	0	0			3,842
Total	**2,401**	**1,441**	**0**	**0**	**0**	**93**	**3,935**
Manassas							
Facilities	0	0	0	0	305,876	0	305,876
Pipelines	8,387	5,032	0	0			13,420
Total	**8,387**	**5,032**	**0**	**0**	**305,876**	**0**	**319,296**
Manassas Park							

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Virginia							
Facilities	0	0	0	0	0	0	0
Pipelines	1,761	1,057	0	0			2,818
Total	**1,761**	**1,057**	**0**	**0**	**0**	**0**	**2,818**
Total	**924,546**	**7,426,168**	**186**	**193,775**	**2,766,072**	**1,674**	**11,312,422**
Region Total	**924,546**	**7,426,168**	**186**	**193,775**	**2,766,072**	**1,674**	**11,312,422**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/states were selected at the time of study region creation.

Hazus: Flood Global Risk Report

Region Name: NOVA_EQ_FL_HU_Test

Flood Scenario: 100Yr

Print Date: Tuesday, August 3, 2021

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

FEMA

RiskMAP
Increasing Resilience Together

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 9 county(ies) from the following state(s):

- Virginia

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is approximately 1,322 square miles and contains 27,988 census blocks. The region contains over 824 thousand households and has a total population of 2,230,623 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 663,685 buildings in the region with a total building replacement value (excluding contents) of 341,516 million dollars. Approximately 92.37% of the buildings (and 84.23% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 663,685 buildings in the region which have an aggregate total replacement value of 341,516 million dollars. Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	287,641,972	84.2%
Commercial	39,194,388	11.5%
Industrial	5,227,982	1.5%
Agricultural	688,752	0.2%
Religion	4,026,943	1.2%
Government	1,401,093	0.4%
Education	3,334,545	1.0%
Total	**341,515,675**	**100%**

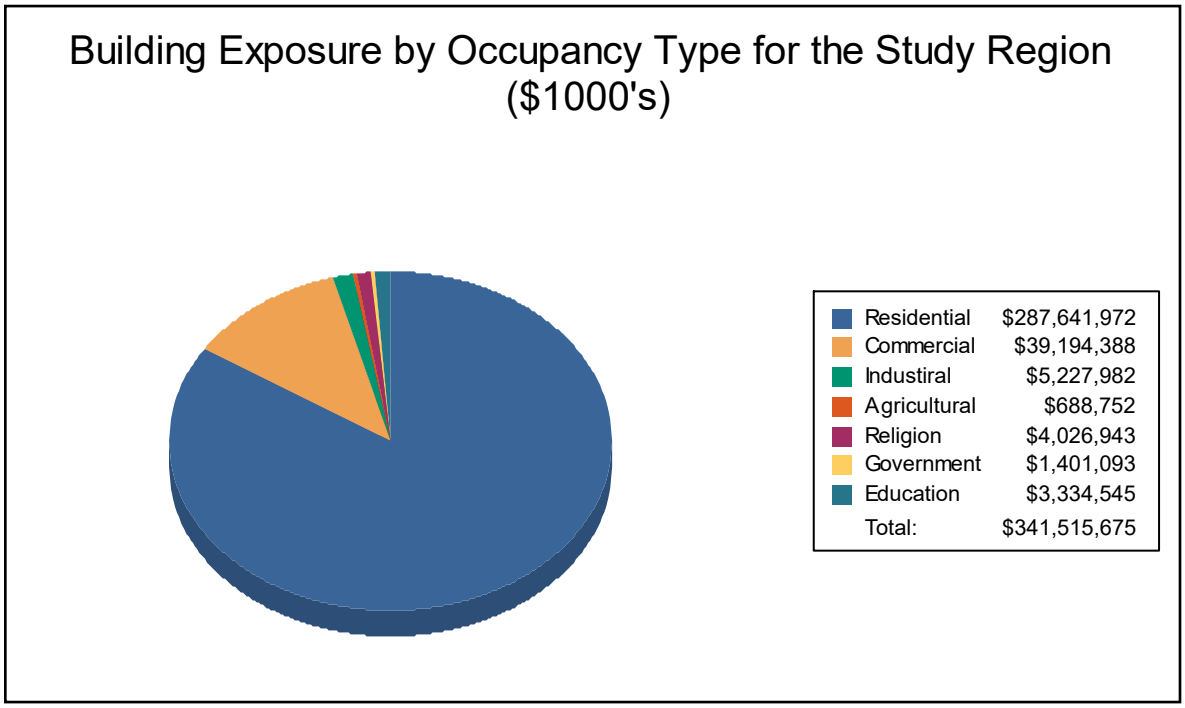
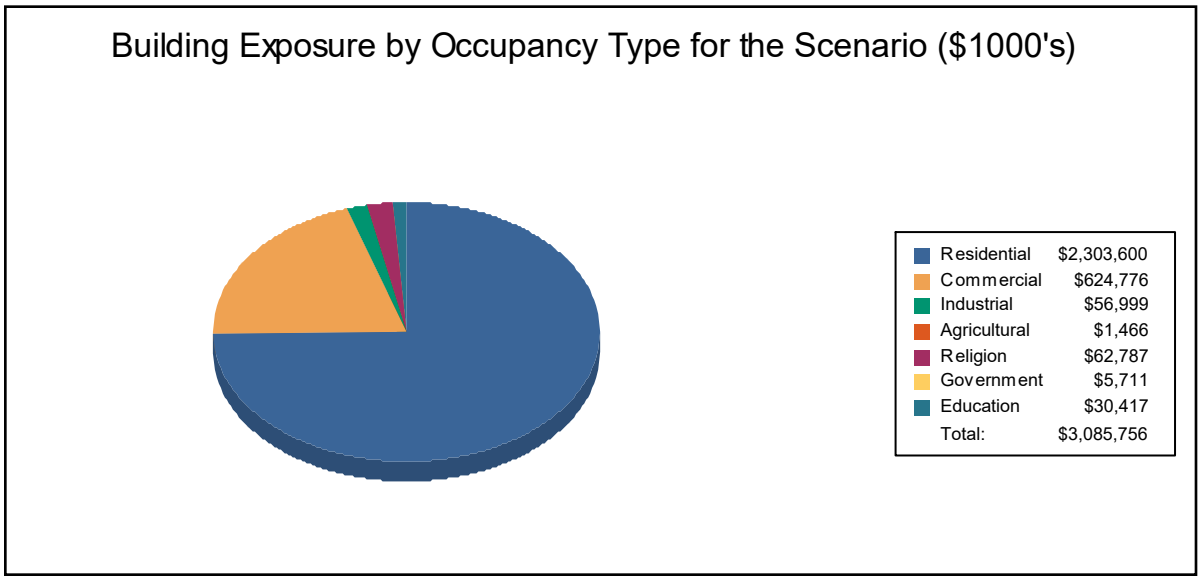


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	27,267,582	85.8%
Commercial	3,262,318	10.3%
Industrial	581,713	1.8%
Agricultural	83,322	0.3%
Religion	276,776	0.9%
Government	151,711	0.5%
Education	173,763	0.5%
Total	**31,797,185**	**100%**



Essential Facility Inventory

For essential facilities, there are 19 hospitals in the region with a total bed capacity of 3,149 beds. There are 846 schools, 110 fire stations, 46 police stations and 14 emergency operation centers.

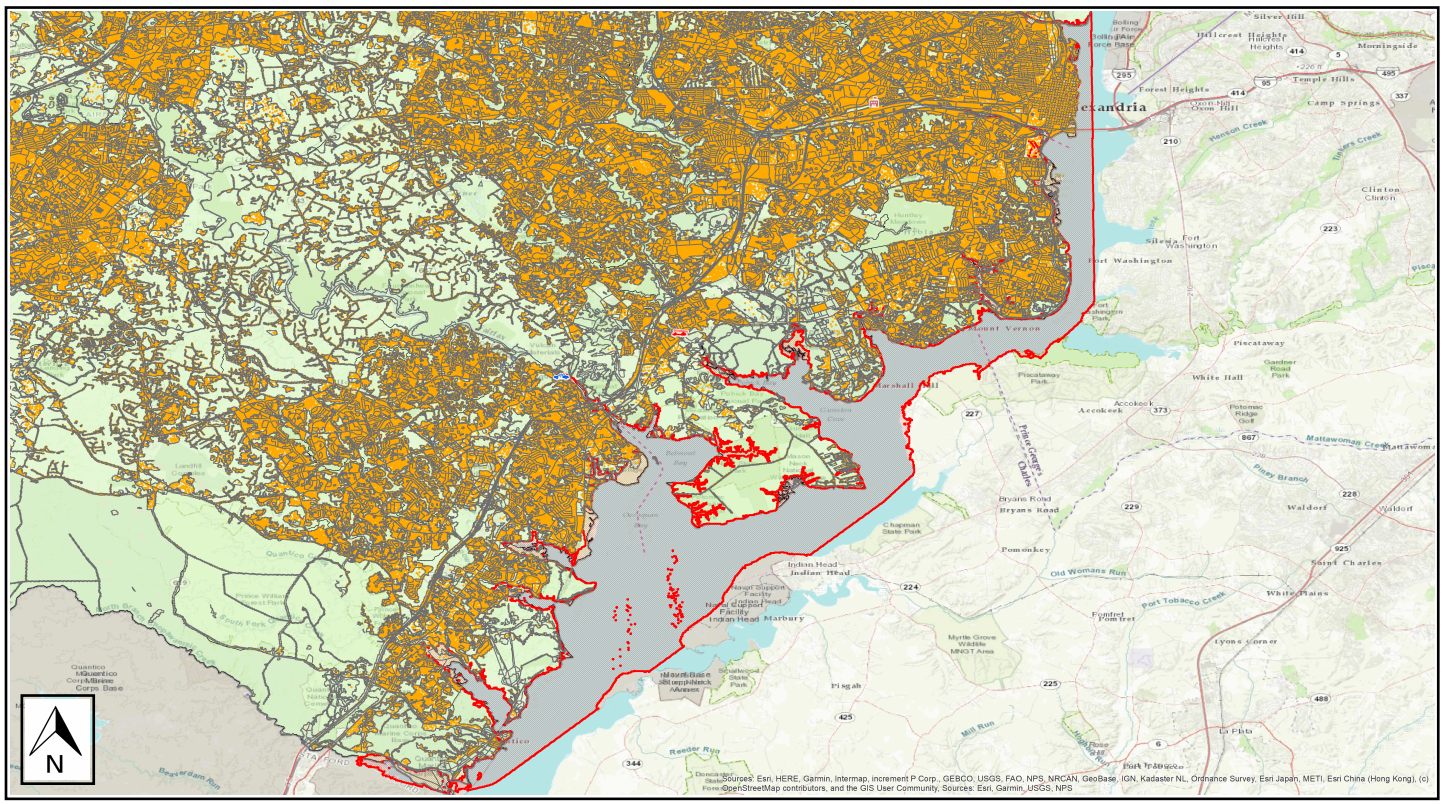
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	NOVA_EQ_FL_HU_Test
Scenario Name:	100Yr
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 1,384 buildings will be at least moderately damaged. This is over 39% of the total number of buildings in the scenario. There are an estimated 501 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

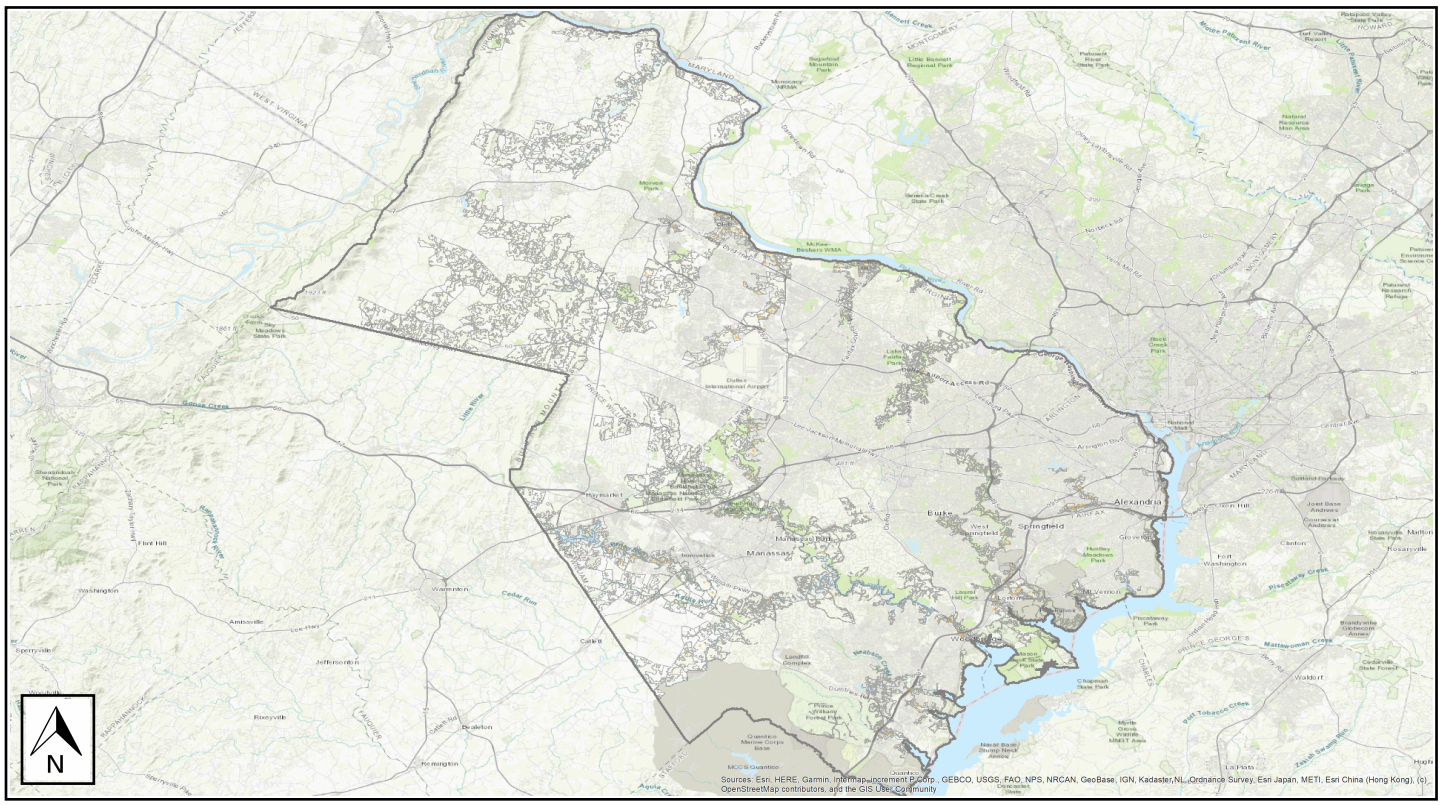


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	2	29	2	29	0	0	0	0	0	0	3	43
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	3	100	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	3	100	0	0	0	0	0	0	0	0
Residential	130	9	295	20	213	14	199	13	168	11	498	33
Total	**132**		**303**		**213**		**199**		**168**		**501**	

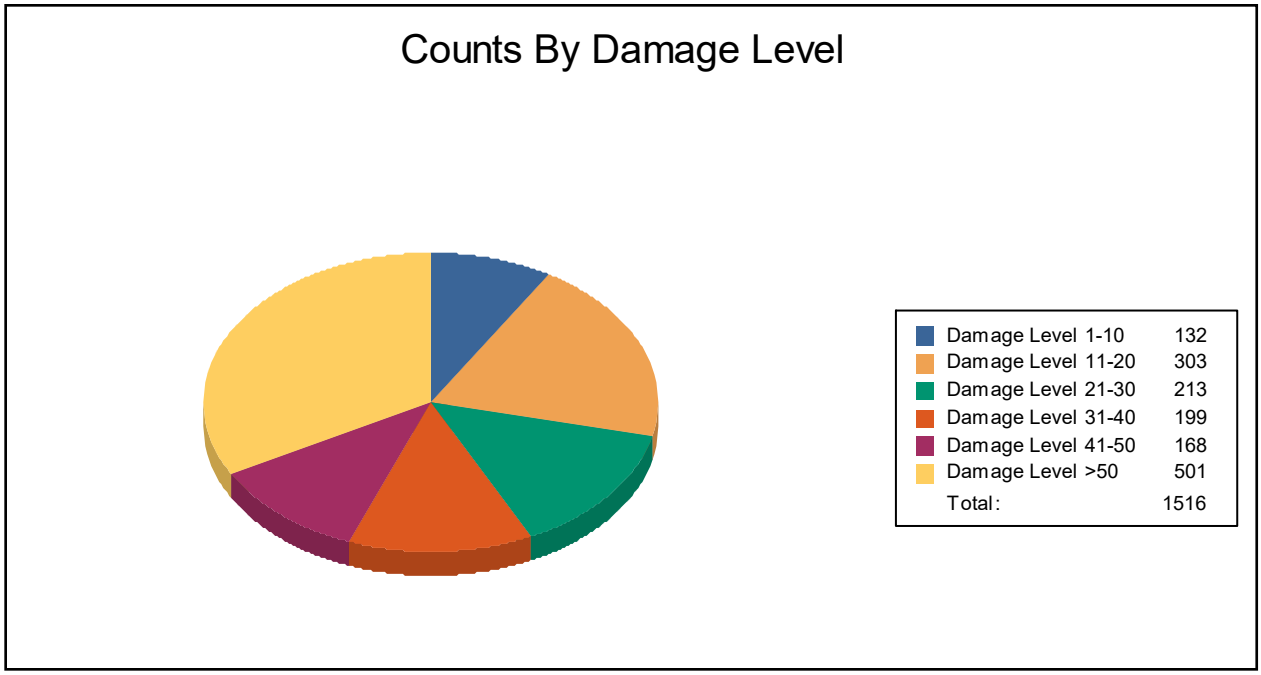


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	4	100
Masonry	33	9	73	20	54	15	50	14	42	12	110	30
Steel	2	22	4	44	0	0	0	0	0	0	3	33
Wood	110	9	241	19	175	14	163	13	143	11	416	33

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 3,149 hospital beds available for use. On the day of the scenario flood event, the model estimates that 3,149 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Emergency Operation Centers	14	0	0	0
Fire Stations	110	2	0	2
Hospitals	19	0	0	0
Police Stations	46	1	0	1
Schools	846	1	0	1

If this report displays all zeros or is blank, two possibilities can explain this.

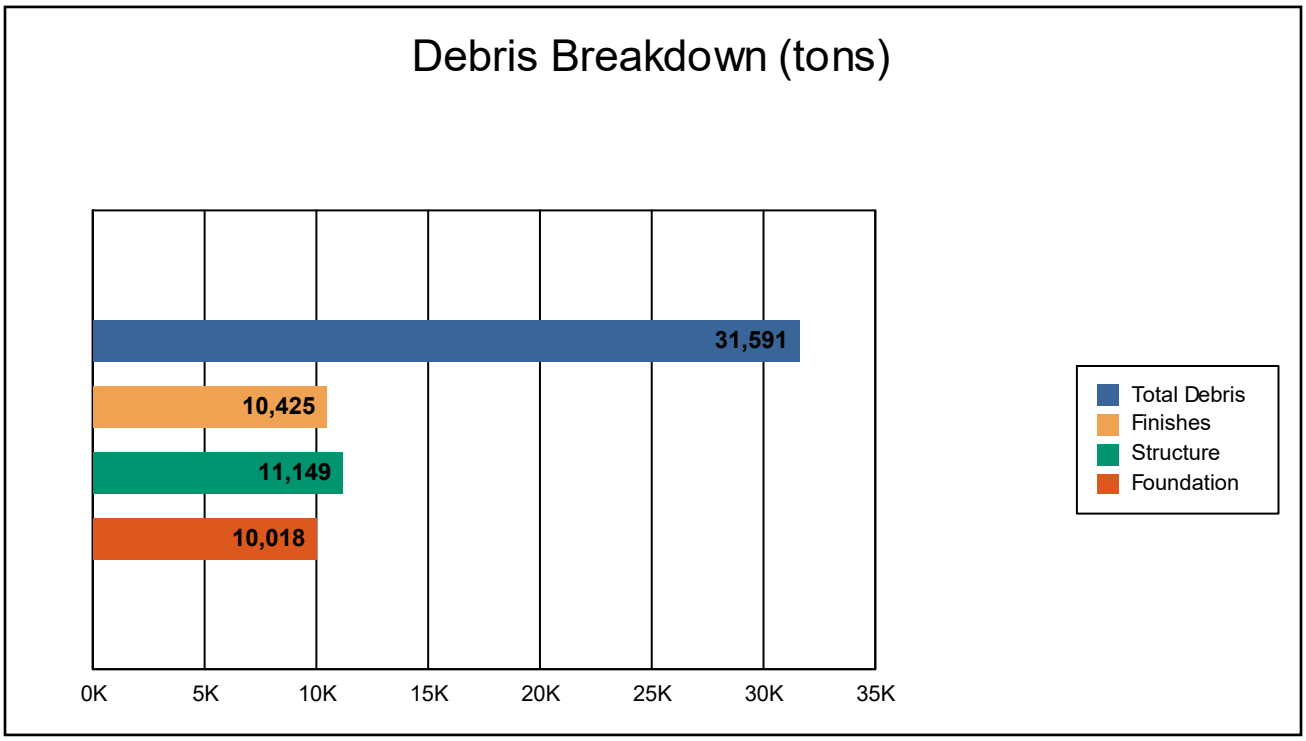
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

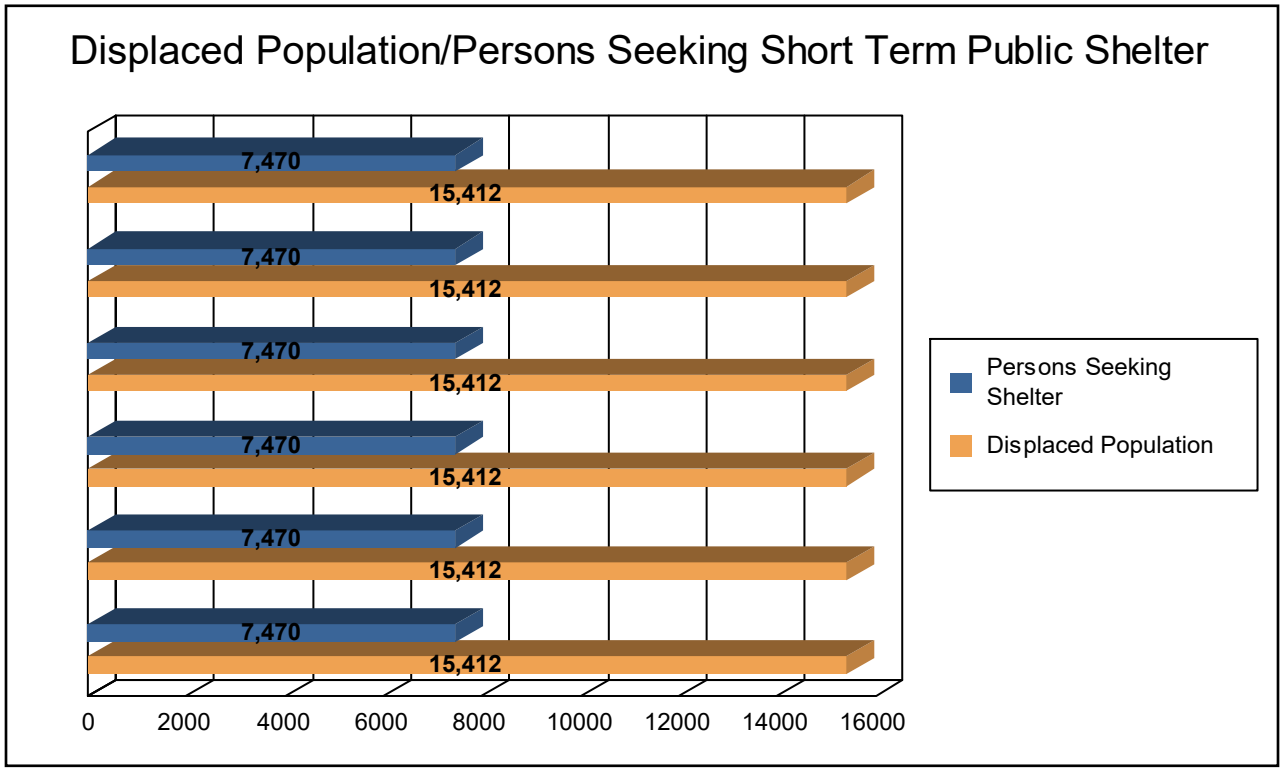


The model estimates that a total of 31,591 tons of debris will be generated. Of the total amount, Finishes comprises 33% of the total, Structure comprises 35% of the total, and Foundation comprises 32%. If the debris tonnage is converted into an estimated number of truckloads, it will require 1264 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 5,137 households (or 15,412 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 7,470 people (out of a total population of 2,230,623) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 1,616.89 million dollars, which represents 5.09 % of the total replacement value of the scenario buildings.

Building-Related Losses

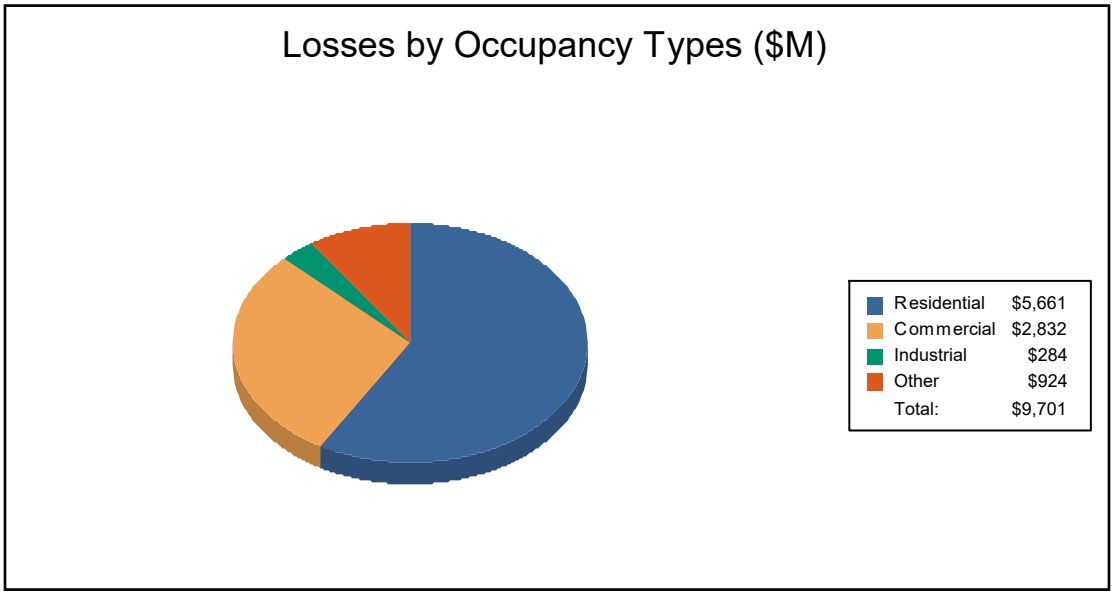
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 1,131.68 million dollars. 30% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 58.35% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	3,251.80	439.91	92.75	53.71	3,838.16
	Content	1,658.68	859.82	157.47	232.72	2,908.69
	Inventory	0.00	19.34	21.72	2.15	43.21
	Subtotal	**4,910.48**	**1,319.07**	**271.94**	**288.58**	**6,790.07**
Business Interruption						
	Income	9.05	660.41	3.27	59.42	732.15
	Relocation	520.66	166.00	2.71	29.64	719.01
	Rental Income	199.21	122.90	0.29	7.25	329.66
	Wage	21.62	563.98	5.90	538.96	1,130.45
	Subtotal	**750.54**	**1,513.29**	**12.18**	**635.27**	**2,911.28**
ALL	**Total**	**5,661.02**	**2,832.36**	**284.12**	**923.84**	**9,701.35**



Appendix A: County Listing for the Region

Virginia

- Arlington
- Fairfax
- Loudoun
- Prince William
- Alexandria
- Fairfax City
- Falls Church
- Manassas
- Manassas Park

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Virginia				
Alexandria	139,966	18,477,776	5,549,311	24,027,087
Arlington	207,627	27,386,560	6,025,940	33,412,500
Fairfax	1,081,726	144,188,703	26,638,455	170,827,158
Fairfax City	22,565	3,164,151	1,516,956	4,681,107
Falls Church	12,332	1,766,161	599,641	2,365,802
Loudoun	312,311	39,257,243	6,070,731	45,327,974
Manassas	37,821	3,672,496	1,274,759	4,947,255
Manassas Park	14,273	1,298,379	261,805	1,560,184
Prince William	402,002	48,430,503	5,936,105	54,366,608
Total	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**
Total Study Region	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**

Quick Assessment Report

August 3, 2021

Study Region : NOVA_EQ_FL_HU_Test
Scenario : 100Yr
Return Period: 100
Analysis Option: 0

Regional Statistics

Area (Square Miles)	1,322
Number of Census Blocks	27,988
Number of Buildings	
Residential	613,061
Total	663,685
Number of People in the Region (x 1000)	2,231
Building Exposure ($ Millions)	
Residential	287,642
Total	341,516

Scenario Results

Shelter Requirements

Displaced Population (# Households)	5,137
Short Term Shelter (# People)	7,470

Economic Loss

Residential Property (Capital Stock) Losses ($ Millions)	818
Total Property (Capital Stock) Losses ($ Millions)	1,132
Business Interruption (Income) Losses ($ Millions)	485

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.

Building Damage by Building Type

August 03, 2021

All values are in thousands of square feet

	Average Damage (%) Within Each Damage Range						
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial
Virginia							
Alexandria							
Concrete	6.0	20.0	21.0	3.0	0.0	1.0	0.0
ManufHousing	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Masonry	97.0	129.0	149.0	48.0	23.0	14.0	3.0
Steel	29.0	123.0	86.0	10.0	6.0	4.0	2.0
Wood	210.0	194.0	269.0	106.0	63.0	27.0	9.0
Total	**342.0**	**466.0**	**525.0**	**167.0**	**92.0**	**46.0**	**14.0**
Arlington							
Concrete	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ManufHousing	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Masonry	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Steel	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wood	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Fairfax							
Concrete	0.0	3.0	9.0	3.0	1.0	2.0	7.0
ManufHousing	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Masonry	41.0	43.0	108.0	69.0	58.0	62.0	108.0

Building Damage by Building Type

	Average Damage (%) Within Each Damage Range						
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial
Steel	6.0	34.0	67.0	32.0	27.0	24.0	33.0
Wood	137.0	124.0	265.0	214.0	183.0	175.0	388.0
Total	**184.0**	**204.0**	**449.0**	**318.0**	**269.0**	**263.0**	**536.0**
Loudoun							
Concrete	2.0	5.0	16.0	3.0	3.0	4.0	0.0
ManufHousing	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Masonry	23.0	37.0	102.0	75.0	66.0	70.0	156.0
Steel	5.0	26.0	75.0	24.0	22.0	20.0	14.0
Wood	60.0	80.0	203.0	194.0	174.0	172.0	510.0
Total	**90.0**	**148.0**	**396.0**	**296.0**	**265.0**	**266.0**	**680.0**
Manassas							
Concrete	0.0	0.0	1.0	1.0	1.0	0.0	0.0
ManufHousing	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Masonry	0.0	1.0	3.0	3.0	4.0	2.0	0.0
Steel	0.0	1.0	3.0	3.0	4.0	2.0	0.0
Wood	0.0	1.0	2.0	3.0	4.0	1.0	0.0
Total	**0.0**	**3.0**	**9.0**	**10.0**	**13.0**	**5.0**	**0.0**
Prince William							
Concrete	0.0	3.0	6.0	3.0	2.0	2.0	12.0
ManufHousing	0.0	0.0	0.0	0.0	0.0	0.0	7.0
Masonry	21.0	39.0	97.0	82.0	60.0	64.0	210.0

Building Damage by Building Type

	Average Damage (%) Within Each Damage Range						
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial
Steel	1.0	30.0	57.0	28.0	25.0	26.0	116.0
Wood	69.0	91.0	229.0	224.0	196.0	206.0	666.0
Total	**91.0**	**163.0**	**389.0**	**337.0**	**283.0**	**298.0**	**1,011.0**
Total	**707.0**	**984.0**	**1,768.0**	**1,128.0**	**922.0**	**878.0**	**2,241.0**
Scenario Total	**707.0**	**984.0**	**1,768.0**	**1,128.0**	**922.0**	**878.0**	**2,241.0**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Building Damage By General Occupancy

August 03, 2021

All values are in thousands of square feet

	Total Dmg Square Footage	Square Footage Distribution by Damage Percent Range						
		< 1	1-10	11-20	21-30	31-40	41-50	Substantial
Virginia								
Alexandria								
Agriculture	0.36	0.08	0.10	0.06	0.12	0.00	0.00	0.00
Government	7.47	2.25	3.93	1.21	0.07	0.02	0.00	0.00
Residential	1,106.05	287.50	204.09	316.58	146.71	87.89	45.11	18.17
Education	14.10	2.46	6.89	3.53	1.21	0.01	0.01	0.00
Religion	19.81	3.23	5.77	10.75	0.06	0.00	0.00	0.00
Industrial	58.06	4.85	19.56	18.18	5.98	5.25	2.18	2.06
Commercial	534.13	51.32	240.52	185.35	28.16	12.94	12.01	3.82
Total	**1,739.98**	**351.68**	**480.86**	**535.65**	**182.32**	**106.11**	**59.31**	**24.06**
Arlington								
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.74
Religion	0.06	0.00	0.00	0.04	0.00	0.00	0.00	0.02
Commercial	2.19	0.01	0.06	0.12	0.15	0.14	0.14	1.56
Residential	4.56	0.11	0.29	0.88	1.04	0.83	0.46	0.95
Education	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**7.54**	**0.12**	**0.35**	**1.04**	**1.19**	**0.97**	**0.60**	**3.27**

FEMA

Building Damage By General Occupancy

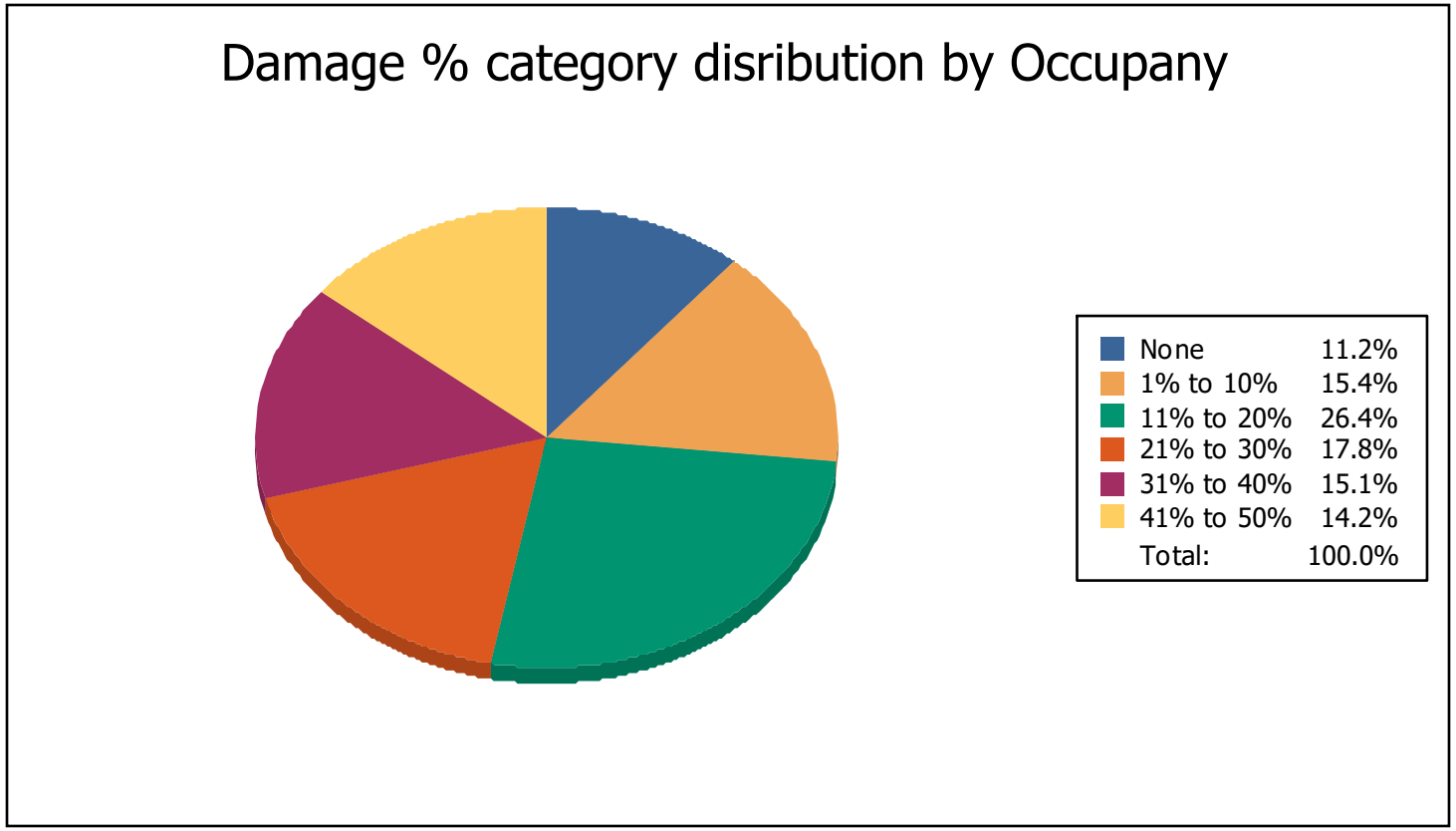
RiskMAP
Increasing Resilience Together

Fairfax								
Religion	19.67	1.53	2.68	13.49	0.65	0.39	0.15	0.79
Industrial	129.88	2.80	7.66	16.84	17.42	25.32	24.00	35.83
Education	8.35	1.18	4.35	2.01	0.40	0.14	0.03	0.23
Government	35.03	6.57	11.37	16.01	0.69	0.32	0.01	0.05
Agriculture	21.05	1.09	3.27	4.28	4.02	2.22	2.77	3.40
Residential	2,212.60	214.25	183.93	366.16	317.02	265.41	258.94	606.88
Commercial	425.58	12.98	69.32	113.82	67.03	56.64	45.84	59.94
Total	**2,852.15**	**240.41**	**282.59**	**532.62**	**407.23**	**350.44**	**331.74**	**707.12**
Loudoun								
Commercial	317.72	9.54	41.42	99.29	52.25	47.48	36.01	31.73
Industrial	71.55	0.80	4.35	11.29	10.78	15.24	14.30	14.80
Agriculture	14.53	0.46	1.55	2.45	2.13	1.27	1.25	5.40
Religion	50.82	1.62	3.00	43.53	0.71	0.36	0.50	1.10
Government	66.26	4.78	11.26	41.38	1.02	2.11	2.40	3.31
Residential	2,057.00	112.90	129.73	274.52	289.04	261.03	257.53	732.24
Education	10.23	0.63	5.36	2.11	0.86	0.37	0.19	0.70
Total	**2,588.10**	**130.73**	**196.67**	**474.58**	**356.79**	**327.86**	**312.20**	**789.28**
Manassas								
Industrial	1.32	0.00	0.14	0.37	0.52	0.26	0.03	0.01
Commercial	44.04	0.56	4.11	8.99	10.04	13.87	5.28	1.19
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Religion	0.25	0.00	0.01	0.24	0.00	0.00	0.00	0.00
Agriculture	0.05	0.00	0.00	0.01	0.02	0.01	0.00	0.00
Residential	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Education	1.48	0.10	0.97	0.38	0.02	0.01	0.01	0.00

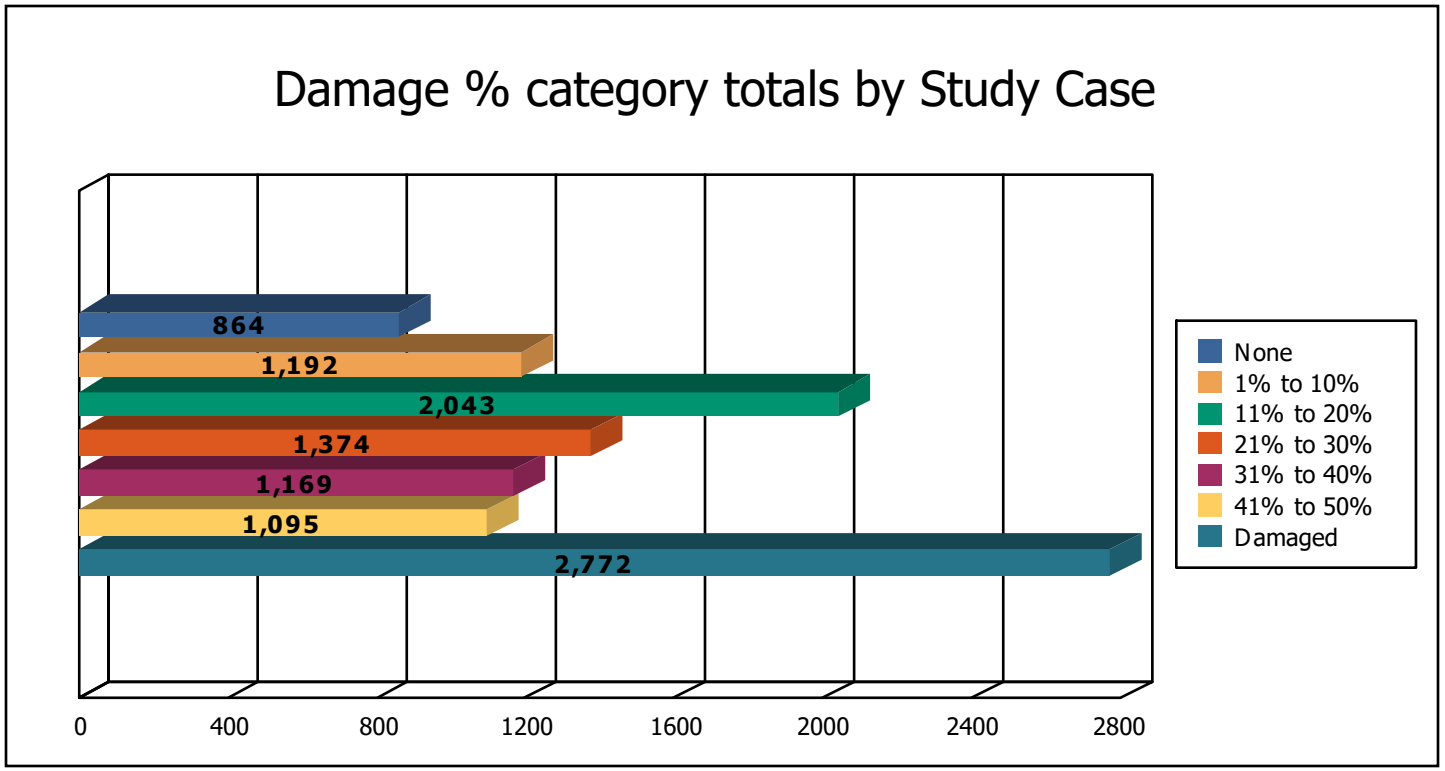
Building Damage By General Occupancy

Total	**47.15**	**0.66**	**5.22**	**9.99**	**10.60**	**14.15**	**5.32**	**1.20**
Prince William								
Government	7.53	0.20	0.84	1.22	0.56	0.18	1.19	3.34
Industrial	114.08	1.89	2.48	10.28	10.78	15.38	20.02	53.25
Residential	2,493.49	126.67	147.49	325.43	337.27	295.92	308.74	951.96
Education	12.09	0.59	3.96	4.57	1.20	0.18	0.29	1.29
Commercial	594.93	7.43	65.67	120.95	62.77	56.18	54.29	227.64
Religion	40.55	3.25	4.37	24.96	2.23	0.49	0.49	4.76
Agriculture	10.86	0.37	1.30	1.45	1.55	0.76	1.01	4.42
Total	**3,273.52**	**140.40**	**226.11**	**488.86**	**416.36**	**369.09**	**386.03**	**1,246.66**
Total	**10,508.44**	**863.99**	**1,191.81**	**2,042.74**	**1,374.49**	**1,168.63**	**1,095.20**	**2,771.60**
Scenario Total	**10,508.44**	**863.99**	**1,191.81**	**2,042.74**	**1,374.49**	**1,168.63**	**1,095.20**	**2,771.60**

Building Damage By General Occupancy



Building Damage By General Occupancy



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Building Damage By General Occupancy Post-FIRM

August 03, 2021

All values are in thousands of square feet

	Total Dmg Square Footage	Square Footage Distribution by Damage Percent Range						
		< 1	1-10	11-20	21-30	31-40	41-50	Substantial
Virginia								
Alexandria								
Agriculture	0.08	0.01	0.02	0.01	0.03	0.00	0.00	0.00
Government	4.24	1.10	1.89	1.16	0.07	0.02	0.00	0.00
Residential	740.56	227.70	155.52	190.11	83.75	45.66	25.11	12.72
Education	10.15	1.16	4.38	3.38	1.21	0.01	0.01	0.00
Religion	4.93	0.93	1.28	2.68	0.03	0.00	0.00	0.00
Industrial	9.34	0.89	2.07	3.22	1.13	1.35	0.35	0.32
Commercial	139.72	10.10	42.22	51.38	14.36	8.17	10.13	3.35
Total	**909.00**	**241.89**	**207.38**	**251.94**	**100.58**	**55.21**	**35.61**	**16.40**
Arlington								
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Religion	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Commercial	0.11	0.00	0.01	0.04	0.03	0.02	0.01	0.01
Residential	1.58	0.07	0.12	0.35	0.33	0.32	0.13	0.26
Education	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**1.71**	**0.07**	**0.13**	**0.40**	**0.36**	**0.34**	**0.13**	**0.27**

Building Damage By General Occupancy Post-FIRM

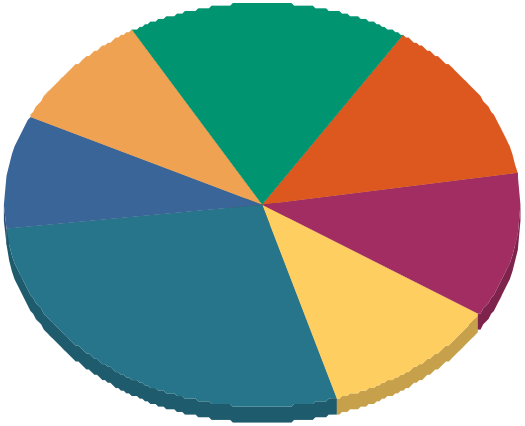
Fairfax								
Religion	8.88	0.72	1.43	6.19	0.19	0.05	0.06	0.25
Industrial	84.58	2.16	5.99	11.88	12.85	17.25	16.34	18.11
Education	4.38	0.42	1.96	1.44	0.28	0.11	0.02	0.15
Government	11.93	1.48	4.24	5.69	0.30	0.20	0.00	0.02
Agriculture	10.35	0.69	2.10	2.29	2.06	1.23	1.02	0.96
Residential	1,570.49	151.21	126.75	251.14	221.95	192.44	186.43	440.56
Commercial	213.43	7.07	41.74	66.01	37.18	30.25	20.92	10.27
Total	**1,904.04**	**163.76**	**184.20**	**344.64**	**274.81**	**241.53**	**224.79**	**470.32**
Loudoun								
Commercial	209.41	7.13	21.40	52.75	35.38	34.83	31.08	26.83
Industrial	46.04	0.48	3.12	8.07	7.72	11.44	7.25	7.96
Agriculture	8.96	0.23	0.72	1.60	1.09	0.80	0.94	3.59
Religion	15.82	1.23	2.25	10.33	0.58	0.27	0.32	0.83
Government	2.98	0.15	0.57	1.53	0.22	0.19	0.10	0.22
Residential	1,851.88	103.63	110.21	237.30	258.41	233.51	233.10	675.73
Education	8.60	0.51	4.04	1.96	0.85	0.37	0.19	0.69
Total	**2,143.70**	**113.36**	**142.32**	**313.54**	**304.24**	**281.40**	**272.98**	**715.87**
Manassas								
Industrial	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Religion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Building Damage By General Occupancy Post-FIRM

	Education	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Prince William									
	Government	3.07	0.10	0.39	0.54	0.21	0.08	0.38	1.38
	Industrial	44.17	0.95	1.20	3.80	4.62	6.11	8.39	19.10
	Residential	1,587.90	97.39	100.03	214.21	215.25	184.43	186.00	590.58
	Education	7.03	0.36	2.00	3.09	0.75	0.10	0.15	0.58
	Commercial	223.73	3.49	21.18	41.30	23.84	23.49	22.57	87.87
	Religion	13.33	0.55	1.35	7.91	0.96	0.19	0.20	2.17
	Agriculture	5.66	0.21	0.71	0.82	0.87	0.41	0.63	2.03
Total		**1,884.89**	**103.05**	**126.84**	**271.65**	**246.50**	**214.82**	**218.31**	**703.71**
Total		**6,843.35**	**622.14**	**660.88**	**1,182.17**	**926.49**	**793.30**	**751.82**	**1,906.56**
Scenario Total		**6,843.35**	**622.14**	**660.88**	**1,182.17**	**926.49**	**793.30**	**751.82**	**1,906.56**

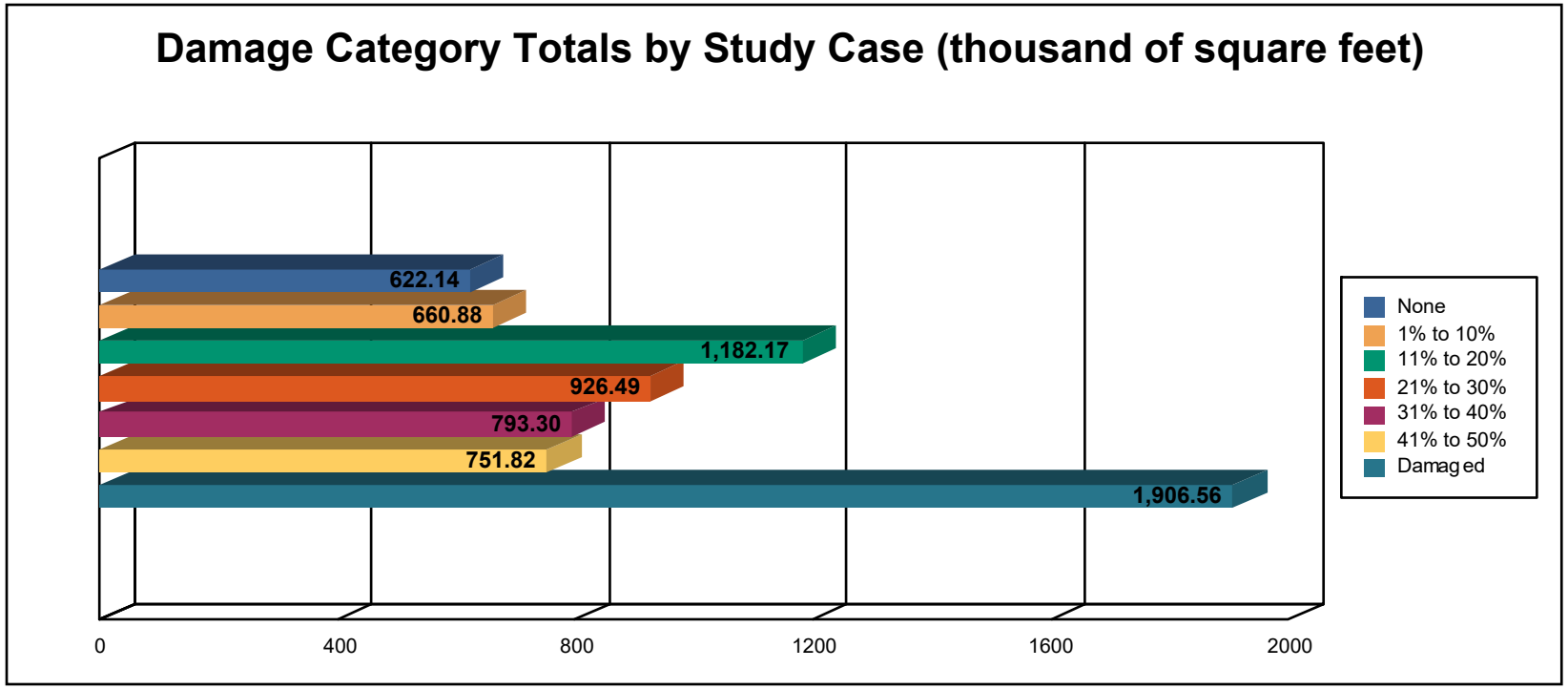
Building Damage By General Occupancy Post-FIRM

Damage Category Totals by Occupancy (thousand of square feet)



None	622.1
1% to 10%	660.9
11% to 20%	1182.2
21% to 30%	926.5
31% to 40%	793.3
41% to 50%	751.8
Substantially Damaged	1906.6
Total:	6843.3

Building Damage By General Occupancy Post-FIRM



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Building Damage By General Occupancy Pre-FIRM

August 03, 2021

All values are in thousands of square feet

	Total Dmg Square Footage	Square Footage Distribution by Damage Percent Range						
		< 1	1-10	11-20	21-30	31-40	41-50	Substantial
Virginia								
Alexandria								
Agriculture	0.29	0.06	0.08	0.05	0.09	0.00	0.00	0.00
Government	3.23	1.15	2.03	0.05	0.00	0.00	0.00	0.00
Residential	365.49	59.80	48.57	126.47	62.96	42.23	20.01	5.45
Education	3.95	1.29	2.51	0.15	0.00	0.00	0.00	0.00
Religion	14.88	2.30	4.49	8.07	0.03	0.00	0.00	0.00
Industrial	48.73	3.95	17.49	14.95	4.86	3.90	1.82	1.75
Commercial	394.41	41.23	198.30	133.96	13.80	4.77	1.88	0.47
Total	**830.98**	**109.79**	**273.48**	**283.71**	**81.74**	**50.90**	**23.70**	**7.67**
Arlington								
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.74
Religion	0.05	0.00	0.00	0.03	0.00	0.00	0.00	0.02
Commercial	2.08	0.01	0.05	0.08	0.13	0.12	0.14	1.55
Residential	2.97	0.04	0.17	0.53	0.70	0.51	0.33	0.69
Education	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Building Damage By General Occupancy Pre-FIRM

	Total Dmg Square Footage	Square Footage Distribution by Damage Percent Range						
		< 1	1-10	11-20	21-30	31-40	41-50	Substantial
Total	**5.84**	**0.04**	**0.22**	**0.65**	**0.83**	**0.63**	**0.47**	**3.00**
Fairfax								
Religion	10.79	0.81	1.25	7.30	0.47	0.34	0.09	0.53
Industrial	45.30	0.65	1.67	4.96	4.57	8.07	7.66	17.72
Education	3.97	0.76	2.39	0.57	0.12	0.03	0.01	0.07
Government	23.10	5.09	7.13	10.32	0.40	0.12	0.01	0.03
Agriculture	10.70	0.40	1.18	1.99	1.95	0.99	1.76	2.44
Residential	642.11	63.04	57.18	115.03	95.07	72.97	72.50	166.32
Commercial	212.14	5.91	27.58	47.81	29.85	26.39	24.93	49.68
Total	**948.11**	**76.65**	**98.39**	**187.98**	**132.43**	**108.91**	**106.95**	**236.80**
Loudoun								
Commercial	108.31	2.41	20.03	46.53	16.87	12.65	4.93	4.89
Industrial	25.51	0.32	1.23	3.22	3.06	3.80	7.05	6.83
Agriculture	5.57	0.23	0.83	0.85	1.05	0.47	0.31	1.81
Religion	35.00	0.38	0.74	33.20	0.13	0.09	0.18	0.27
Government	63.28	4.63	10.69	39.85	0.80	1.92	2.30	3.09
Residential	205.11	9.27	19.51	37.22	30.63	27.53	24.43	56.51
Education	1.62	0.12	1.33	0.15	0.00	0.00	0.00	0.01
Total	**444.40**	**17.37**	**54.35**	**161.04**	**52.54**	**46.46**	**39.22**	**73.42**
Manassas								
Industrial	1.32	0.00	0.14	0.37	0.52	0.26	0.03	0.01
Commercial	44.04	0.56	4.11	8.99	10.04	13.87	5.28	1.19

Building Damage By General Occupancy Pre-FIRM

	Total Dmg Square Footage	Square Footage Distribution by Damage Percent Range						
		< 1	1-10	11-20	21-30	31-40	41-50	Substantial
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Religion	0.25	0.00	0.01	0.24	0.00	0.00	0.00	0.00
Agriculture	0.05	0.00	0.00	0.01	0.02	0.01	0.00	0.00
Residential	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Education	1.48	0.10	0.97	0.38	0.02	0.01	0.01	0.00
Total	**47.15**	**0.66**	**5.22**	**9.99**	**10.60**	**14.15**	**5.32**	**1.20**
Prince William								
Government	4.47	0.10	0.45	0.68	0.35	0.10	0.82	1.97
Industrial	69.91	0.94	1.29	6.48	6.16	9.27	11.62	34.15
Residential	905.59	29.28	47.47	111.22	122.01	111.49	122.74	361.38
Education	5.06	0.23	1.95	1.49	0.45	0.08	0.15	0.71
Commercial	371.19	3.94	44.50	79.65	38.94	32.68	31.72	139.77
Religion	27.22	2.70	3.02	17.06	1.27	0.30	0.29	2.59
Agriculture	5.19	0.16	0.59	0.63	0.68	0.35	0.38	2.39
Total	**1,388.63**	**37.35**	**99.27**	**217.21**	**169.86**	**154.28**	**167.72**	**542.95**
Total	**3,665.10**	**241.86**	**530.93**	**860.57**	**447.99**	**375.33**	**343.38**	**865.04**
Scenario Total	**3,665.10**	**241.86**	**530.93**	**860.57**	**447.99**	**375.33**	**343.38**	**865.04**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Building Damage Count by General Building Type

August 03, 2021

	Count of Buildings (#) by Range of Damage (%)							
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Virginia								
Alexandria								
Concrete	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0
Masonry	20	15	24	7	6	0	0	72
Steel	0	1	1	0	0	0	0	2
Wood	57	44	66	21	19	1	0	208
Total	**77**	**60**	**91**	**28**	**25**	**1**	**0**	**282**
Arlington								
Concrete	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0
Wood	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Fairfax								
Concrete	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0

Building Damage Count by General Building Type

	Count of Buildings (#) by Range of Damage (%)							
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Masonry	6	7	12	11	11	13	18	78
Steel	0	0	0	0	0	0	0	0
Wood	27	26	61	43	38	40	81	316
Total	**33**	**33**	**73**	**54**	**49**	**53**	**99**	**394**
Loudoun								
Concrete	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0
Masonry	4	6	17	16	15	13	53	124
Steel	0	0	2	0	0	0	0	2
Wood	15	19	48	49	50	49	173	403
Total	**19**	**25**	**67**	**65**	**65**	**62**	**226**	**529**
Manassas								
Concrete	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0
Wood	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Prince William								
Concrete	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	4	4
Masonry	5	5	20	20	18	16	39	123

Building Damage Count by General Building Type

	Count of Buildings (#) by Range of Damage (%)							
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Steel	0	1	1	0	0	0	3	5
Wood	18	21	66	62	56	53	162	438
Total	**23**	**27**	**87**	**82**	**74**	**69**	**208**	**570**
Total	**152**	**145**	**318**	**229**	**213**	**185**	**533**	**1,775**
Scenario Total	**152**	**145**	**318**	**229**	**213**	**185**	**533**	**1,775**

Special Notice Regarding Building Count:

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Building Damage Count by General Occupancy

August 03, 2021

	Count of Buildings (#) by Range of Damage (%)							
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Virginia								
Alexandria								
Agriculture	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Residential	74	56	85	25	23	1	0	264
Education	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Commercial	0	1	1	0	0	0	0	2
Total	**74**	**57**	**86**	**25**	**23**	**1**	**0**	**266**
Arlington								
Government	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Building Damage Count by General Occupancy

	Count of Buildings (#) by Range of Damage (%)							
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Fairfax								
Religion	0	0	1	0	0	0	0	1
Industrial	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Residential	30	29	70	50	45	44	88	356
Commercial	0	0	0	0	0	0	0	0
Total	**30**	**29**	**71**	**50**	**45**	**44**	**88**	**357**
Loudoun								
Commercial	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Religion	0	0	2	0	0	0	0	2
Government	0	0	3	0	0	0	0	3
Residential	17	22	59	63	63	61	215	500
Education	0	0	0	0	0	0	0	0
Total	**17**	**22**	**64**	**63**	**63**	**61**	**215**	**505**
Manassas								
Industrial	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0

Building Damage Count by General Occupancy

	Count of Buildings (#) by Range of Damage (%)							
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Agriculture	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Prince William								
Government	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Residential	20	23	81	75	68	62	195	524
Education	0	0	0	0	0	0	0	0
Commercial	0	1	1	0	0	0	3	5
Religion	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Total	**20**	**24**	**82**	**75**	**68**	**62**	**198**	**529**
Total	**141**	**132**	**303**	**213**	**199**	**168**	**501**	**1,657**
Scenario Total	**141**	**132**	**303**	**213**	**199**	**168**	**501**	**1,657**

Building Damage Count by General Occupancy

	Count of Buildings (#) by Range of Damage (%)							
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial	Total

Special Notice Regarding Building Count:

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Building Damage Count by General Occupancy Post-FIRM

August 03, 2021

	Count of Buildings (#) by Range of Damage (%)							
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Virginia								
Alexandria								
Agriculture	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Residential	61	44	47	16	11	1	0	180
Education	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Total	**61**	**44**	**47**	**16**	**11**	**1**	**0**	**180**
Arlington								
Government	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Building Damage Count by General Occupancy Post-FIRM

	Count of Buildings (#) by Range of Damage (%)							
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Fairfax								
Religion	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Residential	25	25	55	40	38	33	74	290
Commercial	0	0	0	0	0	0	0	0
Total	**25**	**25**	**55**	**40**	**38**	**33**	**74**	**290**
Loudoun								
Commercial	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Residential	17	22	58	63	63	59	215	497
Education	0	0	0	0	0	0	0	0
Total	**17**	**22**	**58**	**63**	**63**	**59**	**215**	**497**
Manassas								
Industrial	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0

Building Damage Count by General Occupancy Post-FIRM

	Count of Buildings (#) by Range of Damage (%)							
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Religion	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Prince William								
Government	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Residential	18	18	57	49	41	35	123	341
Education	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	1	1
Religion	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Total	**18**	**18**	**57**	**49**	**41**	**35**	**124**	**342**
Total	**121**	**109**	**217**	**168**	**153**	**128**	**413**	**1,309**
Scenario Total	**121**	**109**	**217**	**168**	**153**	**128**	**413**	**1,309**

Building Damage Count by General Occupancy Post-FIRM

	Count of Buildings (#) by Range of Damage (%)							
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial	Total

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Building Damage Count by General Occupancy Pre-FIRM

August 03, 2021

	Count of Buildings (#) by Range of Damage (%)							
	< 1	1-10	11-20	21-30	31-40	41-50	Substantial	Total
Virginia								
Alexandria								
Agriculture	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Residential	13	12	38	9	12	0	0	84
Education	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Commercial	0	1	1	0	0	0	0	2
Study Region Total	**13**	**13**	**39**	**9**	**12**	**0**	**0**	**86**
Arlington								
Government	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Study Region Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Fairfax								

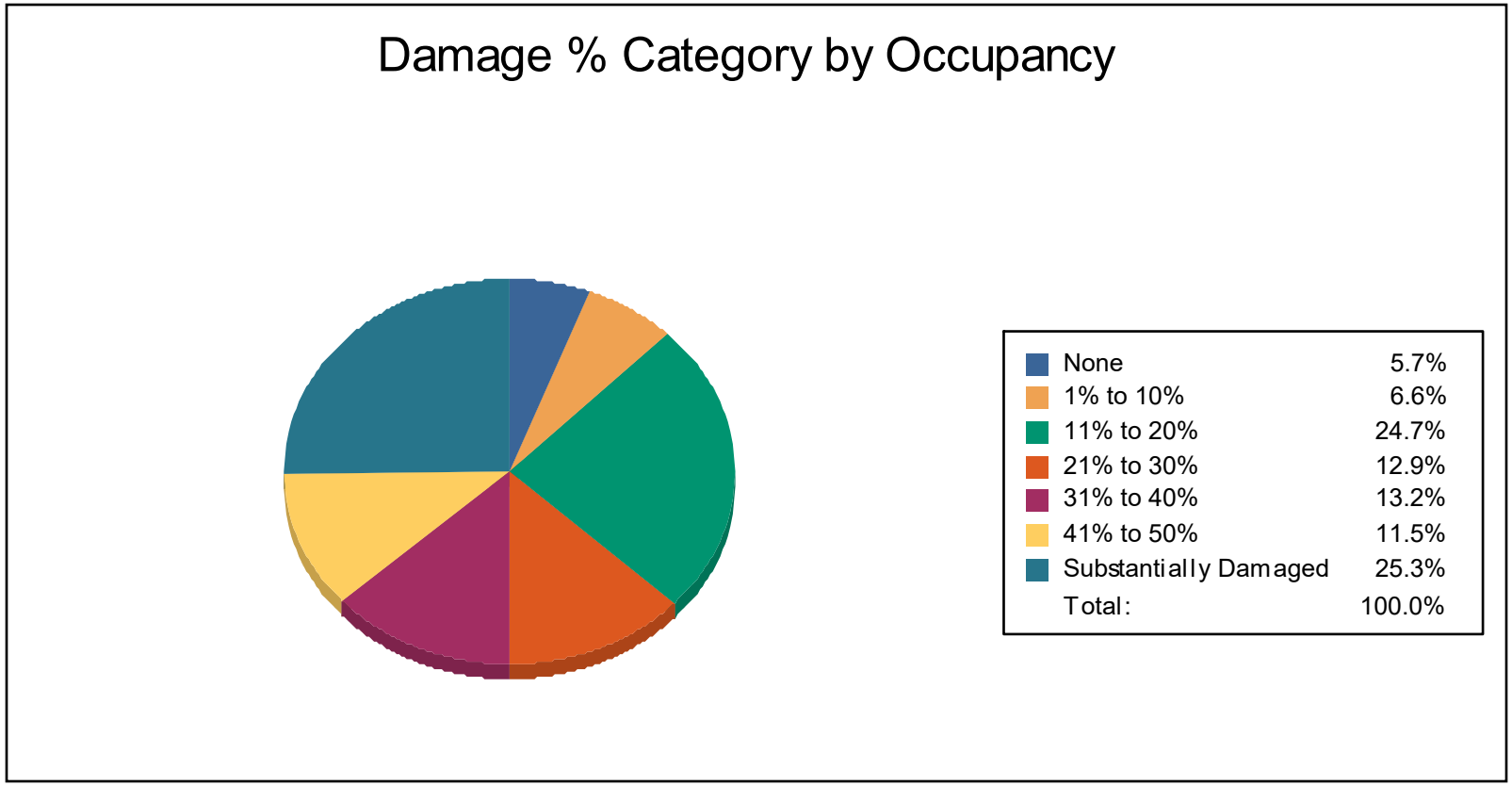
Building Damage Count by General Occupancy Pre-FIRM

Religion	0	0	1	0	0	0	0	1
Industrial	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Residential	5	4	15	10	7	11	14	66
Commercial	0	0	0	0	0	0	0	0
Study Region Total	**5**	**4**	**16**	**10**	**7**	**11**	**14**	**67**
Loudoun								
Commercial	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Religion	0	0	2	0	0	0	0	2
Government	0	0	3	0	0	0	0	3
Residential	0	0	1	0	0	2	0	3
Education	0	0	0	0	0	0	0	0
Study Region Total	**0**	**0**	**6**	**0**	**0**	**2**	**0**	**8**
Manassas								
Industrial	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0
Study Region Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

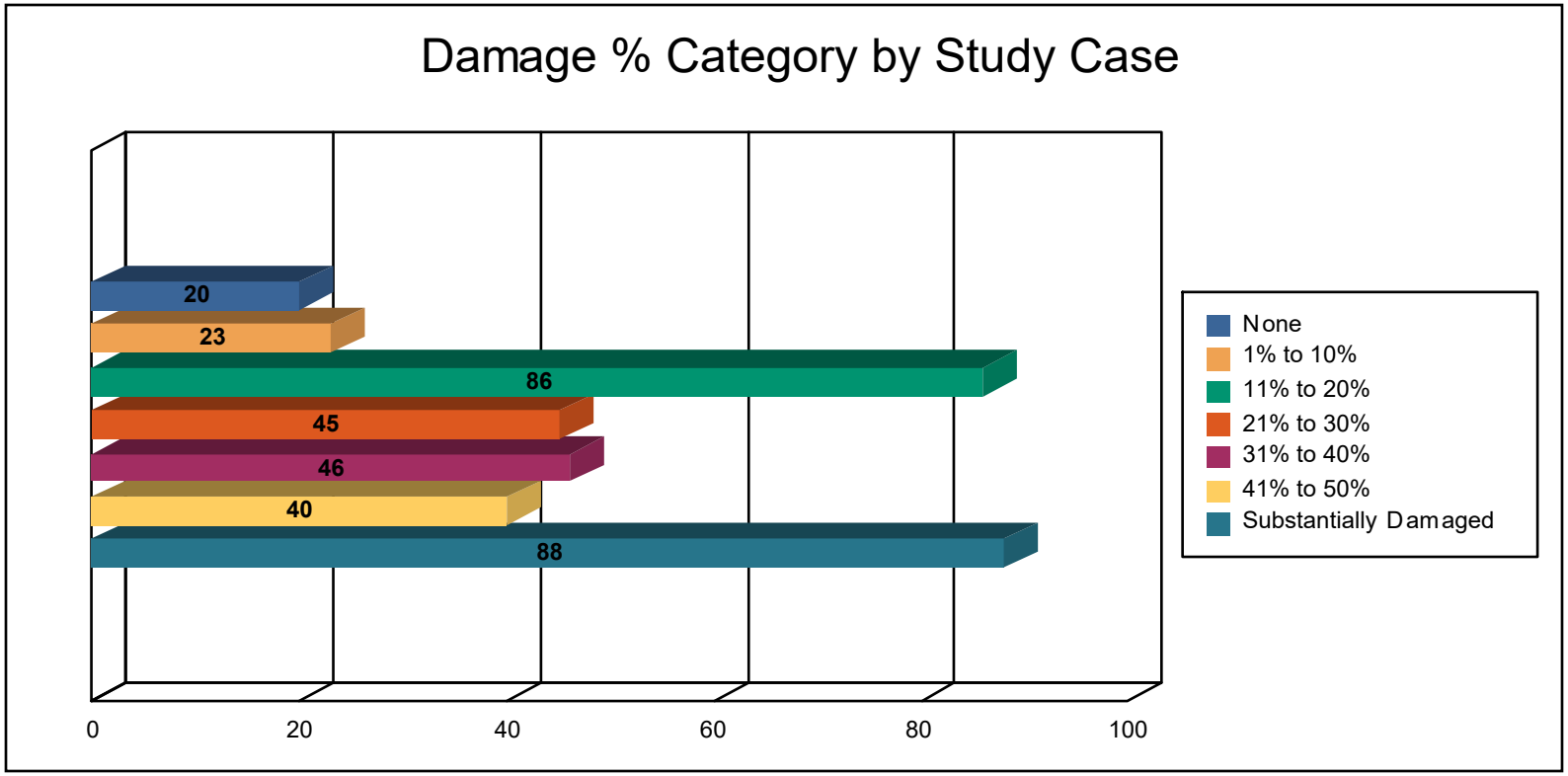
Building Damage Count by General Occupancy Pre-FIRM

Prince William								
Government	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Residential	2	5	24	26	27	27	72	183
Education	0	0	0	0	0	0	0	0
Commercial	0	1	1	0	0	0	2	4
Religion	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0
Study Region Total	**2**	**6**	**25**	**26**	**27**	**27**	**74**	**187**
Total	**20**	**23**	**86**	**45**	**46**	**40**	**88**	**348**
Scenario Total	**20**	**23**	**86**	**45**	**46**	**40**	**88**	**348**

Building Damage Count by General Occupancy Pre-FIRM



Building Damage Count by General Occupancy Pre-FIRM



Building Damage Count by General Occupancy Pre-FIRM

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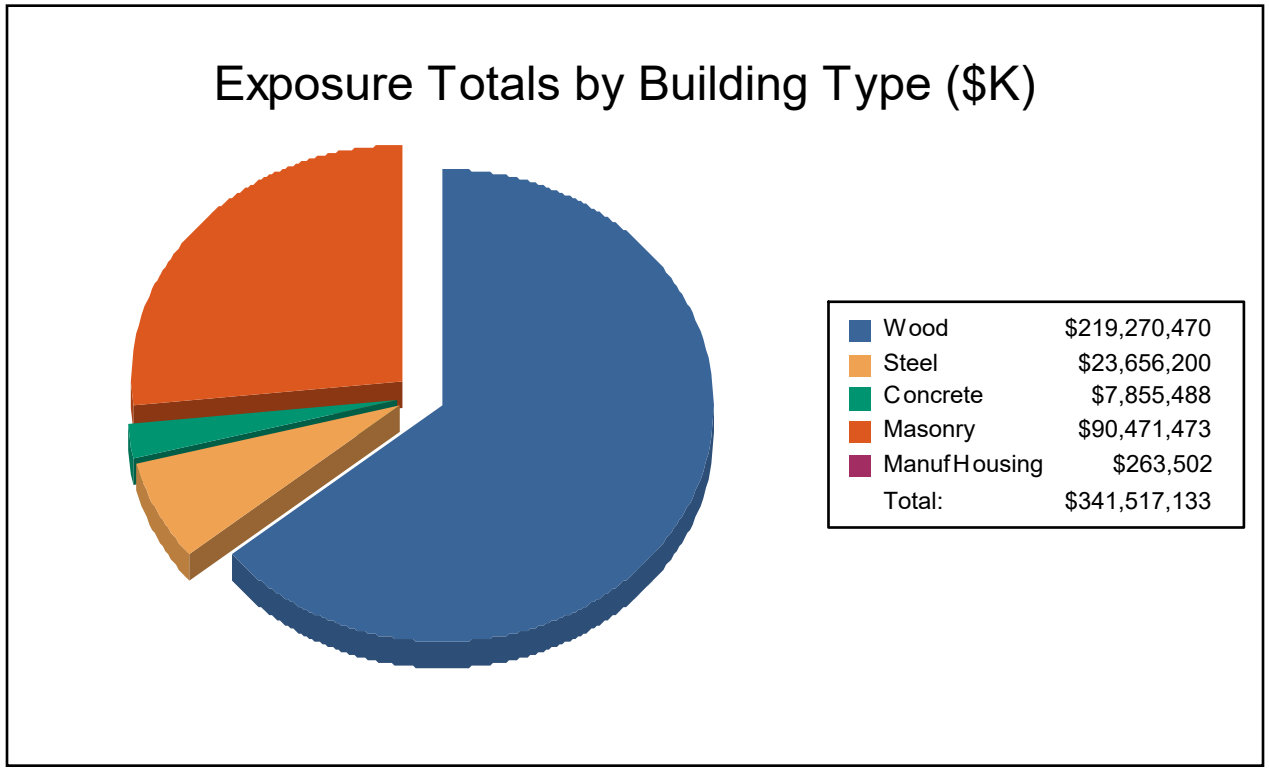
Building Stock Exposure by Building Type

August 03, 2021

All values are in thousands of dollars

	Wood	Steel	Concrete	Masonry	Manuf. Housing	Total
Virginia						
Fairfax City	2,560,328	659,970	195,116	1,263,030	2,666	4,681,110
Loudoun	30,129,693	2,692,250	756,012	11,729,826	20,612	45,328,393
Manassas	2,883,299	582,179	169,074	1,301,275	11,447	4,947,274
Arlington	20,214,845	2,738,208	1,150,777	9,289,567	19,238	33,412,635
Prince William	36,804,994	2,697,095	795,104	14,007,423	62,348	54,366,964
Fairfax	110,412,185	11,501,667	3,709,067	45,068,371	136,369	170,827,659
Manassas Park	997,807	126,897	30,841	404,237	411	1,560,193
Falls Church	1,402,579	254,460	68,044	640,744	0	2,365,827
Alexandria	13,864,740	2,403,474	981,453	6,767,000	10,411	24,027,078
Total	**219,270,470**	**23,656,200**	**7,855,488**	**90,471,473**	**263,502**	**341,517,133**
Study Region Total	**219,270,470**	**23,656,200**	**7,855,488**	**90,471,473**	**263,502**	**341,517,133**

Building Stock Exposure by Building Type



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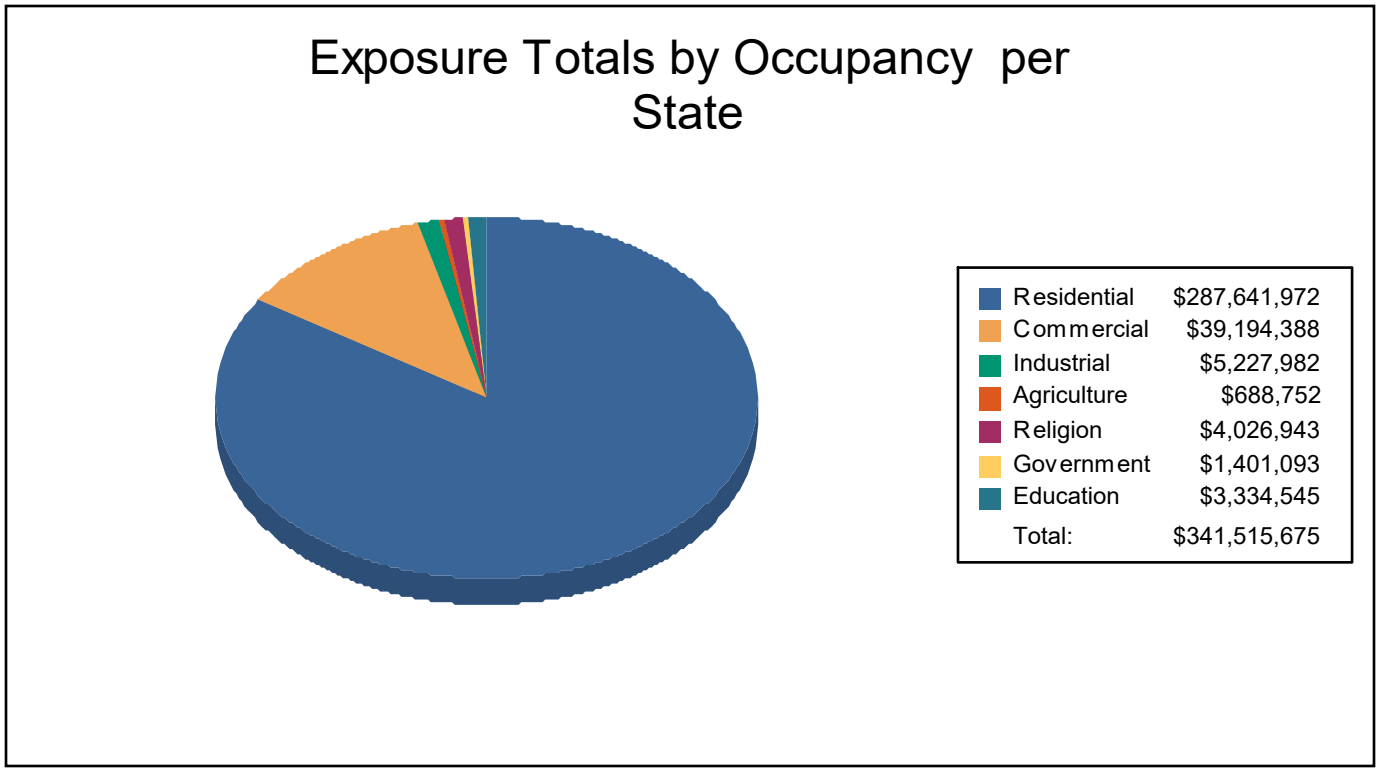
Building Stock Exposure by General Occupancy

August 03, 2021

All values are in thousands of dollars

	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Virginia								
Alexandria	18,477,776	3,608,216	304,079	20,665	567,753	128,869	919,729	24,027,087
Arlington	27,386,560	4,390,075	345,710	26,163	614,708	371,546	277,738	33,412,500
Fairfax	144,188,703	20,116,524	2,464,611	272,032	1,827,947	579,222	1,378,119	170,827,158
Fairfax City	3,164,151	1,210,584	135,723	12,501	110,826	13,954	33,368	4,681,107
Falls Church	1,766,161	461,373	39,966	7,392	58,626	11,611	20,673	2,365,802
Loudoun	39,257,243	4,211,047	886,538	159,244	382,528	134,762	296,612	45,327,974
Manassas	3,672,496	885,410	229,191	11,562	59,555	32,685	56,356	4,947,255
Manassas Park	1,298,379	155,463	64,064	7,422	8,011	5,174	21,671	1,560,184
Prince William	48,430,503	4,155,696	758,100	171,771	396,989	123,270	330,279	54,366,608
Total	**287,641,972**	**39,194,388**	**5,227,982**	**688,752**	**4,026,943**	**1,401,093**	**3,334,545**	**341,515,675**
Study Region Total	**287,641,972**	**39,194,388**	**5,227,982**	**688,752**	**4,026,943**	**1,401,093**	**3,334,545**	**341,515,675**

Building Stock Exposure by General Occupancy



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Care Facilities (Hospital) Damage and Functionality

August 03, 2021

Dollar values are in thousands.

	Total # of Beds	Total Building Damage ($)	Total Content Damage ($)	Non-Functional Hospitals	Average Restoration Time
Total					
Total					
Scenario Total					

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results .

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Combined Wind and Flood Direct Economic Losses for Buildings

August 03, 2021

All values are in thousands of dollars

	Capital Stock Losses				
	Building Loss	Contents Loss	Inventory Loss	Total Loss	Loss Ratio %
Total					

Study Region Total

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

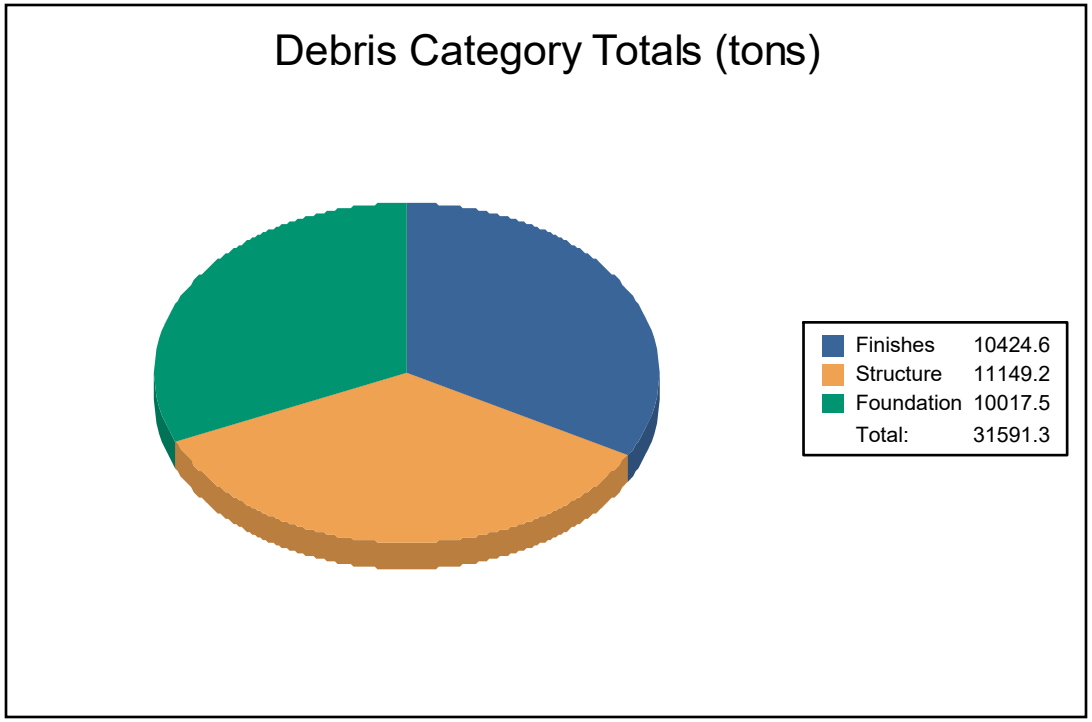
Debris Summary Report

August 03, 2021

All values are in tons.

	Finishes	Structures	Foundations	Total
Virginia				
Alexandria	1,228	65	78	1,372
Arlington	13	8	8	29
Fairfax	2,519	1,716	1,501	5,736
Loudoun	836	619	645	2,101
Prince William	5,828	8,741	7,785	22,354
Total	**10,425**	**11,149**	**10,018**	**31,591**
Scenario Total	**10,425**	**11,149**	**10,018**	**31,591**

Debris Summary Report



Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Depreciated Direct Economic Losses for Buildings

August 03, 2021

All values are in thousands of dollars

	Capital Stock Losses		
	Building Loss	Contents Loss	Total Loss
Virginia			
Arlington	225	168	393
Alexandria	23,817	23,707	47,524
Loudoun	143,851	103,502	247,353
Prince William	165,404	110,947	276,351
Manassas	1,289	2,110	3,399
Fairfax	118,005	82,857	200,862
Total	**452,591**	**323,291**	**775,882**
Scenario Total	**452,591**	**323,291**	**775,882**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Direct Economic Annualized Losses for Buildings

August 03, 2021

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Virginia									
Arlington	561	506	5	0.3	58	174	159	30	1,493
Alexandria	39,906	42,504	670	1.3	16,353	26,828	25,850	10,291	162,402
Loudoun	178,368	132,180	1,207	3.2	31,066	23,202	55,983	12,719	434,725
Fairfax	178,167	130,489	2,270	1.4	30,419	27,261	50,150	12,835	431,591
Prince William	240,638	175,751	3,039	2.4	41,114	41,151	54,676	18,434	574,803
Manassas	2,054	3,352	11	11.4	825	3,409	1,591	635	11,877
Total	**639,694**	**484,782**	**7,202**	**20.0**	**119,835**	**122,025**	**188,409**	**54,944**	**1,616,891**
Scenario Total	**639,694**	**484,782**	**7,202**	**20.0**	**119,835**	**122,025**	**188,409**	**54,944**	**1,616,891**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Direct Economic Loss For Transportation

August 03, 2021

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Virginia								
Alexandria								
Segments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bridges	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Tunnels	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Arlington								
Segments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bridges	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Tunnels	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Fairfax								
Segments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bridges	$12.57	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$12.57
Tunnels	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$12.57**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$12.57**

Direct Economic Loss For Transportation

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Fairfax City								
Segments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bridges	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Tunnels	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Falls Church								
Segments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bridges	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Tunnels	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Loudoun								
Segments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bridges	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Tunnels	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Manassas								
Segments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bridges	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Tunnels	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Direct Economic Loss For Transportation

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Manassas Park								
Segments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bridges	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Tunnels	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Prince William								
Segments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bridges	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Tunnels	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Total	**$12.57**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Scenario Total	**$12.57**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$12.57**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses for Buildings

August 03, 2021

All values are in thousands of dollars

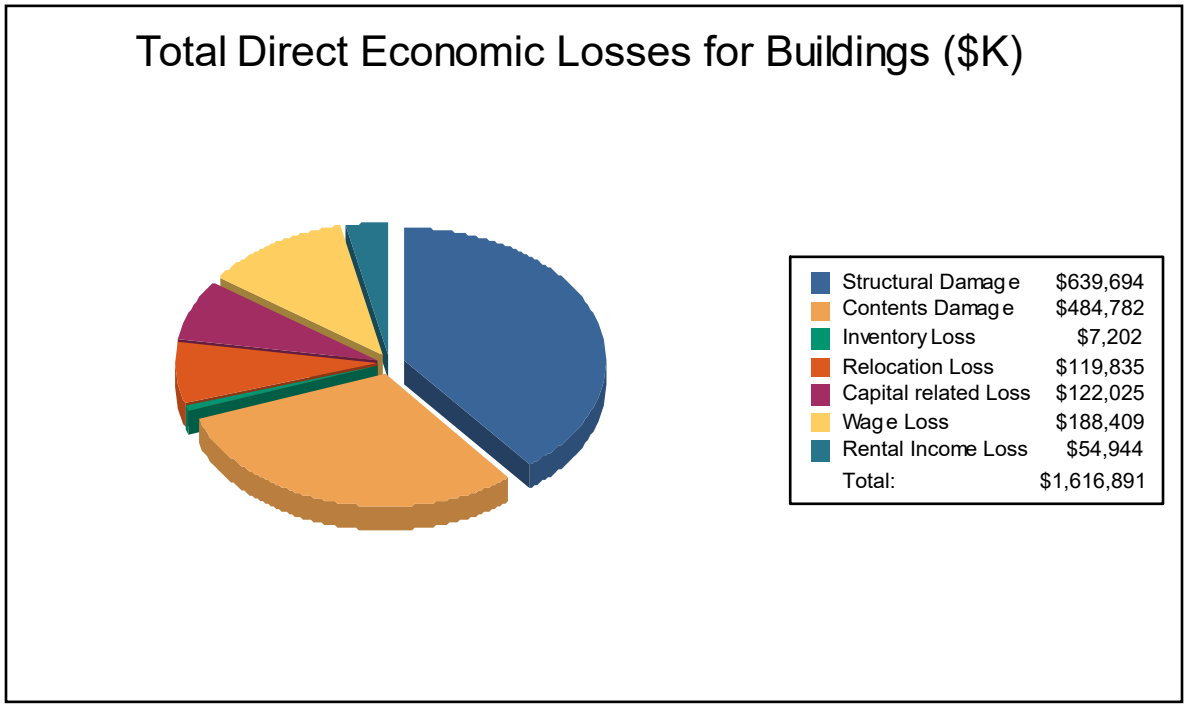
	Capital Stock Losses				Income Losses				
	Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Virginia									
Arlington	561	506	5	0.30	58	174	159	30	1,493
Alexandria	39,906	42,504	670	1.30	16,353	26,828	25,850	10,291	162,402
Loudoun	178,368	132,180	1,207	3.20	31,066	23,202	55,983	12,719	434,725
Fairfax	178,167	130,489	2,270	1.40	30,419	27,261	50,150	12,835	431,591
Prince William	240,638	175,751	3,039	2.40	41,114	41,151	54,676	18,434	574,803
Manassas	2,054	3,352	11	11.40	825	3,409	1,591	635	11,877
Total	**639,694**	**484,782**	**7,202**	**3.33**	**119,835**	**122,025**	**188,409**	**54,944**	**1,616,891**
Scenario Total	**639,694**	**484,782**	**7,202**	**3.33**	**119,835**	**122,025**	**188,409**	**54,944**	**1,616,891**

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Direct Economic Losses for Buildings

August 03, 2021

All values are in thousands of dollars

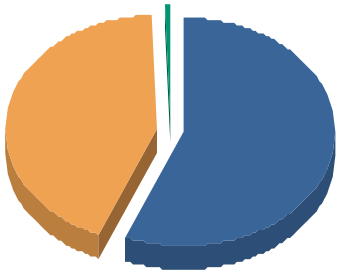


Direct Economic Losses for Buildings

August 03, 2021

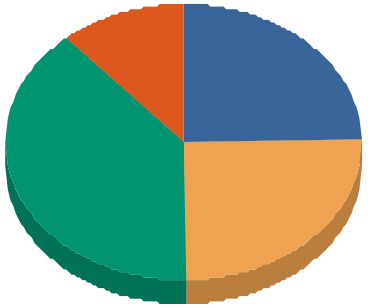
All values are in thousands of dollars

Loss by Capital Stock Categories ($K)



Structural Damage	$639,694
Contents Damage	$484,782
Inventory Loss	$7,202
Total:	$1,131,678

Income Losses by Categories ($K)

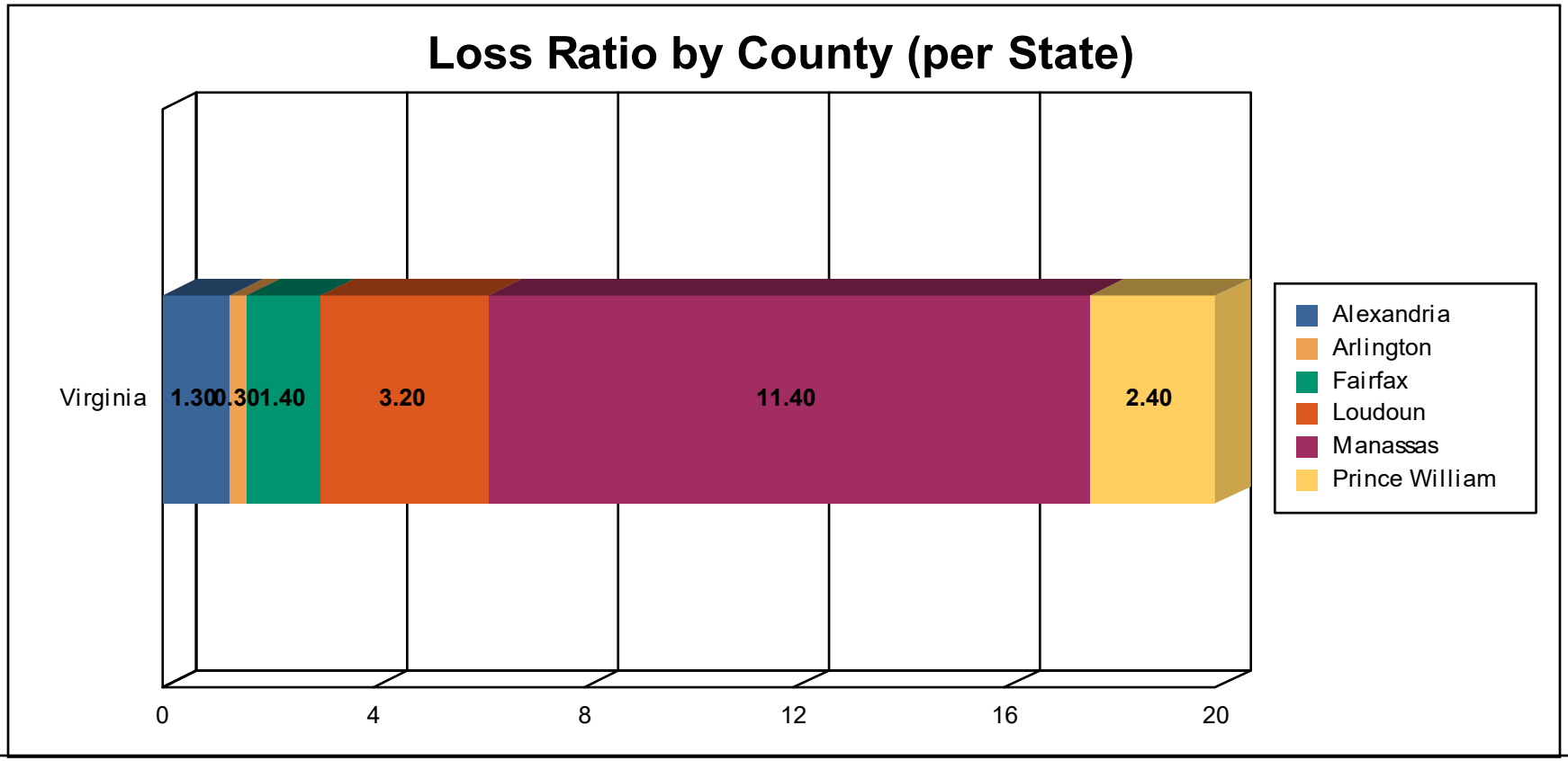


Relocation Loss	$119,835
Capital Related Loss	$122,025
Wage Loss	$188,409
Rental Income Loss	$54,944
Total:	$485,213

Direct Economic Losses for Buildings

August 03, 2021

All values are in thousands of dollars

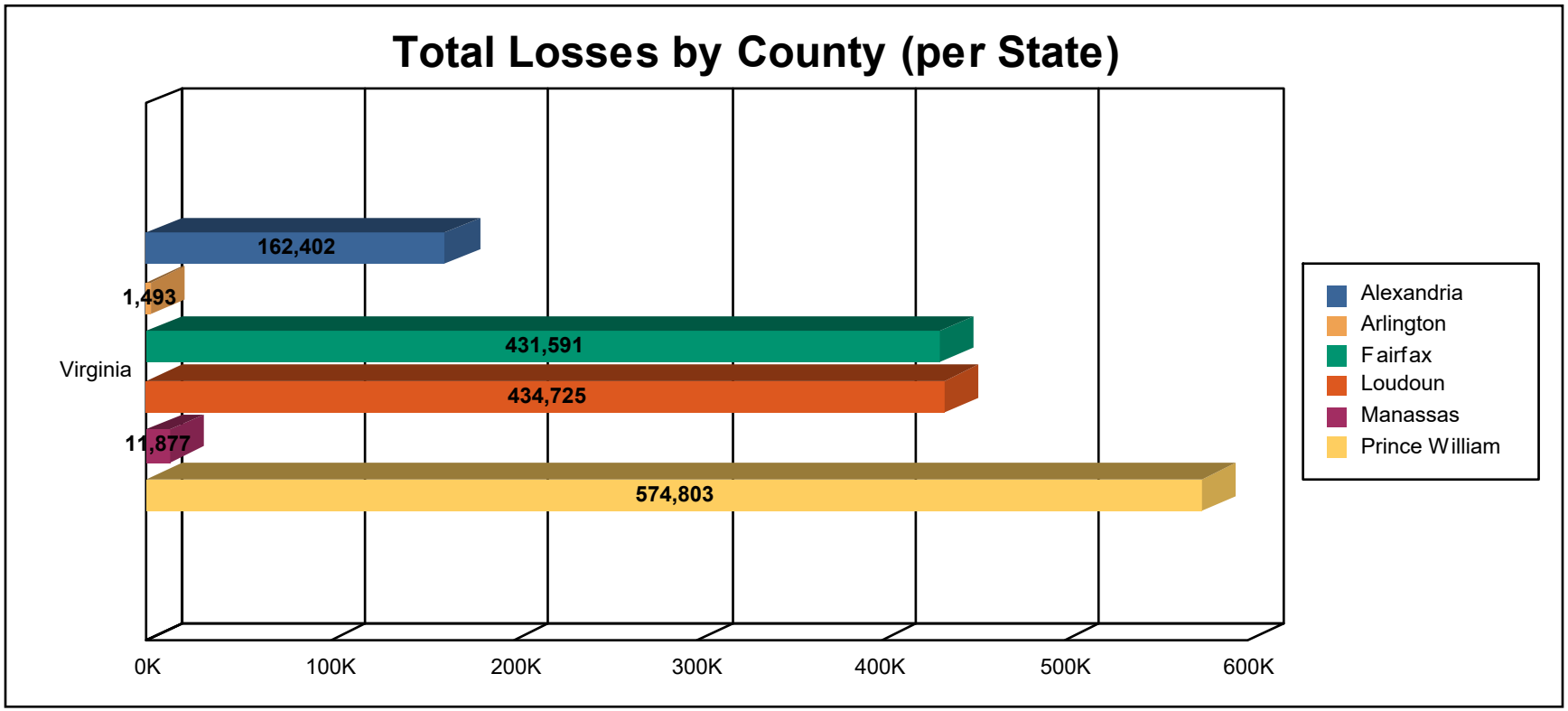


Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Direct Economic Losses for Buildings

August 03, 2021

All values are in thousands of dollars



Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Direct Economic Losses for Buildings

August 03, 2021

All values are in thousands of dollars

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses for User Defined Facilities

Tuesday, August 3, 2021

	Capital Stock Exposure		Capital Stock Losses				Loss Ratio	
	Building Exposure	Contents Exposure	Building Loss	Contents Loss	Inventory Loss	TOTAL Loss	Buildings %	Contents %
Specific Occupancy								
Scenario Total								

Totals reflect User Defined Facilities (UDF) within the flood hazard scenario and will reflect the entire county/state only if all UDF for the study region were innundated.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Direct Economic Losses for Utilities

August 03, 2021

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Virginia							
Alexandria							
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Arlington							
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Fairfax							
Facilities	$0.00	$70,758.83	$0.00	$0.00	$0.00	$0.00	$70,758.83
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$70,758.83**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$70,758.83**
Fairfax City							
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Falls Church							
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Direct Economic Losses for Utilities

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Loudoun							
Facilities	$0.00	$96,696.45	$0.00	$0.00	$0.00	$0.00	$96,696.45
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$96,696.45**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$96,696.45**
Manassas							
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Manassas Park							
Facilities	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Prince William							
Facilities	$37,162.80	$0.00	$0.00	$0.00	$0.00	$0.00	$37,162.80
Pipelines	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	**$37,162.80**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$37,162.80**
Total	**$37,162.80**	**$167,455.28**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$204,618.08**
Scenario Total	**$37,162.80**	**$167,455.28**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$204,618.08**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Vehicles (Day)

August 03, 2021

All values are in dollars.

	Car	Light Truck	Heavy Truck	Total Loss
Virginia				
Alexandria	$8,535,153	$3,643,142	$474,800	$12,653,095
Arlington	$99,104	$55,968	$2,185	$157,257
Fairfax	$17,160,928	$10,615,919	$2,503,766	$30,280,613
Loudoun	$15,265,666	$9,491,450	$1,656,122	$26,413,238
Manassas	$877,574	$552,940	$26,733	$1,457,247
Prince William	$25,880,995	$16,595,219	$4,239,945	$46,716,159
Total	**$67,819,420**	**$40,954,638**	**$8,903,551**	**$117,677,609**
Scenario Total	**$67,819,420**	**$40,954,638**	**$8,903,551**	**$117,677,609**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Direct Economic Losses For Vehicles (Night)

August 03, 2021

All values are in dollars.

	Car	Light Truck	Heavy Truck	Total Loss
Virginia				
Alexandria	$5,964,061.24	$2,898,082.00	$494,495.00	$9,356,638
Arlington	$70,682.40	$36,035.00	$2,185.00	$108,902
Fairfax	$17,029,505.88	$10,499,401.00	$2,636,522.00	$30,165,429
Loudoun	$12,846,463.89	$8,130,676.00	$1,785,729.00	$22,762,869
Manassas	$81,957.66	$48,441.00	$26,733.00	$157,132
Prince William	$23,548,131.05	$14,817,092.00	$4,463,600.00	$42,828,823
Total	**$59,540,802.11**	**$36,429,727**	**$9,409,264**	**$105,379,793**
Scenario Total	**$59,540,802**	**$36,429,727**	**$9,409,264.00**	**$105,379,793**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Emergency Operation Center Damage and Functionality

August 03, 2021

Dollar values are in thousands.

	Count of EOCs	Total Building Damage ($)	Total Content Damage ($)	Non-Functional EOCs	Average Restoration Time
Total					
Total					
Scenario Total					

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results .

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Fire Station Facilities Damage and Functionality

August 03, 2021

Dollar values are in thousands.

	Count of Fire Stations	Total Building Damage ($)	Total Content Damage ($)	Non-Functional Fire Stations	Average Restoration Time
Virginia					
Fairfax					
Fire Station	1	271	1,088	1	480
Total	**1**	**271**	**1,088**	**1**	**480**
Loudoun					
Fire Station	1	743	3,985	1	720
Total	**1**	**743**	**3,985**	**1**	**720**
Total	**2**	**1,015**	**5,073**	**2**	**600**
Scenario Total	**2**	**1,015**	**5,073**	**2**	**600**

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results .

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Highway Bridge Damage and Functionality

August 03, 2021

Dollar values are in thousands.

	# of Bridges	Average Damage (%)	Total Loss ($)	Count-Non-Functional
Virginia				
Fairfax	1	5.00	13	0
Total	**1**	**5.00**	**13**	**0**
Scenario Total	**1**	**5.00**	**13**	**0**

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results .

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Light Rail Bridge Damage and Functionality

August 03, 2021

Dollar values are in thousands.

	# of Bridges	Average Damage (%)	Total Loss ($)	Count-Non-Functional
Total				

Scenario Total

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results .

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Police Station Facilities Damage and Functionality

August 03, 2021

Dollar values are in thousands.

	Count of Police Stations	Total Building Damage ($)	Total Content Damage ($)	Non-Functional Police Stations	Average Restoration Time
Virginia					
Prince William					
Police Station	1	1,246.87	3,943.11	1	900
Total	**1**	**1,246.87**	**3,943.11**	**1**	**900**
Total	**1**	**1,246.87**	**3,943.11**	**1**	**900**
Scenario Total	**1**	**1,246.87**	**3,943.11**	**1**	**900**

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results .

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Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Potable Water System Facility Damage

August 03, 2021

Dollar values are in thousands.

	# of Facilities	Average Damage (%)	Total Loss ($)	Non-Functional Facilities
Virginia				
Prince William	3	40.0	37,163	3
Total	**3**	**40.0**	**37,163**	**3**
Scenario Total	**3**	**40.0**	**37,163**	**3**

If this report displays all zeros, two possibilities can explain this.

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Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

School Damage and Functionality

August 03, 2021

Dollar values are in thousands.

	Count of Schools	Total Building Damage ($)	Total Content Damage ($)	Non-Functional Schools	Average Restoration Time
Virginia					
Alexandria					
Grade Schools (Primary and High Schools)	1	695.46	3,771.44	1	480
Total	**1**	**695.46**	**3,771.44**	**1**	**480**
Total	**1**	**695.46**	**3,771.44**	**1**	**480**
Scenario Total	**1**	**695.46**	**3,771.44**	**1**	**480**

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results .

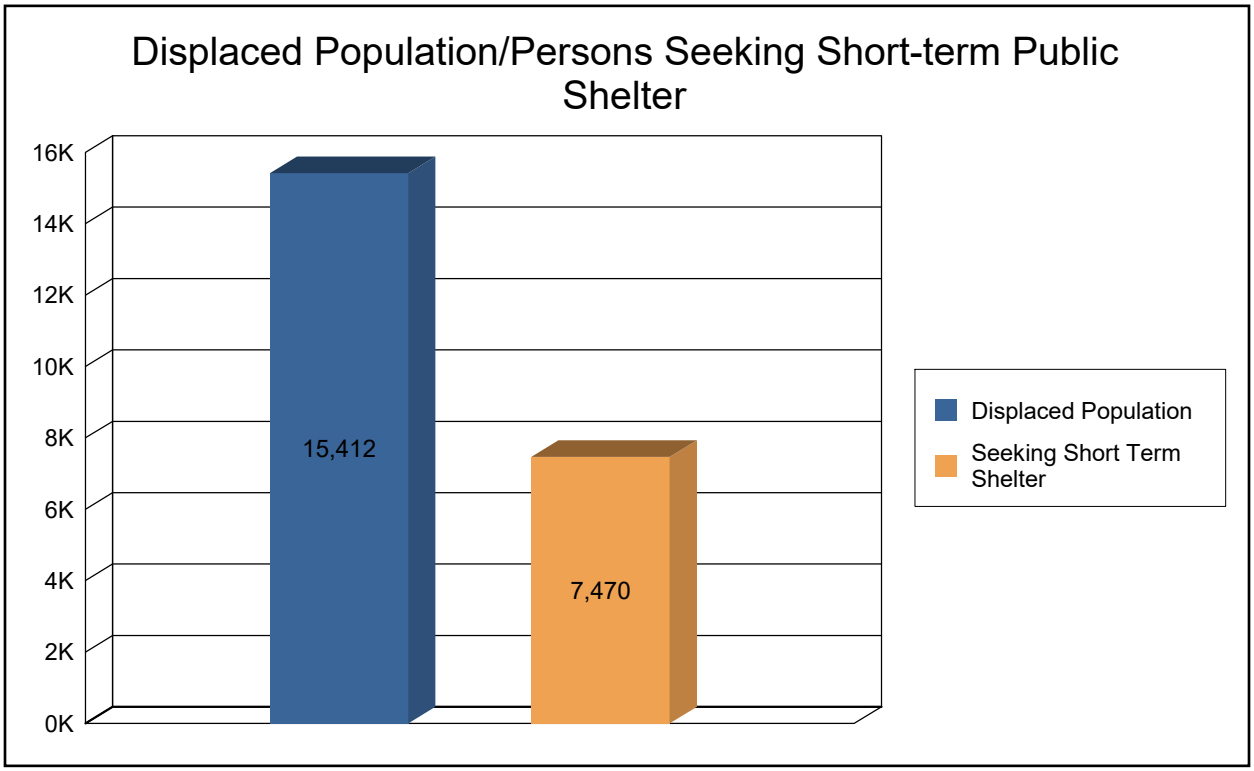
Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Shelter Summary Report

August 03, 2021

	# of Displaced People	# of People Needing Short Term Shelter
Virginia		
Alexandria	2,465	1,011
Arlington	14	13
Fairfax	5,039	2,858
Loudoun	3,088	1,396
Manassas	0	0
Prince William	4,806	2,192
Total	**15,412**	**7,470**
Scenario Total	**15,412**	**7,470**



Shelter Summary Report

	# of Displaced People	# of People Needing Short Term Shelter

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Transportation System Dollar Exposure

August 03, 2021

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Virginia								
Alexandria								
Segments	405,210	45,485	39,556	0	0	0	0	490,250
Bridges	1,016,569	57,132	0	0	0	0	0	1,073,701
Tunnels	0	0	0	0	0	0	0	0
Facilities	0	5,326	14,063	0	0	0	0	19,389
Total	**1,421,779**	**107,943**	**53,619**	**0**	**0**	**0**	**0**	**1,583,341**
Arlington								
Segments	876,955	5,925	23,914	0	0	0	0	906,794
Bridges	928,523	8,790	0	0	0	0	0	937,313
Tunnels	28,960	0	0	0	0	0	0	28,960
Facilities	0	0	33,752	1,406	0	0	0	35,158
Total	**1,834,438**	**14,714**	**57,666**	**1,406**	**0**	**0**	**0**	**1,908,225**
Fairfax								
Segments	3,839,512	77,657	88,007	0	0	0	33,949	4,039,126
Bridges	4,006,912	153,817	0	0	0	0	0	4,160,729
Tunnels	0	0	0	0	0	0	0	0
Facilities	0	7,989	28,127	1,406	13,887	0	42,014	93,423

Transportation System Dollar Exposure

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Total	**7,846,425**	**239,463**	**116,134**	**1,406**	**13,887**	**0**	**75,963**	**8,293,279**
Fairfax City								
Segments	179,249	0	0	0	0	0	0	179,249
Bridges	10,407	0	0	0	0	0	0	10,407
Tunnels	0	0	0	0	0	0	0	0
Facilities	0	0	0	0	0	0	0	0
Total	**189,657**	**0**	**0**	**0**	**0**	**0**	**0**	**189,657**
Falls Church								
Segments	38,978	0	0	0	0	0	0	38,978
Bridges	831	0	0	0	0	0	0	831
Tunnels	0	0	0	0	0	0	0	0
Facilities	0	0	0	0	0	0	0	0
Total	**39,809**	**0**	**0**	**0**	**0**	**0**	**0**	**39,809**
Loudoun								
Segments	1,157,715	0	0	0	0	0	45,917	1,203,631
Bridges	1,195,951	0	0	0	0	0	0	1,195,951
Tunnels	0	0	0	0	0	0	0	0
Facilities	0	0	0	0	0	1,331	11,075	12,406
Total	**2,353,666**	**0**	**0**	**0**	**0**	**1,331**	**56,991**	**2,411,988**
Manassas								
Segments	124,636	18,826	11,542	0	0	0	0	155,004

Transportation System Dollar Exposure

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Bridges	58,637	8,790	0	0	0	0	0	67,427
Tunnels	0	0	0	0	0	0	0	0
Facilities	0	2,663	2,813	0	0	0	0	5,476
Total	**183,273**	**30,278**	**14,355**	**0**	**0**	**0**	**0**	**227,906**
Manassas Park								
Segments	10,561	2,946	0	0	0	0	0	13,506
Bridges	271	0	0	0	0	0	0	271
Tunnels	0	0	0	0	0	0	0	0
Facilities	0	0	2,813	0	0	0	0	2,813
Total	**10,832**	**2,946**	**2,813**	**0**	**0**	**0**	**0**	**16,590**
Prince William								
Segments	1,092,574	80,019	21,525	0	0	0	0	1,194,117
Bridges	973,815	83,501	0	0	0	0	0	1,057,316
Tunnels	0	0	0	0	0	0	0	0
Facilities	0	5,326	11,251	1,406	16,665	0	0	34,648
Total	**2,066,389**	**168,845**	**32,776**	**1,406**	**16,665**	**0**	**0**	**2,286,081**
Total	**15,946,267**	**107,943**	**53,619**	**4,219**	**30,552**	**1,331**	**0**	**1,583,341**
Study Region Total	**15,946,267**	**564,190**	**277,362**	**4,219**	**30,552**	**1,331**	**132,954**	**16,956,875**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Utility System Dollar Exposure

August 03, 2021

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Virginia							
Alexandria							
Facilities	0	502,762	0	0	152,938	0	655,701
Pipelines	0	0	0	0	0	0	0
Total	**0**	**502,762**	**0**	**0**	**152,938**	**0**	**655,701**
Arlington							
Facilities	0	754,144	0	0	0	372	754,516
Pipelines	0	0	0	0	0	0	0
Total	**0**	**754,144**	**0**	**0**	**0**	**372**	**754,516**
Fairfax							
Facilities	61,938	1,005,525	93	1,538	769,086	744	1,838,924
Pipelines	0	0	0	66,817	0	0	66,817
Total	**61,938**	**1,005,525**	**93**	**68,355**	**769,086**	**744**	**1,905,741**
Fairfax City							

Utility System Dollar Exposure

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Facilities	0	0	93	0	0	93	186
Pipelines	0	0	0	0	0	0	0
Total Falls Church	**0**	**0**	**93**	**0**	**0**	**93**	**186**
Facilities	0	0	0	0	0	93	93
Pipelines	0	0	0	0	0	0	0
Total Loudoun	**0**	**0**	**0**	**0**	**0**	**93**	**93**
Facilities	123,876	3,770,718	0	4,615	769,086	93	4,668,387
Pipelines	0	0	0	71,288	0	0	71,288
Total Manassas	**123,876**	**3,770,718**	**0**	**75,903**	**769,086**	**93**	**4,739,675**
Facilities	0	0	0	0	305,876	0	305,876
Pipelines	0	0	0	0	0	0	0
Total Manassas Park	**0**	**0**	**0**	**0**	**305,876**	**0**	**305,876**

Utility System Dollar Exposure

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Facilities	0	0	0	0	0	0	0
Pipelines	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Prince William							
Facilities	92,907	1,005,525	0	1,538	769,086	279	1,869,335
Pipelines	0	0	0	47,979	0	0	47,979
Total	**92,907**	**1,005,525**	**0**	**49,517**	**769,086**	**279**	**1,917,314**
Total	**278,721**	**7,038,673**	**186**	**193,775**	**2,766,072**	**1,674**	**10,279,102**
Study Region Total	**278,721**	**7,038,673**	**186**	**193,775**	**2,766,072**	**1,674**	**10,279,102**

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Vehicle Dollar Exposure (Day)

August 03, 2021

All values are in dollars.

	Cars	Light Trucks	Heavy Trucks	Total
Virginia				
Alexandria	$1,151,518,225	$798,833,892	$166,039,961	$2,116,392,078
Arlington	$1,513,572,057	$1,050,113,639	$200,188,405	$2,763,874,101
Fairfax	$6,447,310,587	$4,472,334,178	$1,161,777,544	$12,081,422,309
Fairfax City	$297,987,820	$206,770,522	$58,618,452	$563,376,794
Falls Church	$127,517,603	$88,552,735	$24,926,538	$240,996,876
Loudoun	$1,283,409,690	$890,272,668	$286,792,146	$2,460,474,504
Manassas	$253,059,750	$175,741,250	$59,851,083	$488,652,083
Manassas Park	$56,233,893	$39,051,589	$15,613,326	$110,898,808
Prince William	$1,550,805,121	$1,075,447,043	$326,601,562	$2,952,853,726
Total	**$12,681,414,746**	**$8,797,117,516**	**$2,300,409,017**	**$23,778,941,279**
Study Region Total	**$12,681,414,746**	**$8,797,117,516**	**$2,300,409,017**	**$23,778,941,279**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Vehicle Dollar Exposure (Night)

August 03, 2021

All values are in dollars.

	Cars	Light Trucks	Heavy Trucks	Total
Virginia				
Alexandria	$1,109,873,030	$767,818,283	$174,303,154	$2,051,994,467
Arlington	$1,566,393,721	$1,083,980,710	$212,103,838	$2,862,478,269
Fairfax	$6,776,506,330	$4,689,243,733	$1,226,102,621	$12,691,852,684
Fairfax City	$190,158,595	$131,572,198	$61,859,815	$383,590,608
Falls Church	$99,557,496	$68,933,036	$26,524,393	$195,014,925
Loudoun	$1,222,855,251	$846,883,186	$303,409,838	$2,373,148,275
Manassas	$225,398,317	$156,008,160	$62,818,528	$444,225,005
Manassas Park	$59,642,328	$41,263,694	$16,480,733	$117,386,755
Prince William	$1,757,803,409	$1,216,531,824	$345,638,863	$3,319,974,096
Total	**$13,008,188,477**	**$9,002,234,824**	**$2,429,241,783**	**$24,439,665,084**
Study Region Total	**$13,008,188,477**	**$9,002,234,824**	**$2,429,241,783**	**$24,439,665,084**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Waste Water Facility Damage

August 03, 2021

Dollar values are in thousands.

	# of Facilities	Average Damage (%)	Total Loss ($)	Non-Functional Facilities
Virginia				
Fairfax	2	28.1	70,759	2
Loudoun	4	19.2	96,696	2
Total	**6**	**47.4**	**167,455**	**4**
Scenario Total	**6**	**47.4**	**167,455**	**4**

If this report displays all zeros, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results .

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: NOVA_EQ_FL_HU_Test
Scenario: 100Yr
Return Period: 100

Hazus: Hurricane Global Risk Report

Region Name: NOVA_EQ_FL_HU_Test

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Monday, July 26, 2021

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 9 county(ies) from the following state(s):

- Virginia

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,321.72 square miles and contains 520 census tracts. There are over 823 thousand households in the region and a total population of 2,230,623 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 663 thousand buildings in the region with a total building replacement value (excluding contents) of 341,516 million dollars (2014 dollars). Approximately 92% of the buildings (and 84% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 663,685 buildings in the region which have an aggregate total replacement value of 341,516 million (2014 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

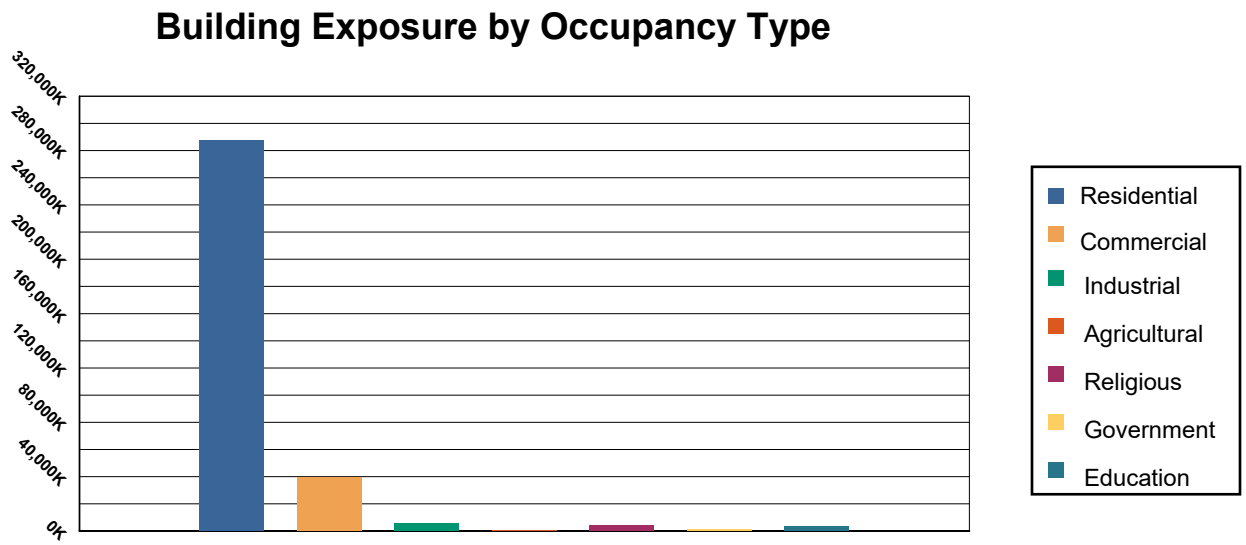


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	287,641,972	84.23%
Commercial	39,194,388	11.48%
Industrial	5,227,982	1.53%
Agricultural	688,752	0.20%
Religious	4,026,943	1.18%
Government	1,401,093	0.41%
Education	3,334,545	0.98%
Total	**341,515,675**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 19 hospitals in the region with a total bed capacity of 3,149 beds. There are 846 schools, 110 fire stations, 46 police stations and 14 emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

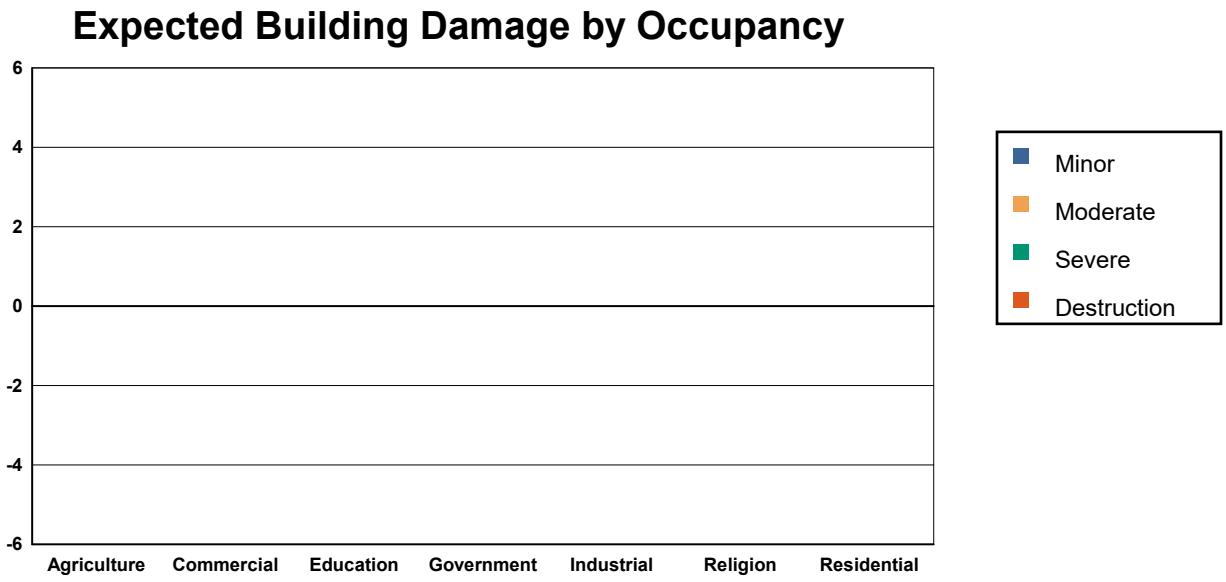


Table 2: Expected Building Damage by Occupancy : 10 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1,650.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	34,228.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Education	1,854.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Government	1,183.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	8,145.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Religion	3,564.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	613,061.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**663,685.00**		**0.00**		**0.00**		**0.00**		**0.00**	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	5,477	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	167,486	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	5,134	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	22,560	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	462,757	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 3149 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

Thematic Map of Essential Facilities with greater than 50% moderate

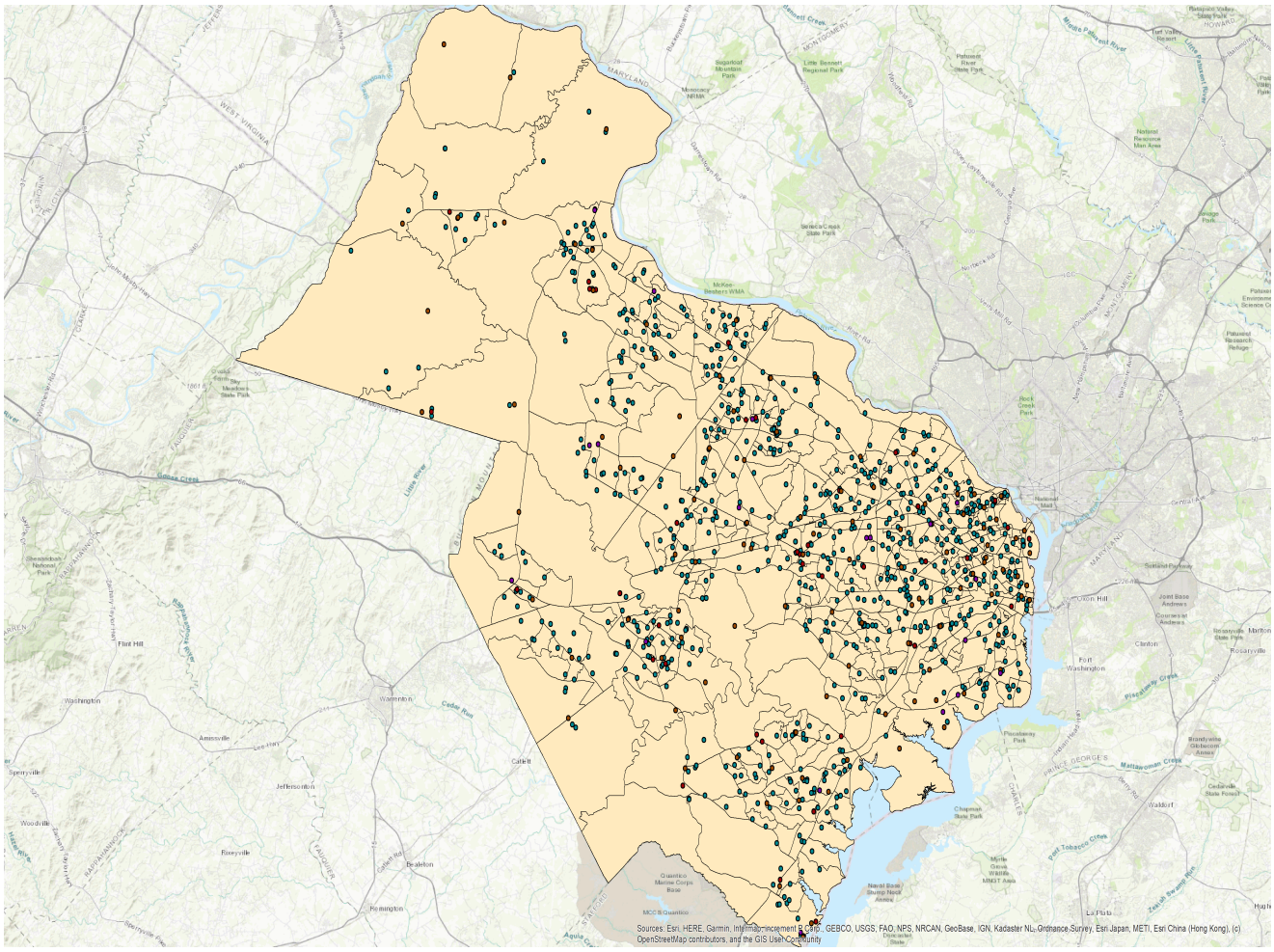
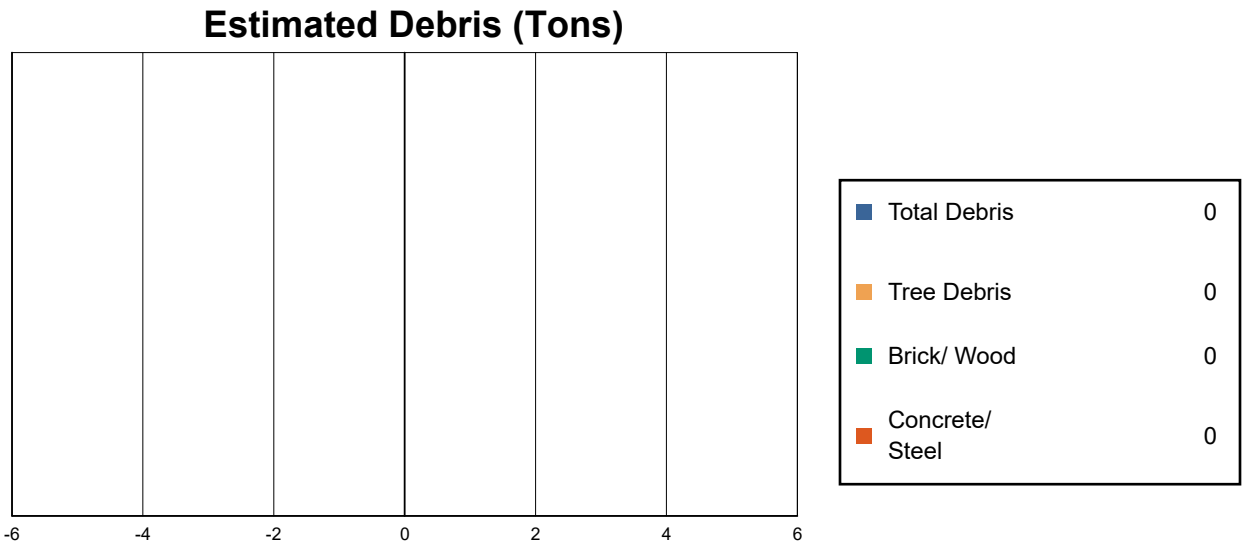


Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	14	0	0	14
Fire Stations	110	0	0	110
Hospitals	19	0	0	19
Police Stations	46	0	0	46
Schools	846	0	0	846

Induced Hurricane Damage

Debris Generation

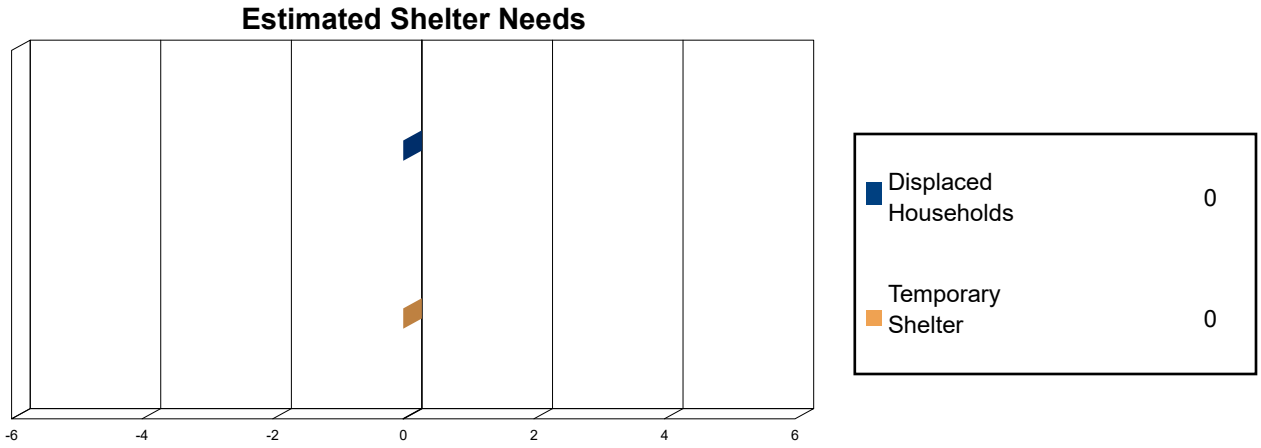


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 2,230,623) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

**Loss by Business Interruption Type (left)
and Building Damage Type (right)**

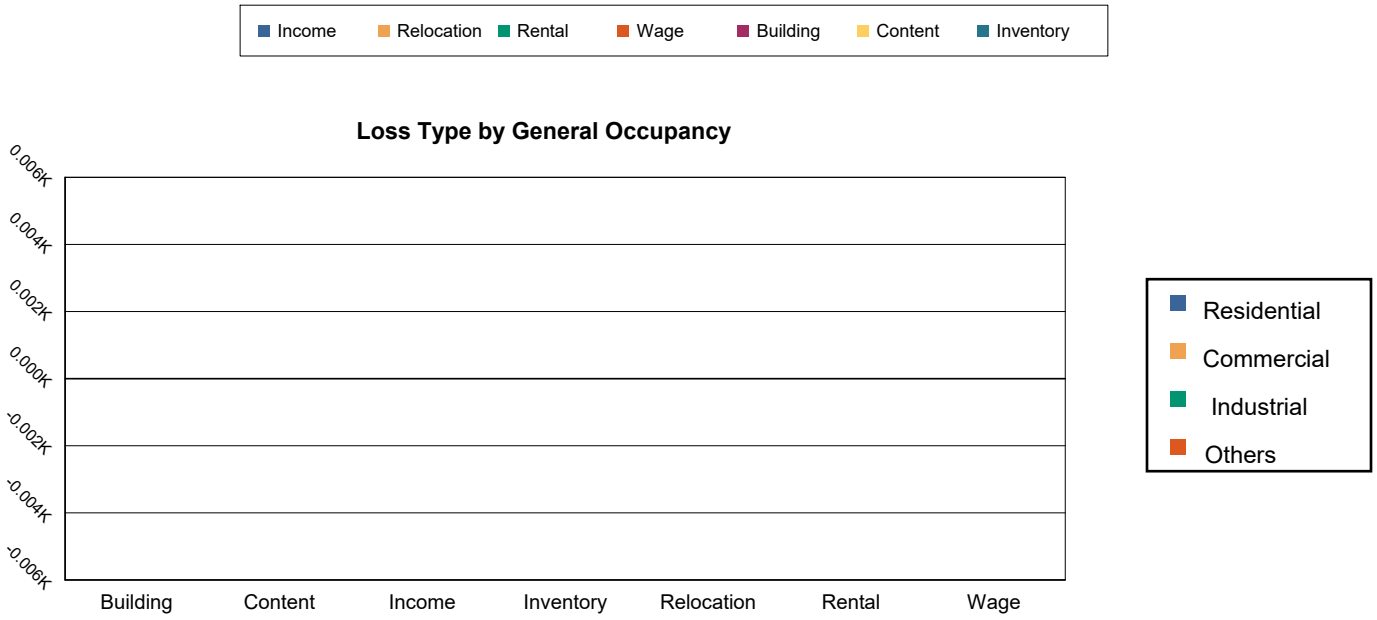


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Total

Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Appendix A: County Listing for the Region

Virginia

- Arlington
- Fairfax
- Loudoun
- Prince William
- Alexandria
- Fairfax City
- Falls Church
- Manassas
- Manassas Park

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Virginia				
Alexandria	139,966	18,477,776	5,549,311	24,027,087
Arlington	207,627	27,386,560	6,025,940	33,412,500
Fairfax	1,081,726	144,188,703	26,638,455	170,827,158
Fairfax City	22,565	3,164,151	1,516,956	4,681,107
Falls Church	12,332	1,766,161	599,641	2,365,802
Loudoun	312,311	39,257,243	6,070,731	45,327,974
Manassas	37,821	3,672,496	1,274,759	4,947,255
Manassas Park	14,273	1,298,379	261,805	1,560,184
Prince William	402,002	48,430,503	5,936,105	54,366,608
Total	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**
Study Region Total	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**

Hazus: Hurricane Global Risk Report

Region Name: NOVA_EQ_FL_HU_Test

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Monday, July 26, 2021

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

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The hurricane loss estimates provided in this report are based on a region that includes 9 county(ies) from the following state(s):

- Virginia

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,321.72 square miles and contains 520 census tracts. There are over 823 thousand households in the region and a total population of 2,230,623 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 663 thousand buildings in the region with a total building replacement value (excluding contents) of 341,516 million dollars (2014 dollars). Approximately 92% of the buildings (and 84% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 663,685 buildings in the region which have an aggregate total replacement value of 341,516 million (2014 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

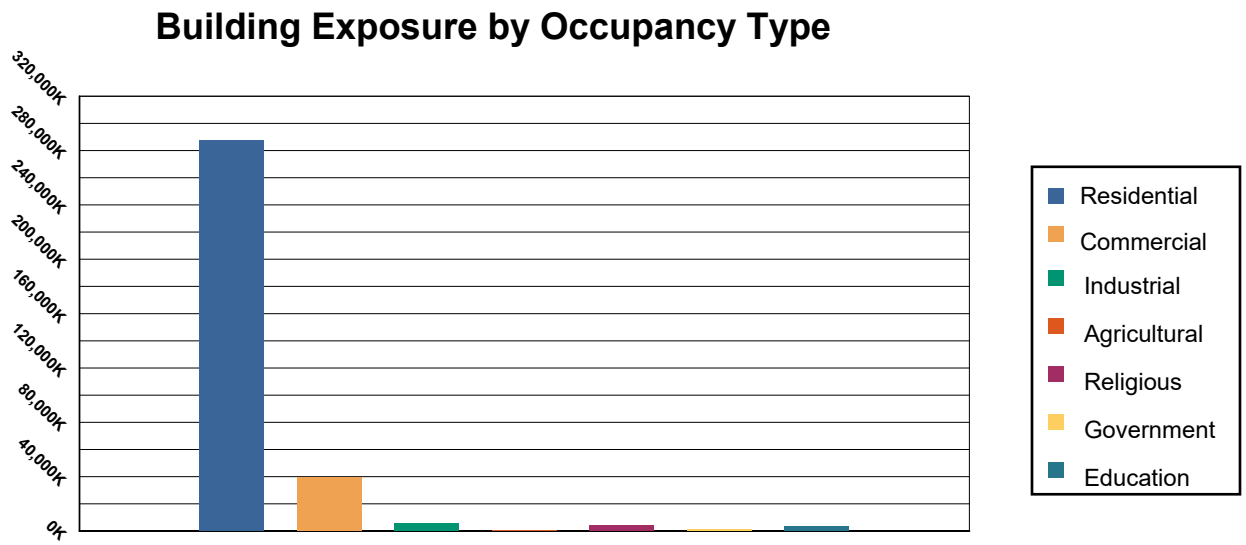

Table 1: Building Exposure by Occupancy Type

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Residential	287,641,972	84.23%
Commercial	39,194,388	11.48%
Industrial	5,227,982	1.53%
Agricultural	688,752	0.20%
Religious	4,026,943	1.18%
Government	1,401,093	0.41%
Education	3,334,545	0.98%
Total	**341,515,675**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 19 hospitals in the region with a total bed capacity of 3,149 beds. There are 846 schools, 110 fire stations, 46 police stations and 14 emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

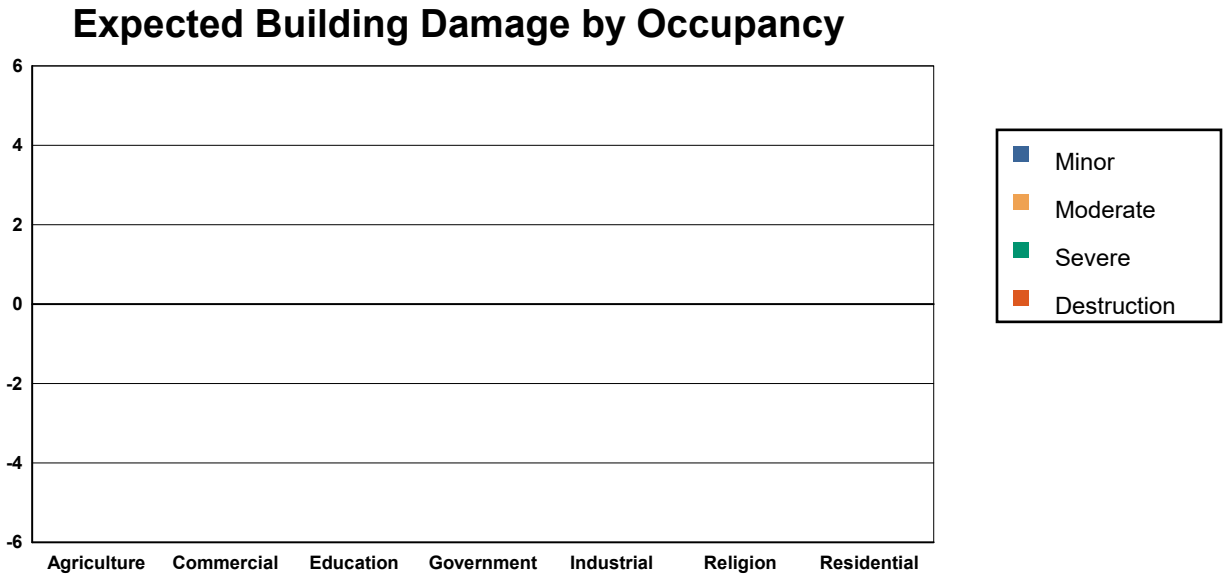


Table 2: Expected Building Damage by Occupancy : 20 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1,650.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	34,228.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Education	1,854.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Government	1,183.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	8,145.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Religion	3,564.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	613,061.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**663,685.00**		**0.00**		**0.00**		**0.00**		**0.00**	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	5,477	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	167,486	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	5,134	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	22,560	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	462,757	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 3149 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

Thematic Map of Essential Facilities with greater than 50% moderate

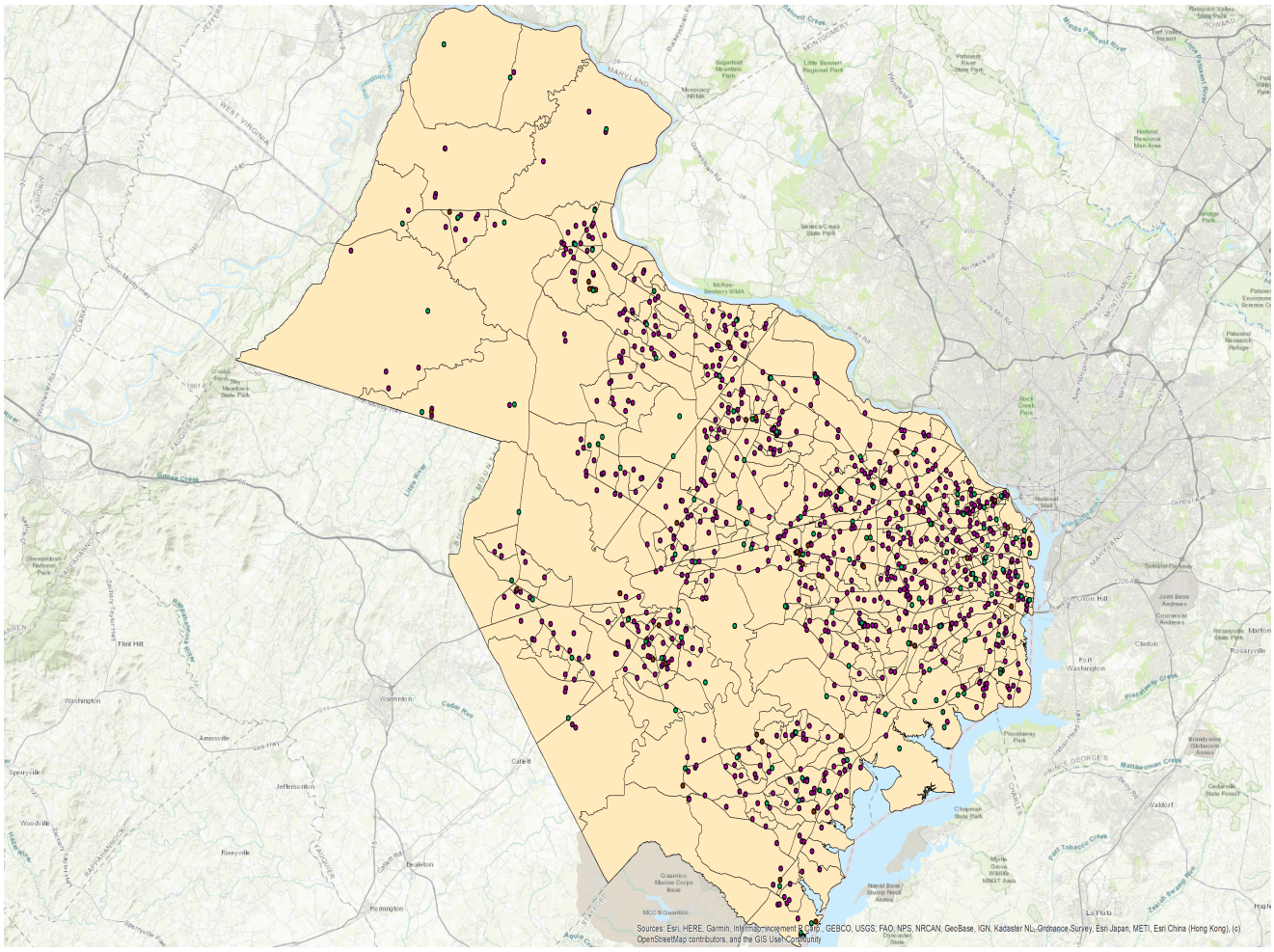
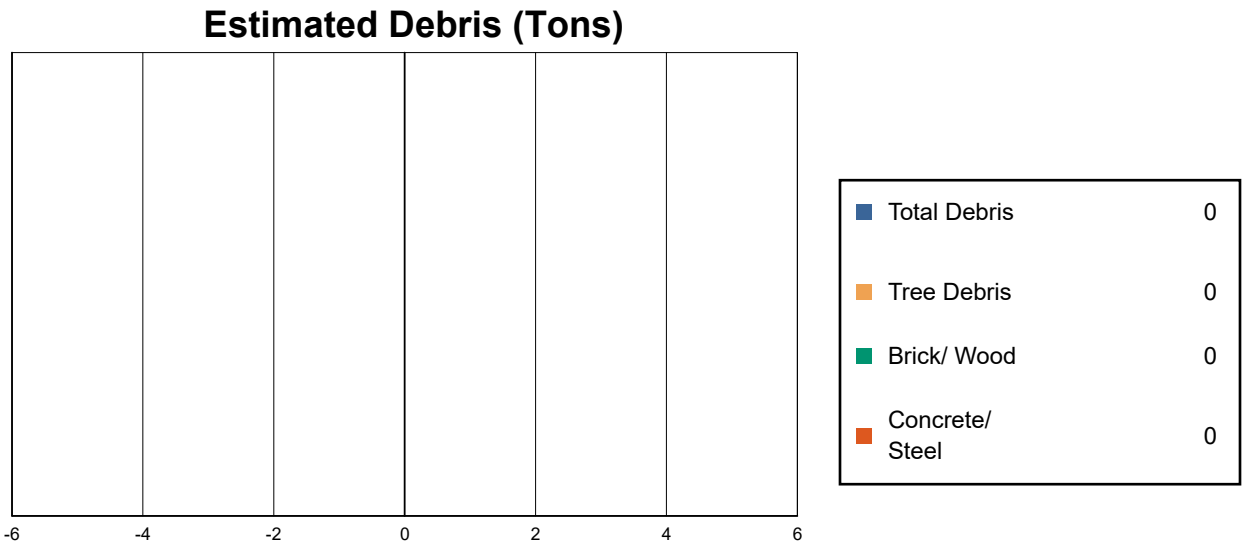


Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	14	0	0	14
Fire Stations	110	0	0	110
Hospitals	19	0	0	19
Police Stations	46	0	0	46
Schools	846	0	0	846

Induced Hurricane Damage

Debris Generation

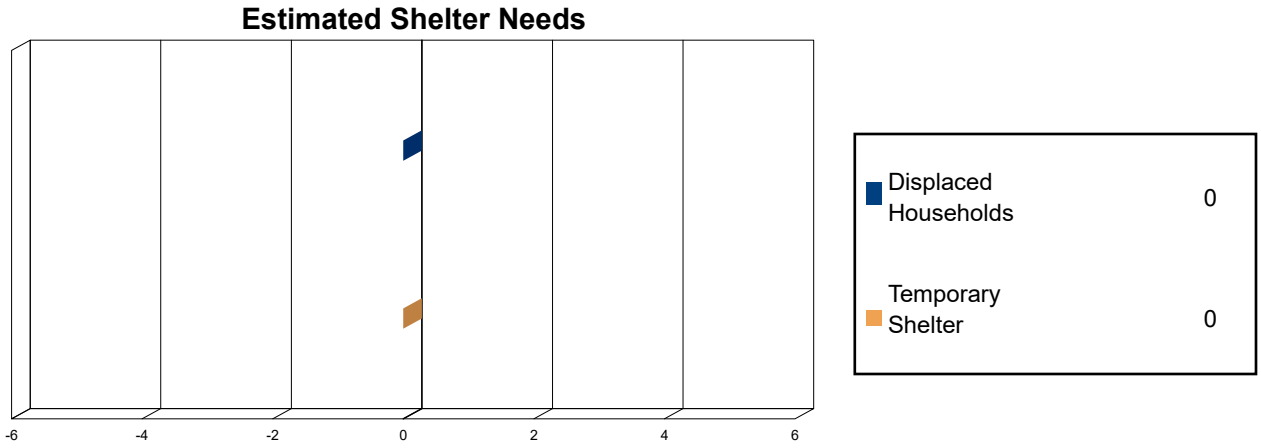


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



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Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

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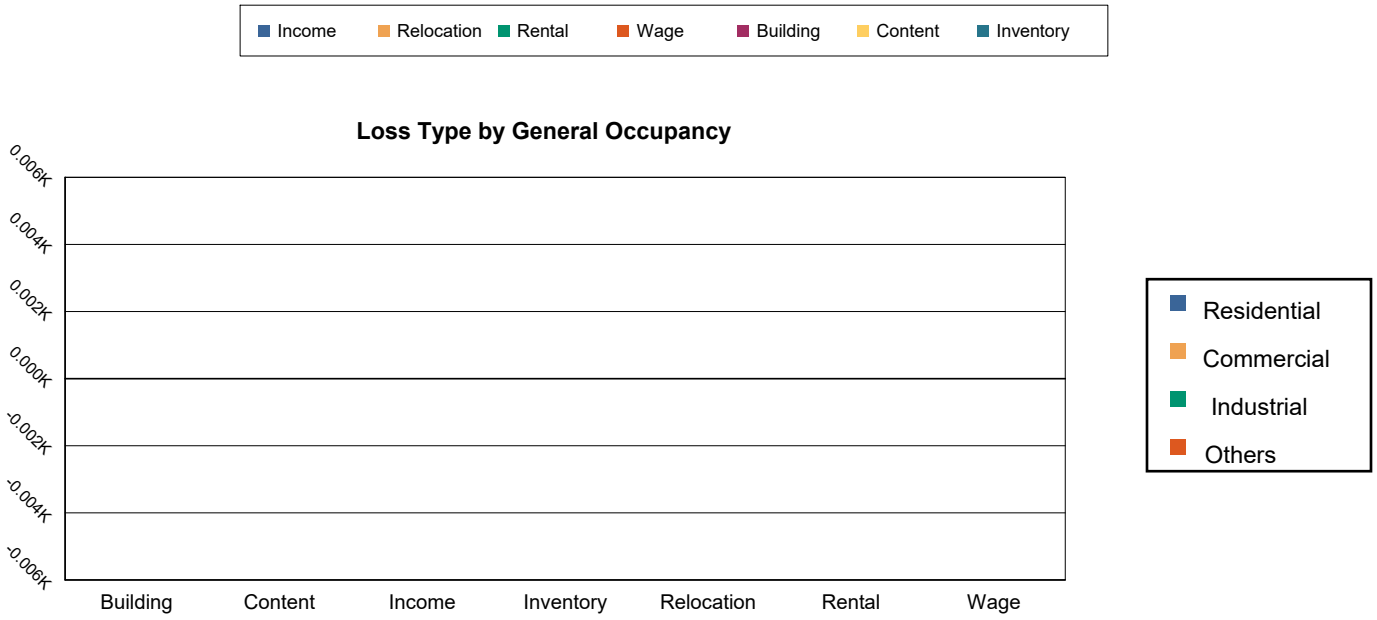

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Category	Area	Residential	Commercial	Industrial	Others	Total
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	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Total

Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

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Hazus: Hurricane Global Risk Report

Region Name: NOVA_EQ_FL_HU_Test

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Monday, July 26, 2021

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Note:
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General Building Stock

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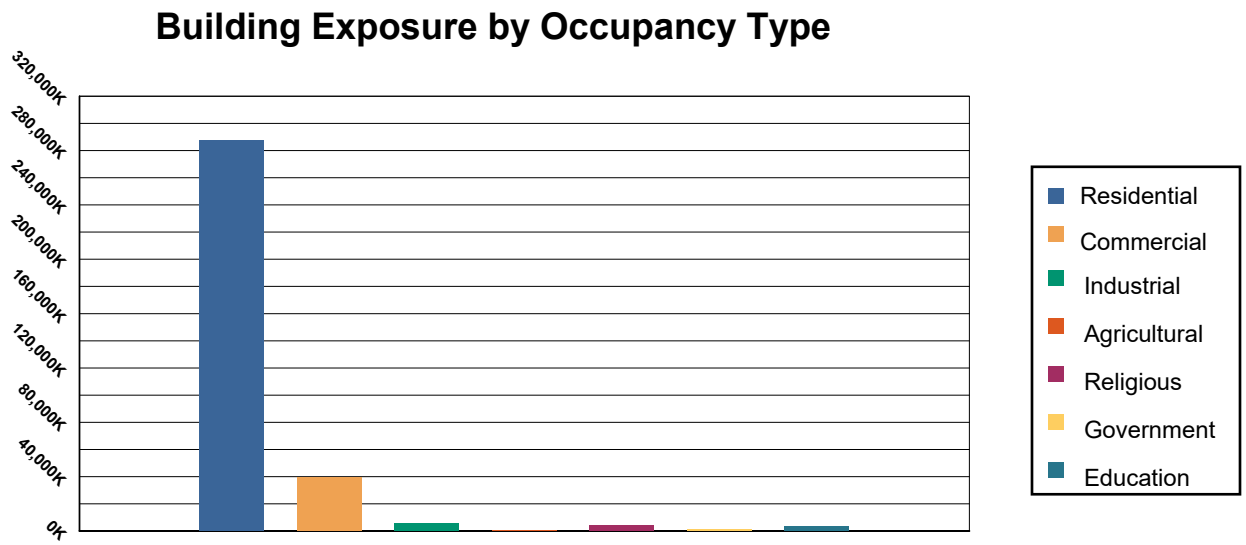

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Essential Facility Inventory

For essential facilities, there are 19 hospitals in the region with a total bed capacity of 3,149 beds. There are 846 schools, 110 fire stations, 46 police stations and 14 emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
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Building Damage

General Building Stock Damage

Hazus estimates that about 5,454 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

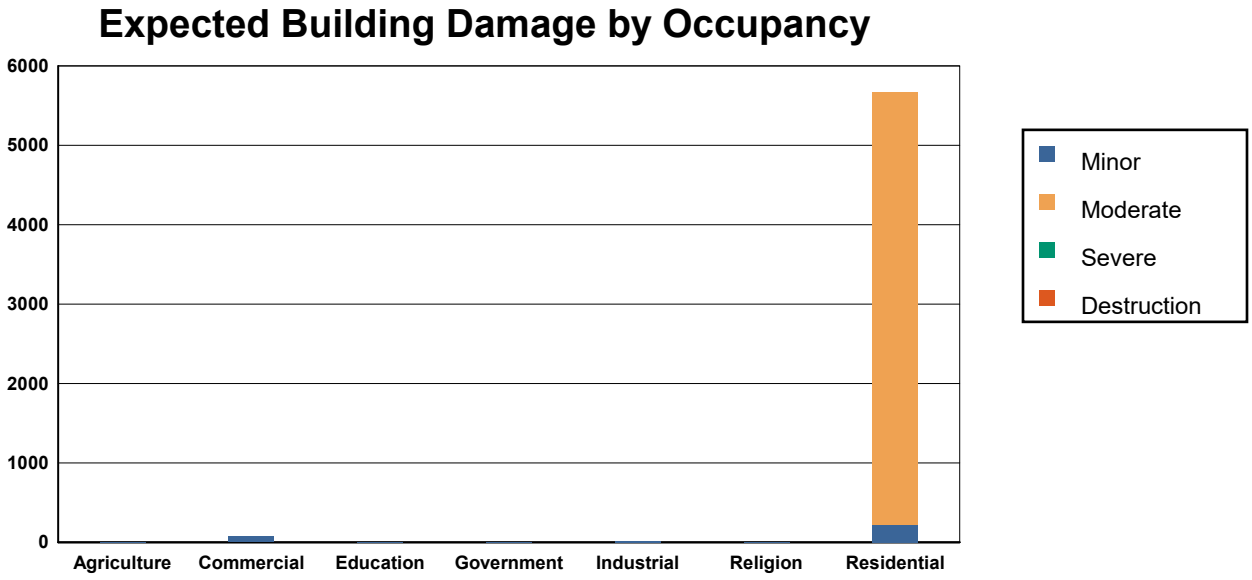


Table 2: Expected Building Damage by Occupancy : 50 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1,647.59	99.85	2.41	0.15	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	34,155.48	99.79	72.52	0.21	0.00	0.00	0.00	0.00	0.00	0.00
Education	1,849.74	99.77	4.26	0.23	0.00	0.00	0.00	0.00	0.00	0.00
Government	1,180.14	99.76	2.86	0.24	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	8,125.77	99.76	19.23	0.24	0.00	0.00	0.00	0.00	0.00	0.00
Religion	3,558.05	99.83	5.95	0.17	0.00	0.00	0.00	0.00	0.00	0.00
Residential	607,387.89	99.07	218.99	0.04	5,454.12	0.89	0.00	0.00	0.00	0.00
Total	**657,904.67**		**326.22**		**5,454.12**		**0.00**		**0.00**	

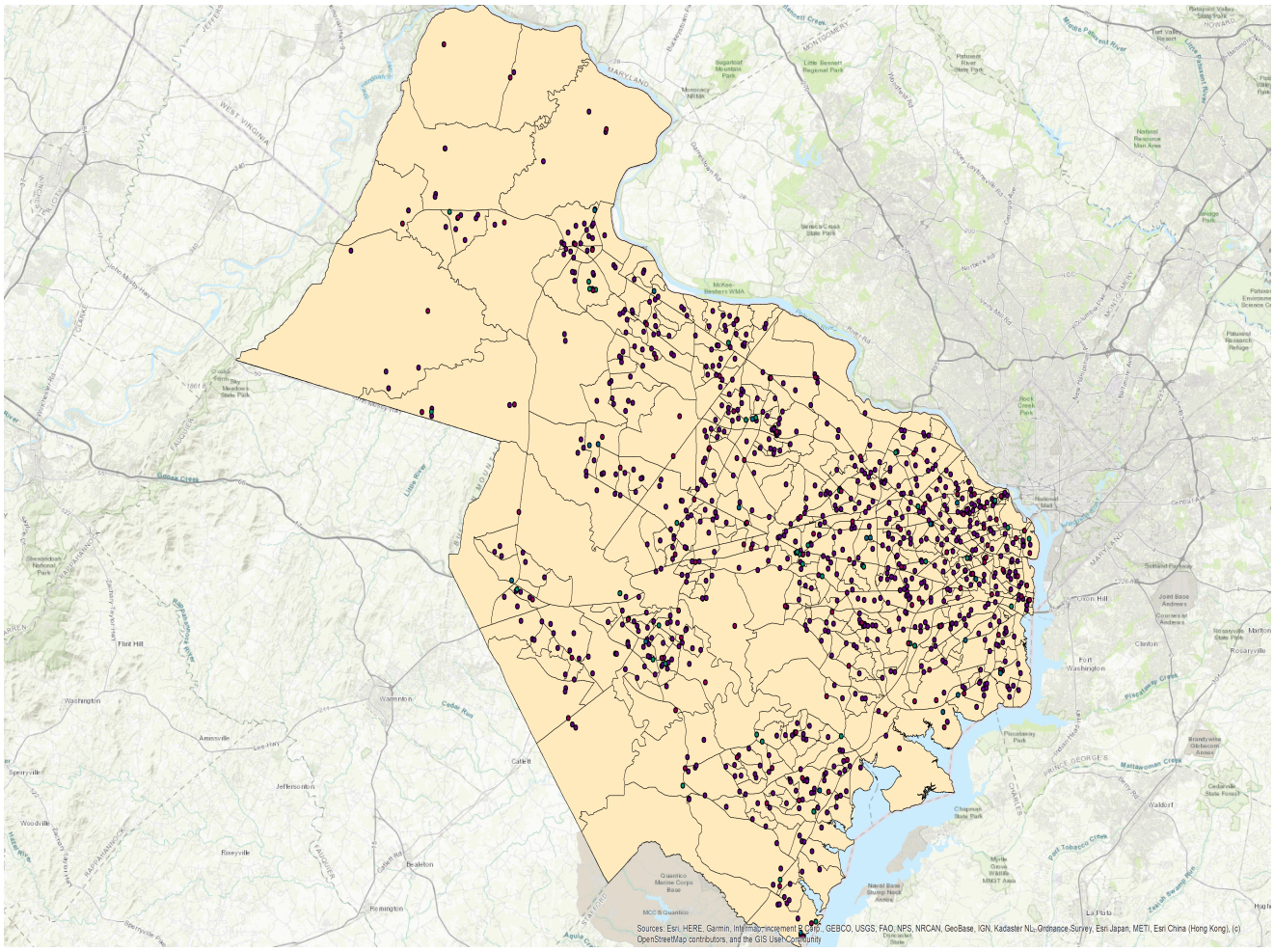
Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	5,460	99.69	17	0.31	0	0.00	0	0.00	0	0.00
Masonry	166,071	99.16	241	0.14	1,174	0.70	0	0.00	0	0.00
MH	5,134	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	22,502	99.74	58	0.26	0	0.00	0	0.00	0	0.00
Wood	458,692	99.12	0	0.00	4,065	0.88	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 3149 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

Thematic Map of Essential Facilities with greater than 50% moderate



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		# Facilities		
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EOCs	14	0	0	14
Fire Stations	110	0	0	110
Hospitals	19	0	0	19
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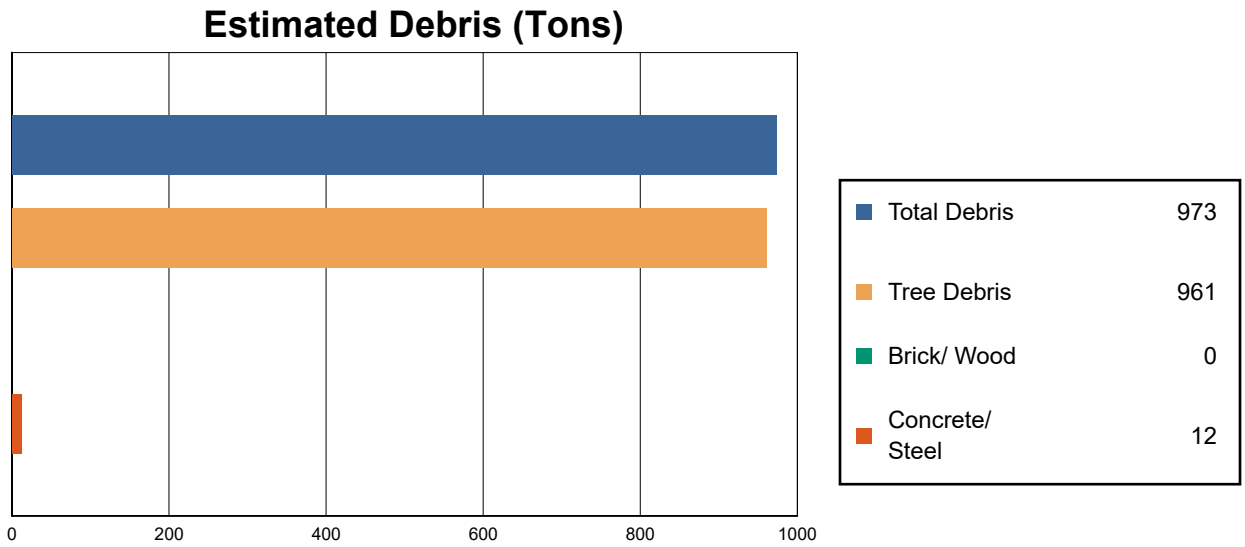
Schools	846	0	0	846

Induced Hurricane Damage

Debris Generation

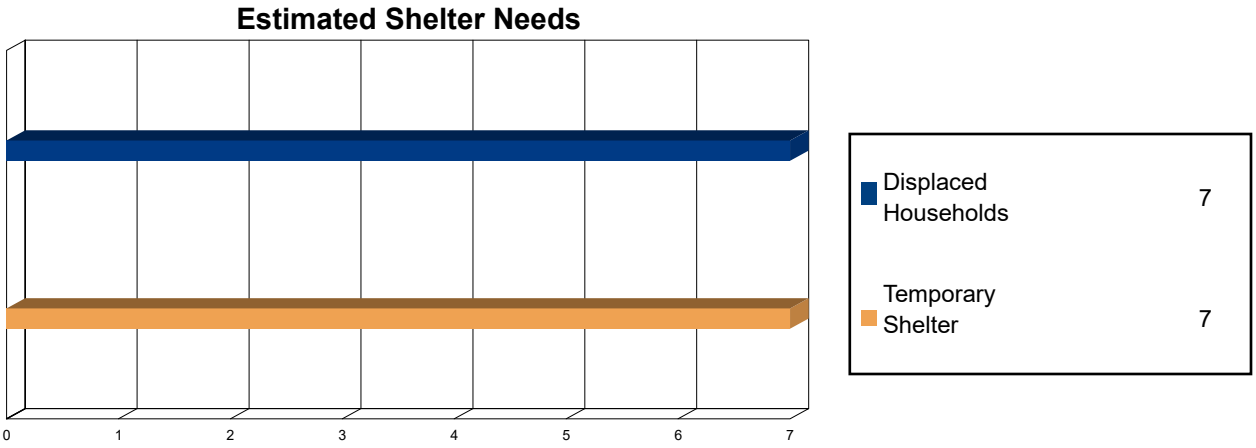


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 973 tons of debris will be generated. Of the total amount, 536 tons (55%) is Other Tree Debris. Of the remaining 437 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises of 3% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 425 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 7 households to be displaced due to the hurricane. Of these, 7 people (out of a total population of 2,230,623) will seek temporary shelter in public shelters.

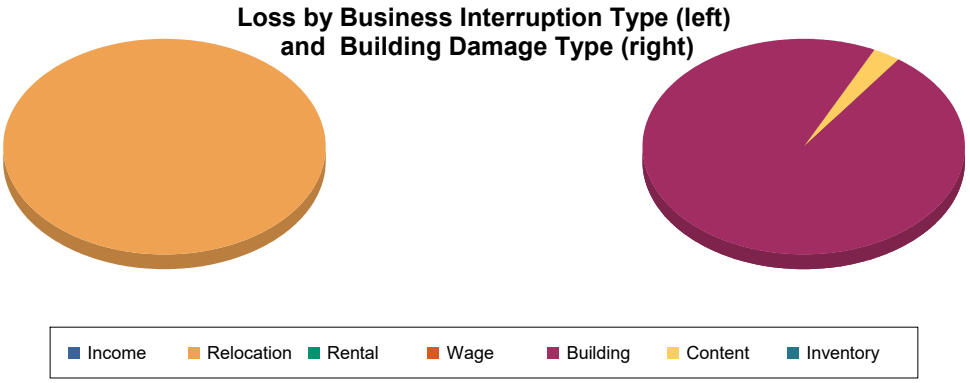
Economic Loss

The total economic loss estimated for the hurricane is 1508.5 million dollars, which represents 0.44 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 1,508 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



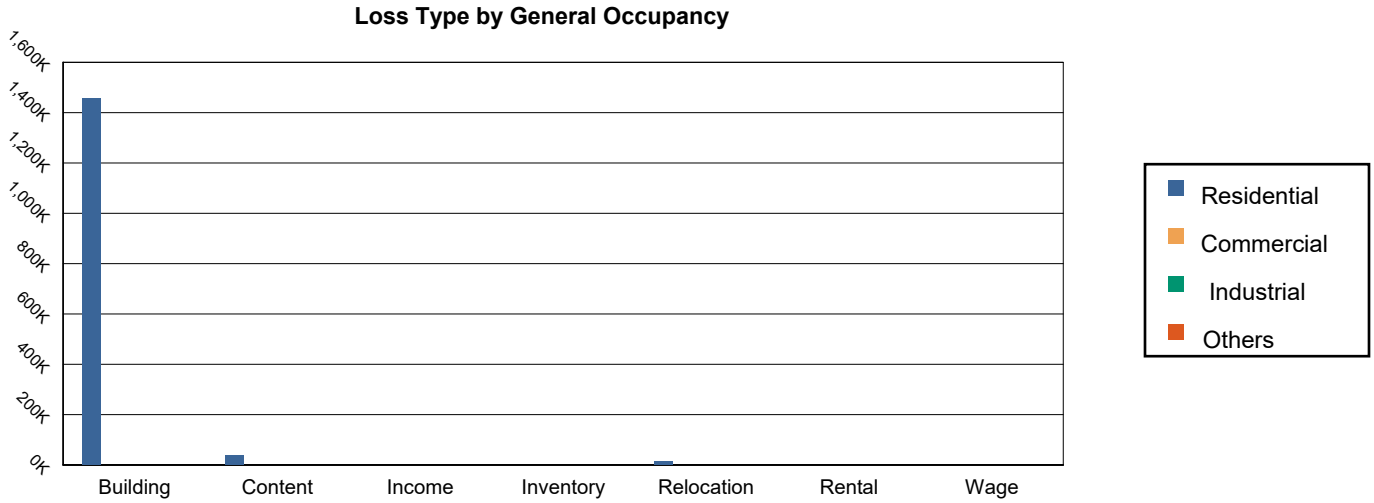


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	1,456,355.51	0.00	0.00	0.00	1,456,355.51
	Content	39,785.47	0.00	0.00	0.00	39,785.47
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**1,496,140.98**	**0.00**	**0.00**	**0.00**	**1,496,140.98**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	12,321.33	0.00	0.00	0.00	12,321.33
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**12,321.33**	**0.00**	**0.00**	**0.00**	**12,321.33**

Total

Total	**1,508,462.31**	**0.00**	**0.00**	**0.00**	**1,508,462.31**

Appendix A: County Listing for the Region

Virginia

- Arlington
- Fairfax
- Loudoun
- Prince William
- Alexandria
- Fairfax City
- Falls Church
- Manassas
- Manassas Park

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Virginia				
Alexandria	139,966	18,477,776	5,549,311	24,027,087
Arlington	207,627	27,386,560	6,025,940	33,412,500
Fairfax	1,081,726	144,188,703	26,638,455	170,827,158
Fairfax City	22,565	3,164,151	1,516,956	4,681,107
Falls Church	12,332	1,766,161	599,641	2,365,802
Loudoun	312,311	39,257,243	6,070,731	45,327,974
Manassas	37,821	3,672,496	1,274,759	4,947,255
Manassas Park	14,273	1,298,379	261,805	1,560,184
Prince William	402,002	48,430,503	5,936,105	54,366,608
Total	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**
Study Region Total	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**

Hazus: Hurricane Global Risk Report

Region Name:	NOVA_EQ_FL_HU_Test
Hurricane Scenario:	Probabilistic 100-year Return Period
Print Date:	Monday, July 26, 2021

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 9 county(ies) from the following state(s):

- Virginia

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,321.72 square miles and contains 520 census tracts. There are over 823 thousand households in the region and a total population of 2,230,623 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 663 thousand buildings in the region with a total building replacement value (excluding contents) of 341,516 million dollars (2014 dollars). Approximately 92% of the buildings (and 84% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 663,685 buildings in the region which have an aggregate total replacement value of 341,516 million (2014 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

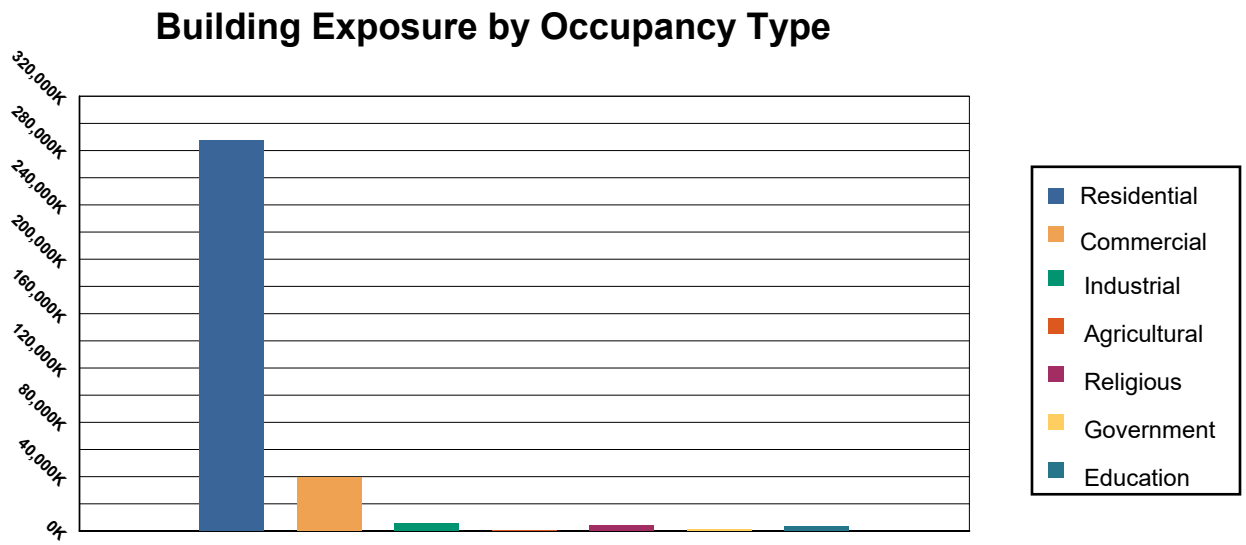


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	287,641,972	84.23%
Commercial	39,194,388	11.48%
Industrial	5,227,982	1.53%
Agricultural	688,752	0.20%
Religious	4,026,943	1.18%
Government	1,401,093	0.41%
Education	3,334,545	0.98%
Total	**341,515,675**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 19 hospitals in the region with a total bed capacity of 3,149 beds. There are 846 schools, 110 fire stations, 46 police stations and 14 emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 32,857 buildings will be at least moderately damaged. This is over 5% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

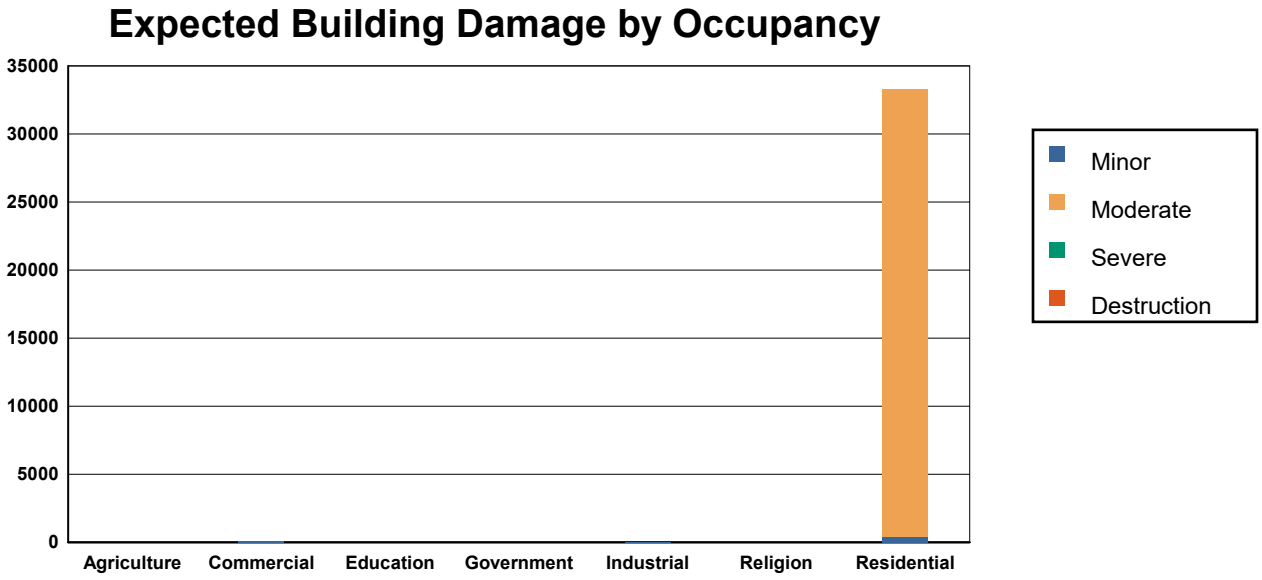


Table 2: Expected Building Damage by Occupancy : 100 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1,646.66	99.80	3.34	0.20	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	34,131.11	99.72	96.89	0.28	0.00	0.00	0.00	0.00	0.00	0.00
Education	1,848.26	99.69	5.74	0.31	0.00	0.00	0.00	0.00	0.00	0.00
Government	1,179.14	99.67	3.86	0.33	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	8,119.72	99.69	25.28	0.31	0.00	0.00	0.00	0.00	0.00	0.00
Religion	3,556.12	99.78	7.88	0.22	0.00	0.00	0.00	0.00	0.00	0.00
Residential	579,755.73	94.57	448.00	0.07	32,856.63	5.36	0.64	0.00	0.00	0.00
Total	**630,236.73**		**590.99**		**32,856.63**		**0.64**		**0.00**	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	5,454	99.58	23	0.42	0	0.00	0	0.00	0	0.00
Masonry	160,143	95.62	394	0.24	6,949	4.15	0	0.00	0	0.00
MH	5,134	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	22,483	99.66	77	0.34	0	0.00	0	0.00	0	0.00
Wood	438,140	94.68	62	0.01	24,555	5.31	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 3149 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

Thematic Map of Essential Facilities with greater than 50% moderate

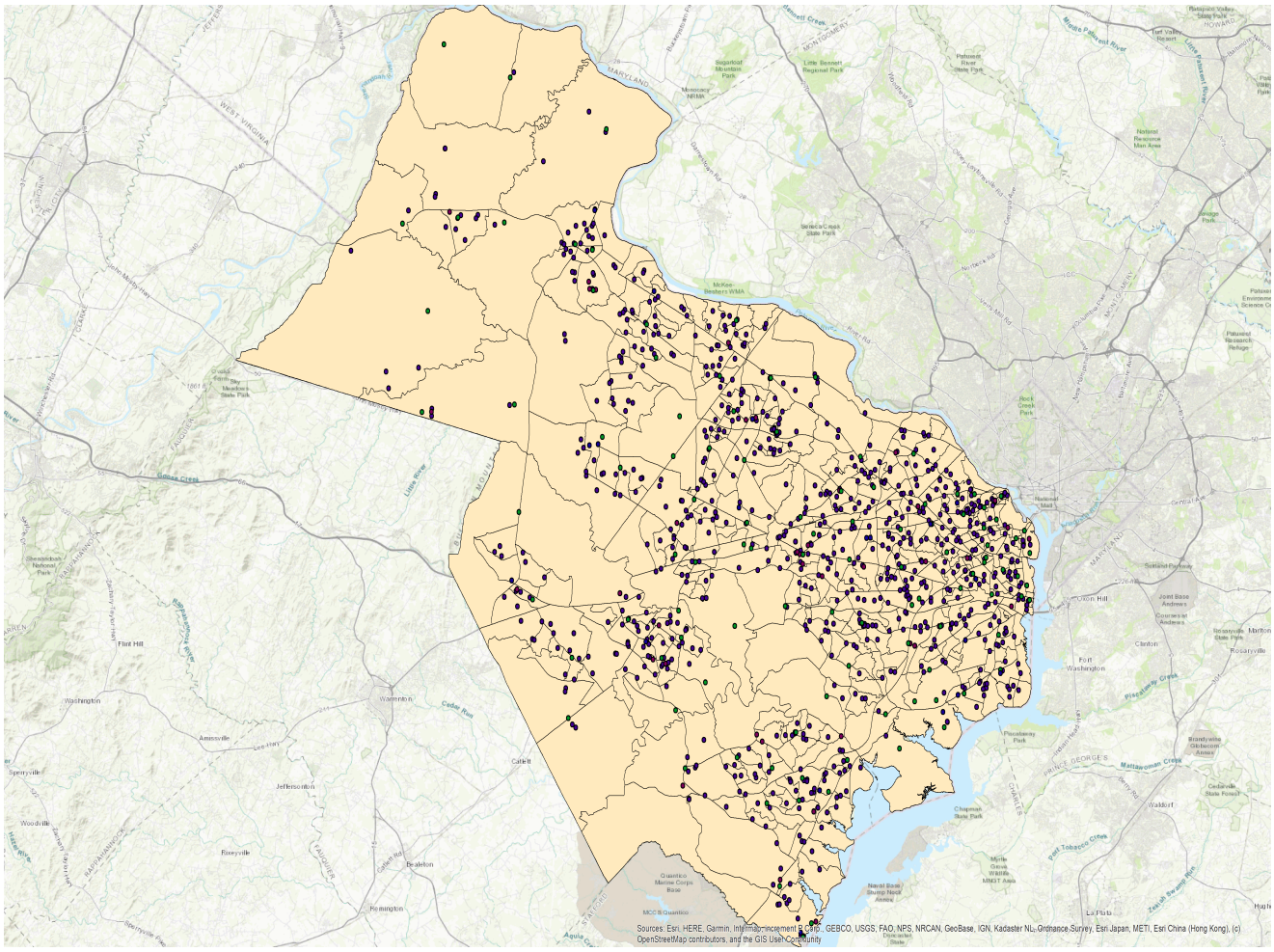
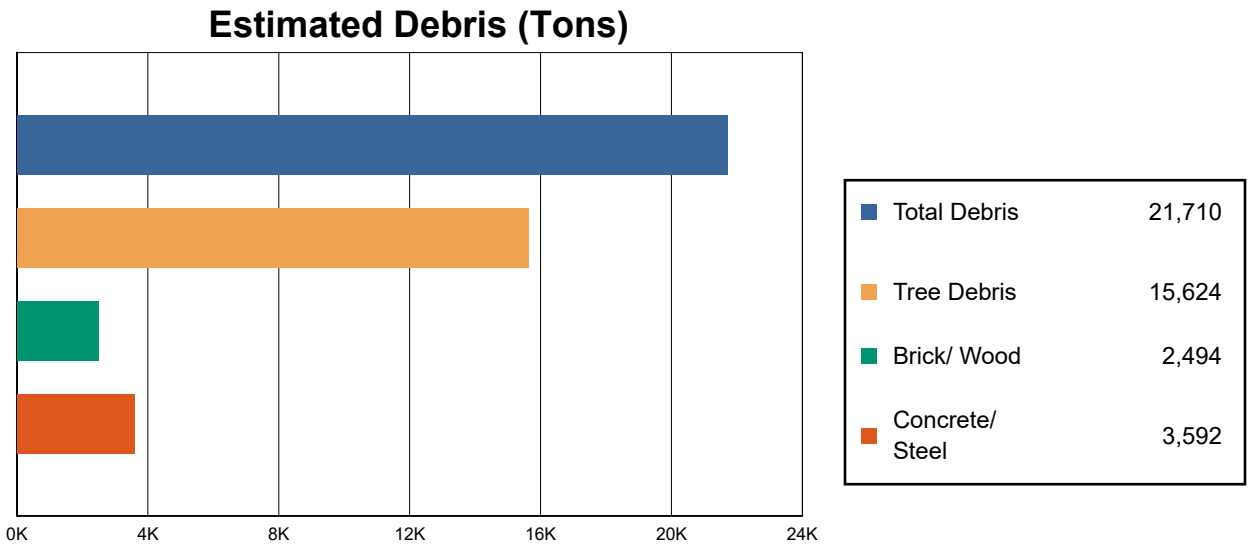


Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	14	0	0	14
Fire Stations	110	0	0	110
Hospitals	19	0	0	19
Police Stations	46	0	0	46
Schools	846	0	0	846

Induced Hurricane Damage

Debris Generation

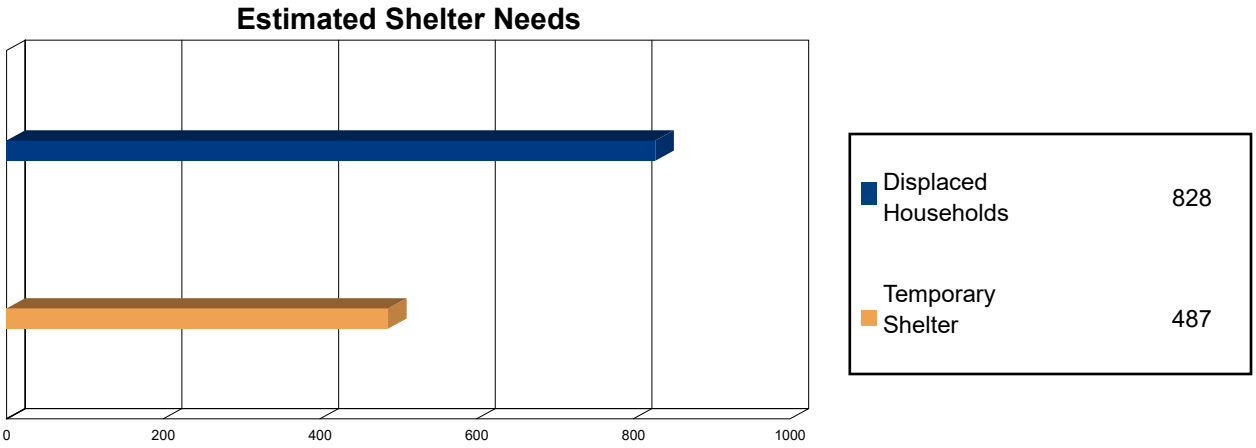


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 21,710 tons of debris will be generated. Of the total amount, 8,357 tons (38%) is Other Tree Debris. Of the remaining 13,353 tons, Brick/Wood comprises 19% of the total, Reinforced Concrete/Steel comprises of 27% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 243 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 7,267 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 828 households to be displaced due to the hurricane. Of these, 487 people (out of a total population of 2,230,623) will seek temporary shelter in public shelters.

Economic Loss

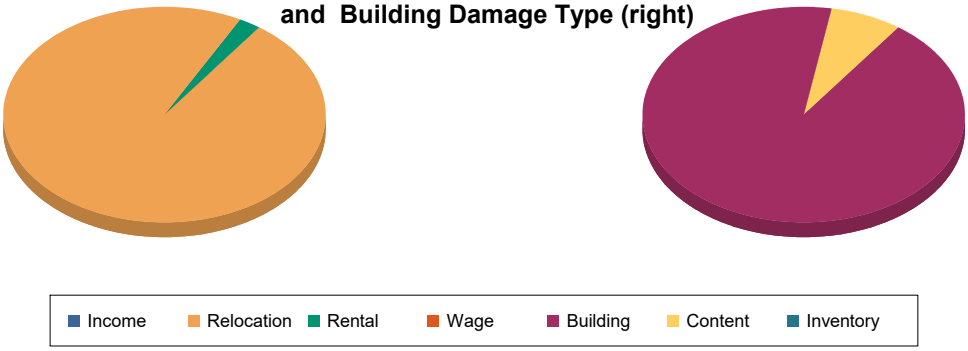
The total economic loss estimated for the hurricane is 4214.2 million dollars, which represents 1.23 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 4,214 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

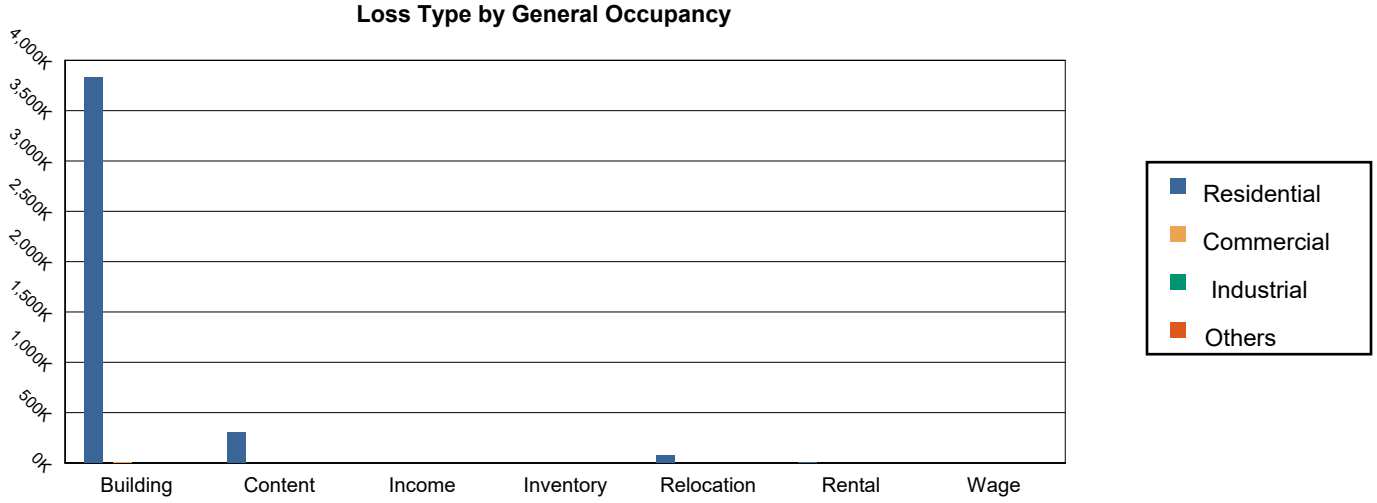


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	3,827,104.08	2,629.61	293.29	619.58	3,830,646.55
	Content	301,445.02	0.00	0.00	0.00	301,445.02
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**4,128,549.10**	**2,629.61**	**293.29**	**619.58**	**4,132,091.57**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	80,401.74	0.02	0.00	0.00	80,401.76
	Rental	1,733.60	0.00	0.00	0.00	1,733.60
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**82,135.35**	**0.02**	**0.00**	**0.00**	**82,135.37**

Total

Total	**4,210,684.45**	**2,629.62**	**293.29**	**619.58**	**4,214,226.94**

Appendix A: County Listing for the Region

Virginia

- Arlington
- Fairfax
- Loudoun
- Prince William
- Alexandria
- Fairfax City
- Falls Church
- Manassas
- Manassas Park

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Virginia				
Alexandria	139,966	18,477,776	5,549,311	24,027,087
Arlington	207,627	27,386,560	6,025,940	33,412,500
Fairfax	1,081,726	144,188,703	26,638,455	170,827,158
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Total	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**
Study Region Total	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**

Hazus: Hurricane Global Risk Report

Region Name: NOVA_EQ_FL_HU_Test

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Monday, July 26, 2021

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

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The hurricane loss estimates provided in this report are based on a region that includes 9 county(ies) from the following state(s):

- Virginia

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,321.72 square miles and contains 520 census tracts. There are over 823 thousand households in the region and a total population of 2,230,623 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 663 thousand buildings in the region with a total building replacement value (excluding contents) of 341,516 million dollars (2014 dollars). Approximately 92% of the buildings (and 84% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 663,685 buildings in the region which have an aggregate total replacement value of 341,516 million (2014 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

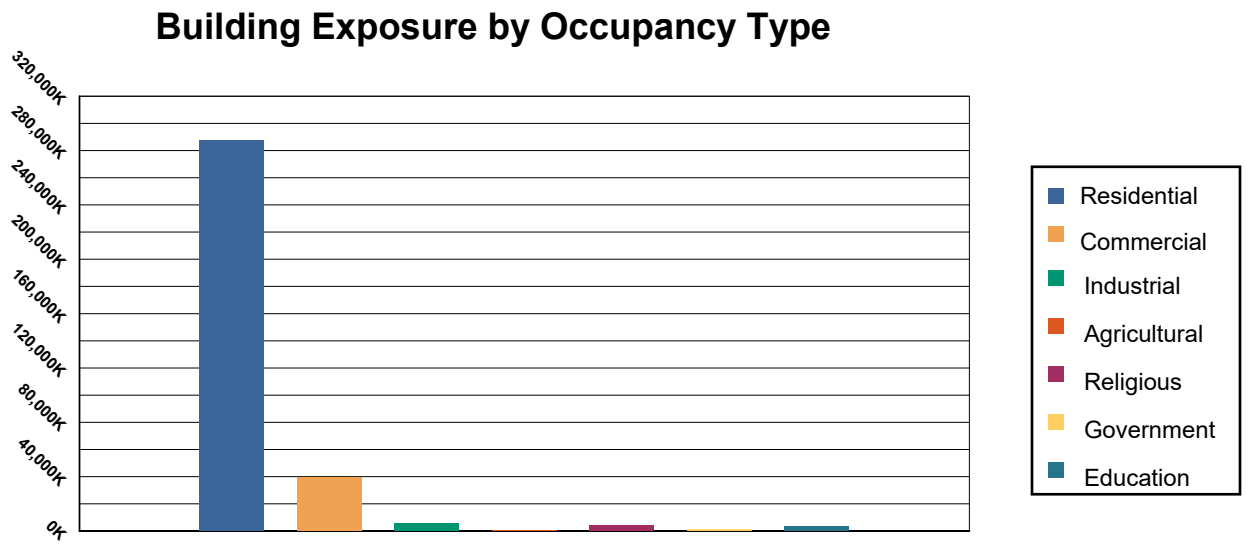


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	287,641,972	84.23%
Commercial	39,194,388	11.48%
Industrial	5,227,982	1.53%
Agricultural	688,752	0.20%
Religious	4,026,943	1.18%
Government	1,401,093	0.41%
Education	3,334,545	0.98%
Total	**341,515,675**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 19 hospitals in the region with a total bed capacity of 3,149 beds. There are 846 schools, 110 fire stations, 46 police stations and 14 emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 122,767 buildings will be at least moderately damaged. This is over 18% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

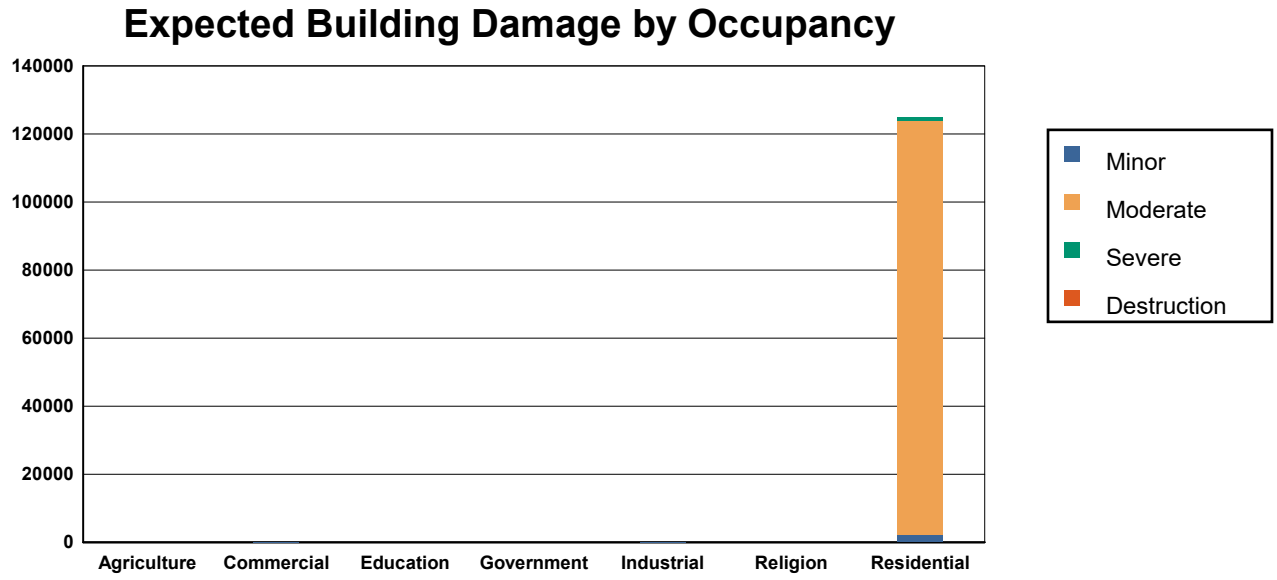


Table 2: Expected Building Damage by Occupancy : 200 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1,643.32	99.60	6.45	0.39	0.19	0.01	0.04	0.00	0.00	0.00
Commercial	34,043.53	99.46	180.42	0.53	4.04	0.01	0.01	0.00	0.00	0.00
Education	1,843.15	99.41	10.85	0.59	0.01	0.00	0.00	0.00	0.00	0.00
Government	1,175.57	99.37	7.43	0.63	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	8,100.37	99.45	44.37	0.54	0.21	0.00	0.04	0.00	0.00	0.00
Religion	3,548.77	99.57	15.22	0.43	0.00	0.00	0.00	0.00	0.00	0.00
Residential	487,972.71	79.60	2,326.11	0.38	121,666.82	19.85	1,095.36	0.18	0.00	0.00
Total	**538,327.42**		**2,590.85**		**121,671.27**		**1,095.46**		**0.00**	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	5,433	99.20	44	0.80	0	0.00	0	0.00	0	0.00
Masonry	140,492	83.88	1,087	0.65	25,672	15.33	235	0.14	0	0.00
MH	5,133	99.99	0	0.01	0	0.01	0	0.00	0	0.00
Steel	22,419	99.37	139	0.62	2	0.01	0	0.00	0	0.00
Wood	369,407	79.83	1,200	0.26	91,333	19.74	817	0.18	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 3149 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

Thematic Map of Essential Facilities with greater than 50% moderate

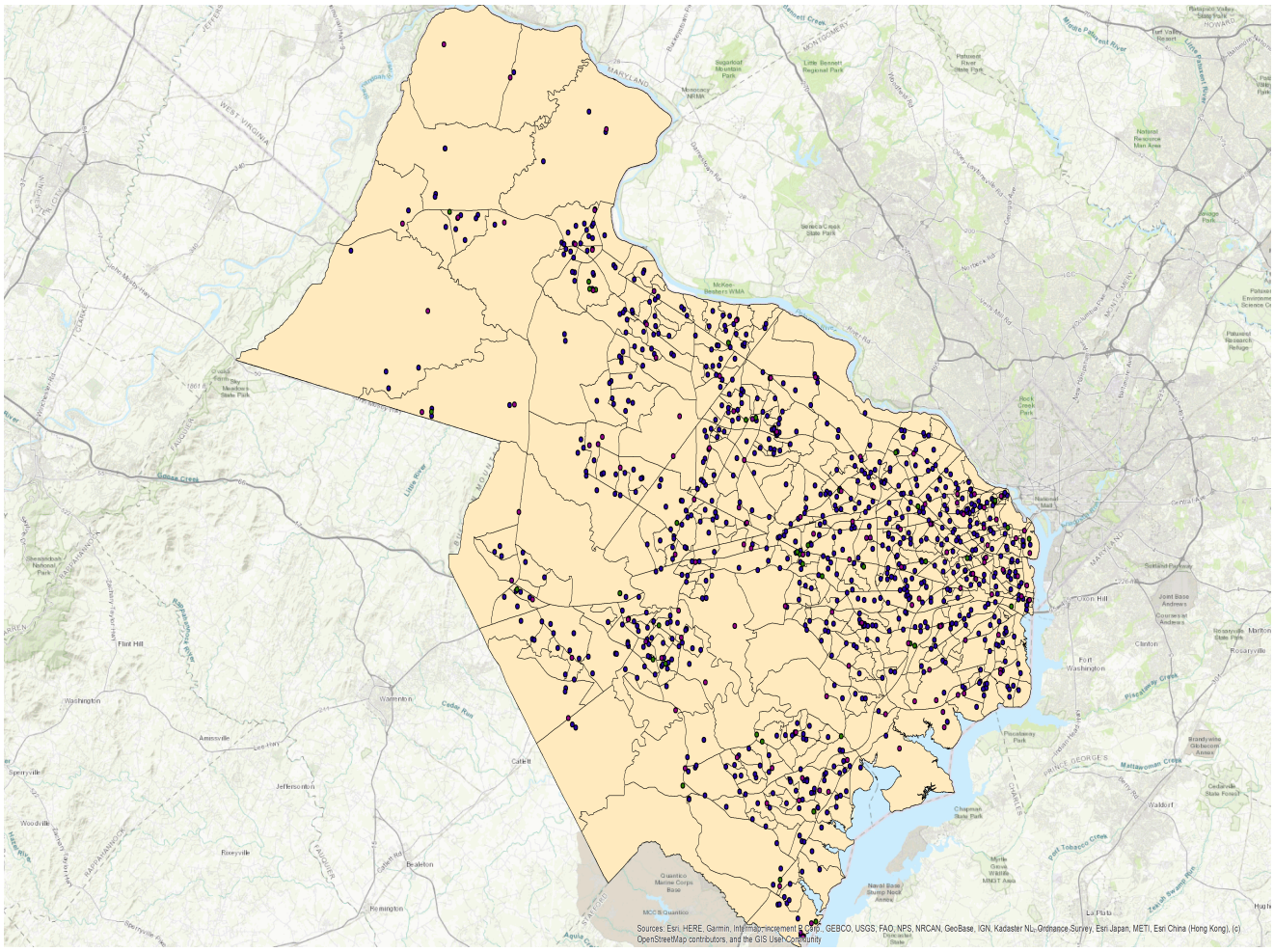
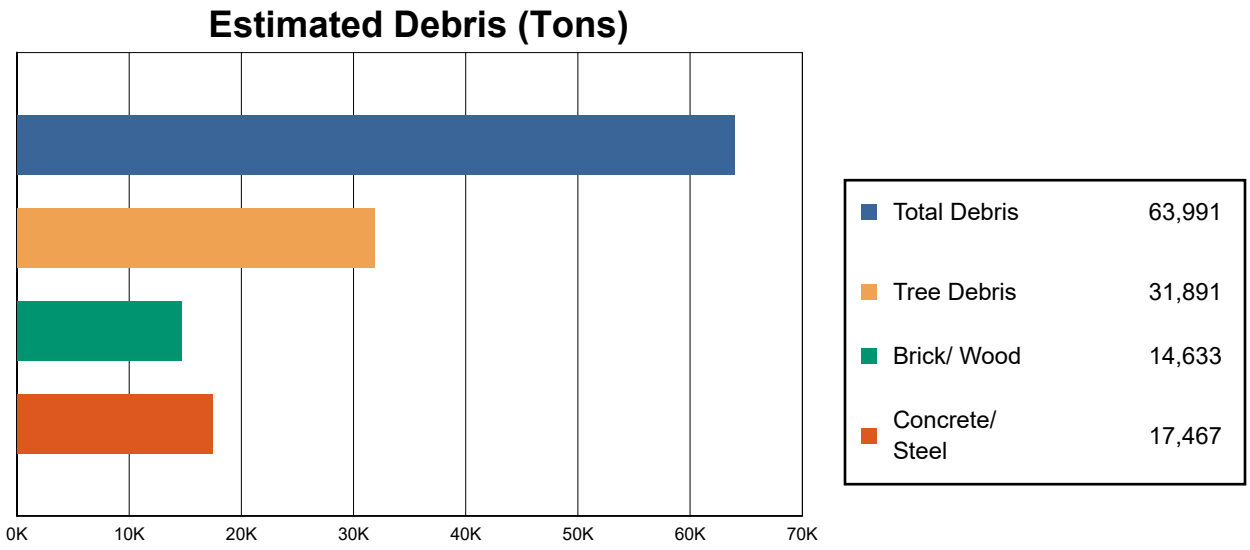


Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	14	0	0	14
Fire Stations	110	0	0	110
Hospitals	19	0	0	19
Police Stations	46	0	0	46
Schools	846	0	0	846

Induced Hurricane Damage

Debris Generation

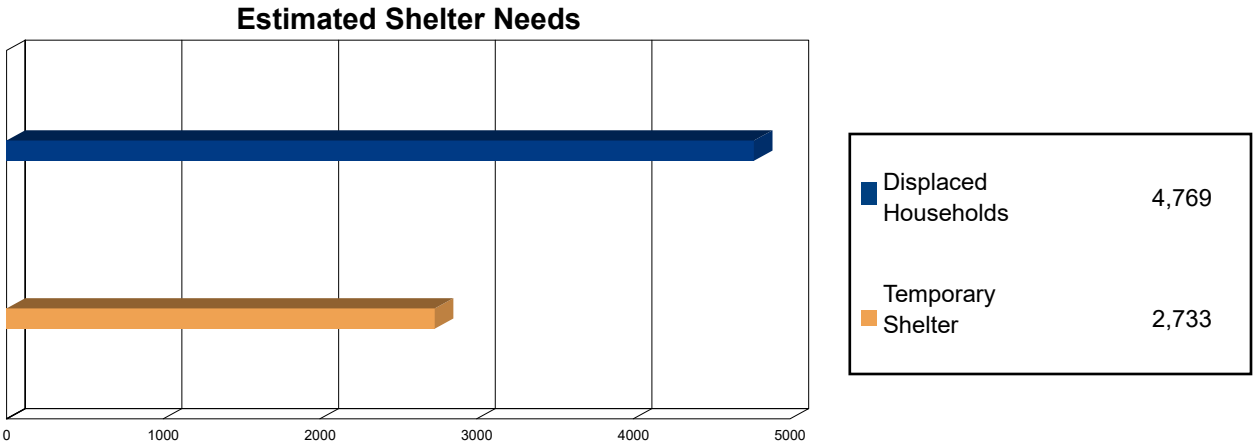


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 63,991 tons of debris will be generated. Of the total amount, 16,223 tons (25%) is Other Tree Debris. Of the remaining 47,768 tons, Brick/Wood comprises 31% of the total, Reinforced Concrete/Steel comprises of 37% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 1284 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 15,668 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 4,769 households to be displaced due to the hurricane. Of these, 2,733 people (out of a total population of 2,230,623) will seek temporary shelter in public shelters.

Economic Loss

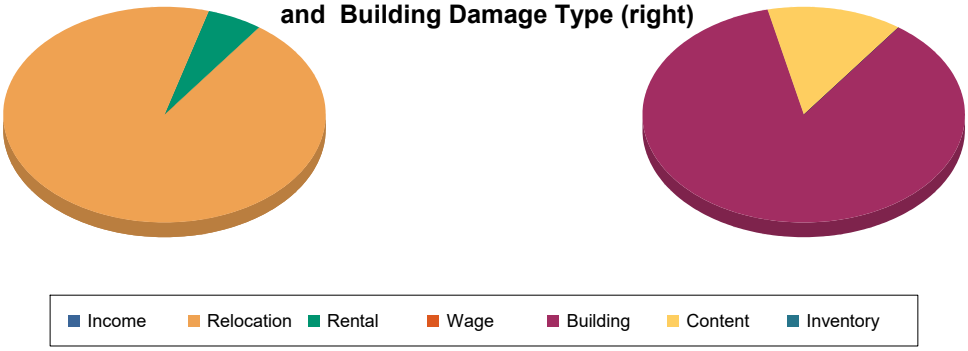
The total economic loss estimated for the hurricane is 10082.6 million dollars, which represents 2.95 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 10,083 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

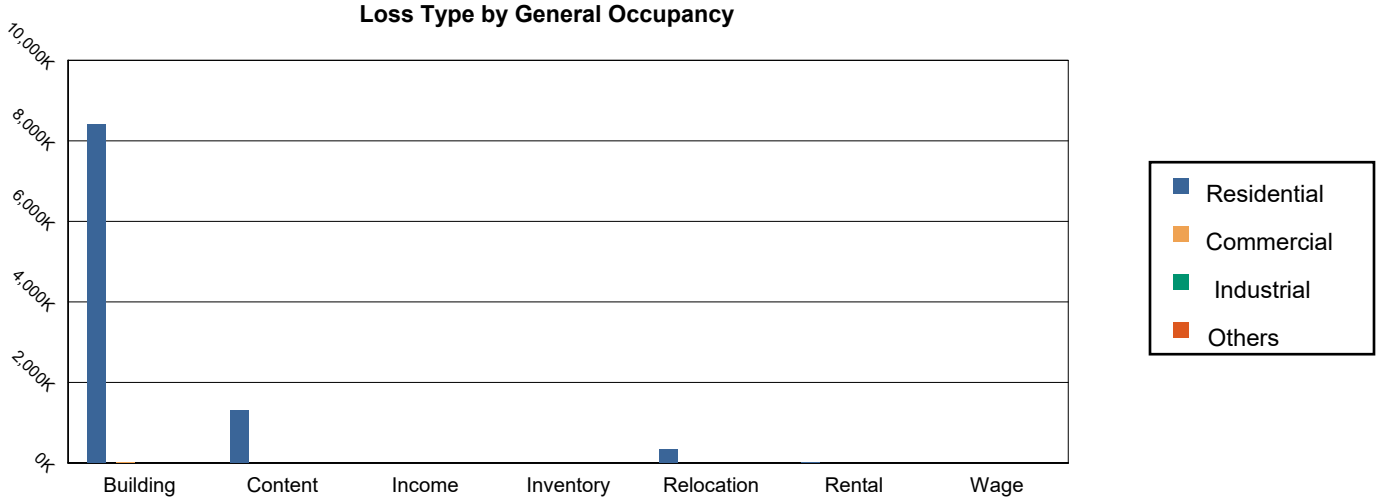


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	8,405,941.75	4,311.41	515.44	1,114.98	8,411,883.58
	Content	1,309,971.63	0.44	7.14	0.47	1,309,979.68
	Inventory	0.00	0.03	1.43	0.05	1.51
	Subtotal	**9,715,913.38**	**4,311.89**	**524.00**	**1,115.50**	**9,721,864.77**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	340,237.61	36.53	0.22	0.61	340,274.97
	Rental	20,458.69	0.00	0.00	0.00	20,458.69
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**360,696.30**	**36.53**	**0.22**	**0.61**	**360,733.65**

Total

Total	**10,076,609.67**	**4,348.42**	**524.22**	**1,116.11**	**10,082,598.42**

Appendix A: County Listing for the Region

Virginia

- Arlington
- Fairfax
- Loudoun
- Prince William
- Alexandria
- Fairfax City
- Falls Church
- Manassas
- Manassas Park

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Virginia				
Alexandria	139,966	18,477,776	5,549,311	24,027,087
Arlington	207,627	27,386,560	6,025,940	33,412,500
Fairfax	1,081,726	144,188,703	26,638,455	170,827,158
Fairfax City	22,565	3,164,151	1,516,956	4,681,107
Falls Church	12,332	1,766,161	599,641	2,365,802
Loudoun	312,311	39,257,243	6,070,731	45,327,974
Manassas	37,821	3,672,496	1,274,759	4,947,255
Manassas Park	14,273	1,298,379	261,805	1,560,184
Prince William	402,002	48,430,503	5,936,105	54,366,608
Total	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**
Study Region Total	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**

Hazus: Hurricane Global Risk Report

Region Name:	NOVA_EQ_FL_HU_Test
Hurricane Scenario:	Probabilistic 500-year Return Period
Print Date:	Monday, July 26, 2021

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 9 county(ies) from the following state(s):

- Virginia

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 1,321.72 square miles and contains 520 census tracts. There are over 823 thousand households in the region and a total population of 2,230,623 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 663 thousand buildings in the region with a total building replacement value (excluding contents) of 341,516 million dollars (2014 dollars). Approximately 92% of the buildings (and 84% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 663,685 buildings in the region which have an aggregate total replacement value of 341,516 million (2014 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

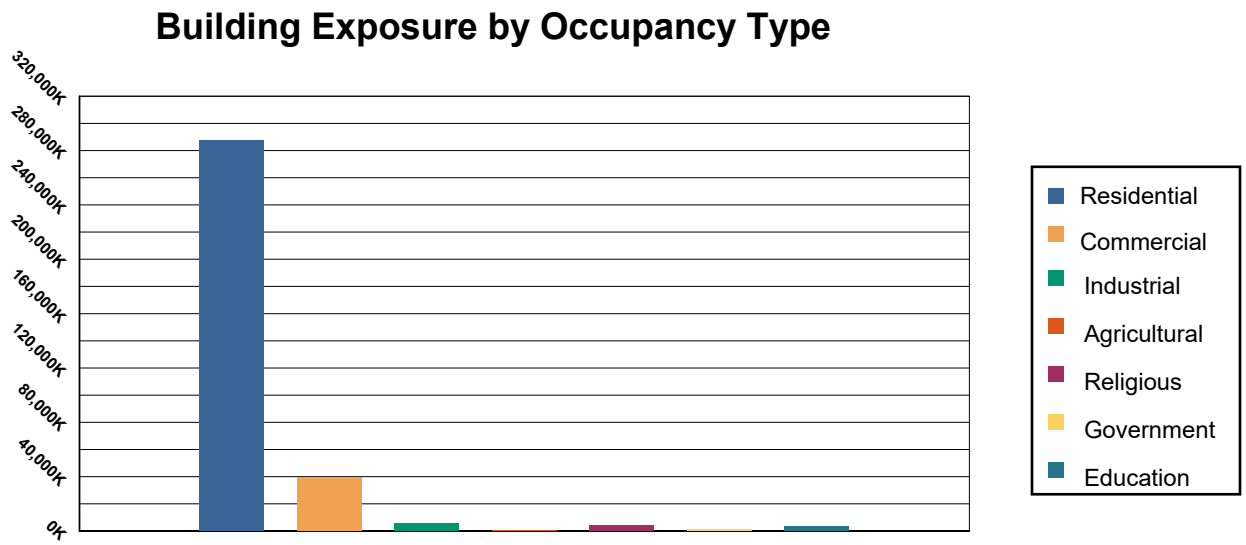


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	287,641,972	84.23%
Commercial	39,194,388	11.48%
Industrial	5,227,982	1.53%
Agricultural	688,752	0.20%
Religious	4,026,943	1.18%
Government	1,401,093	0.41%
Education	3,334,545	0.98%
Total	**341,515,675**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 19 hospitals in the region with a total bed capacity of 3,149 beds. There are 846 schools, 110 fire stations, 46 police stations and 14 emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 366,259 buildings will be at least moderately damaged. This is over 55% of the total number of buildings in the region. There are an estimated 1 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

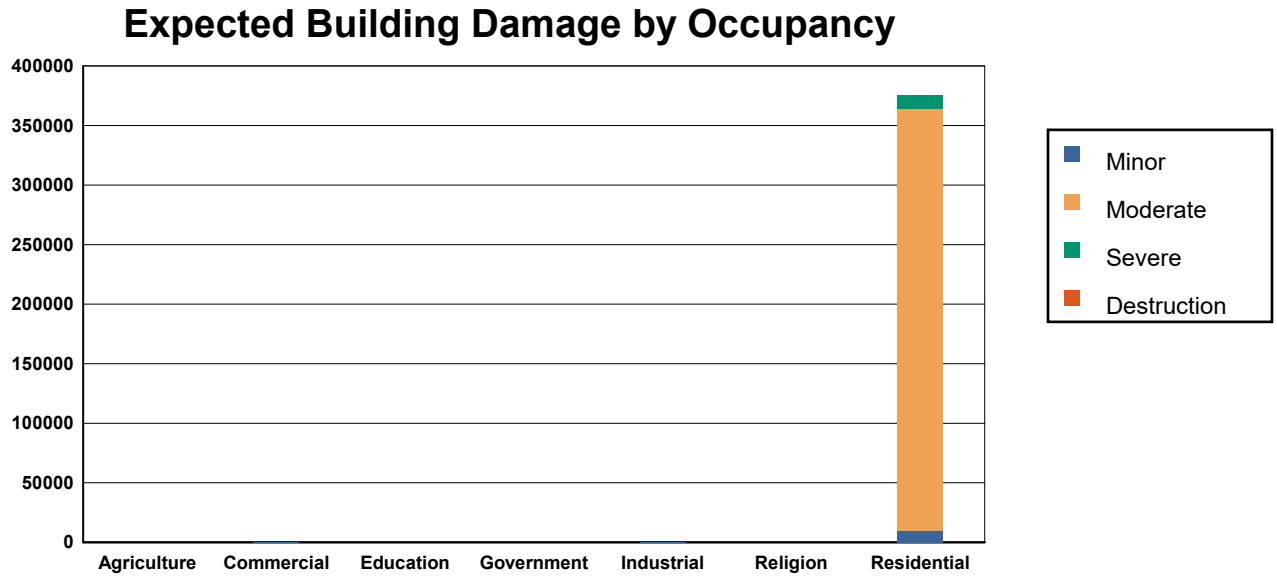


Table 2: Expected Building Damage by Occupancy : 500 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1,627.96	98.66	20.03	1.21	1.58	0.10	0.43	0.03	0.00	0.00
Commercial	33,784.35	98.70	417.45	1.22	25.63	0.07	0.57	0.00	0.00	0.00
Education	1,831.34	98.78	22.39	1.21	0.27	0.01	0.00	0.00	0.00	0.00
Government	1,168.67	98.79	14.16	1.20	0.17	0.01	0.00	0.00	0.00	0.00
Industrial	8,039.06	98.70	102.91	1.26	2.67	0.03	0.35	0.00	0.00	0.00
Religion	3,526.71	98.95	36.81	1.03	0.48	0.01	0.00	0.00	0.00	0.00
Residential	237,211.33	38.69	9,623.06	1.57	354,622.98	57.84	11,602.57	1.89	1.06	0.00
Total	**287,189.41**		**10,236.82**		**354,653.79**		**11,603.92**		**1.06**	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	5,384	98.31	91	1.67	1	0.02	0	0.00	0	0.00
Masonry	87,600	52.30	2,877	1.72	74,520	44.49	2,489	1.49	0	0.00
MH	5,130	99.92	3	0.06	1	0.02	0	0.00	0	0.00
Steel	22,248	98.62	294	1.30	17	0.07	1	0.00	0	0.00
Wood	182,063	39.34	6,630	1.43	265,444	57.36	8,619	1.86	1	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 3149 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

Thematic Map of Essential Facilities with greater than 50% moderate

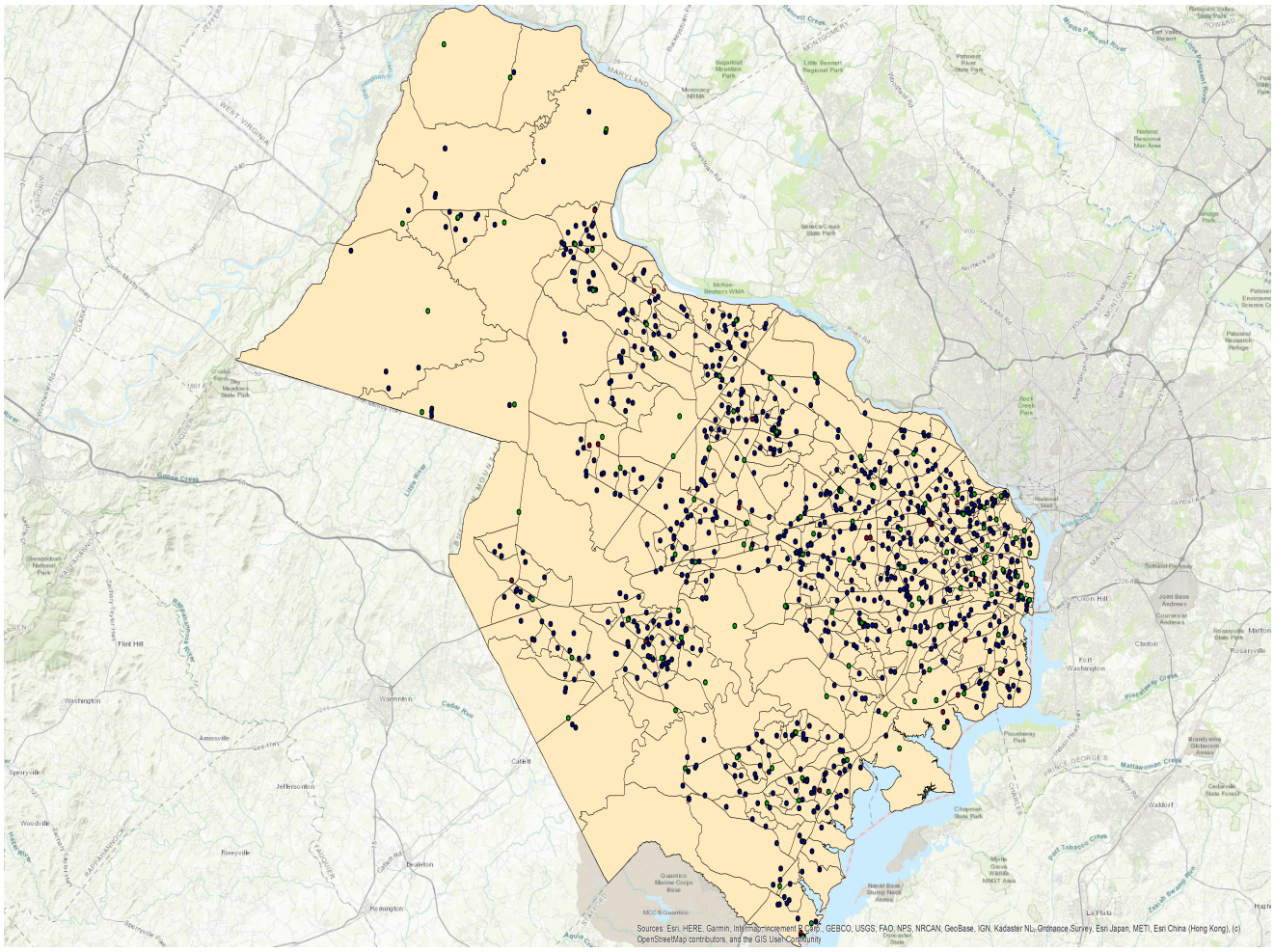
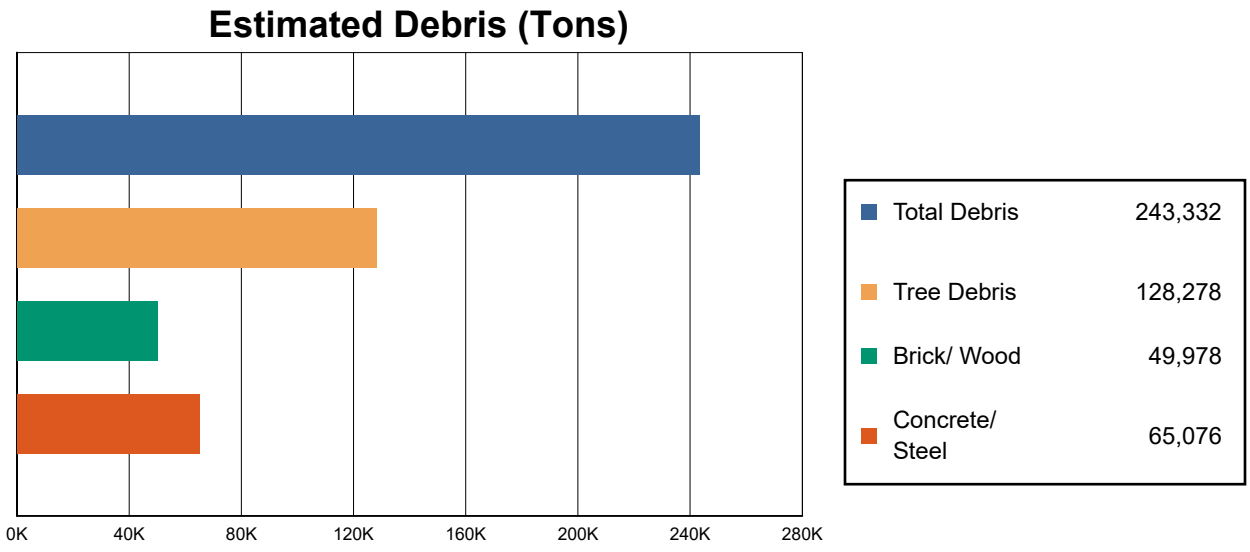


Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	14	0	0	14
Fire Stations	110	0	0	110
Hospitals	19	0	0	19
Police Stations	46	0	0	46
Schools	846	0	0	846

Induced Hurricane Damage

Debris Generation

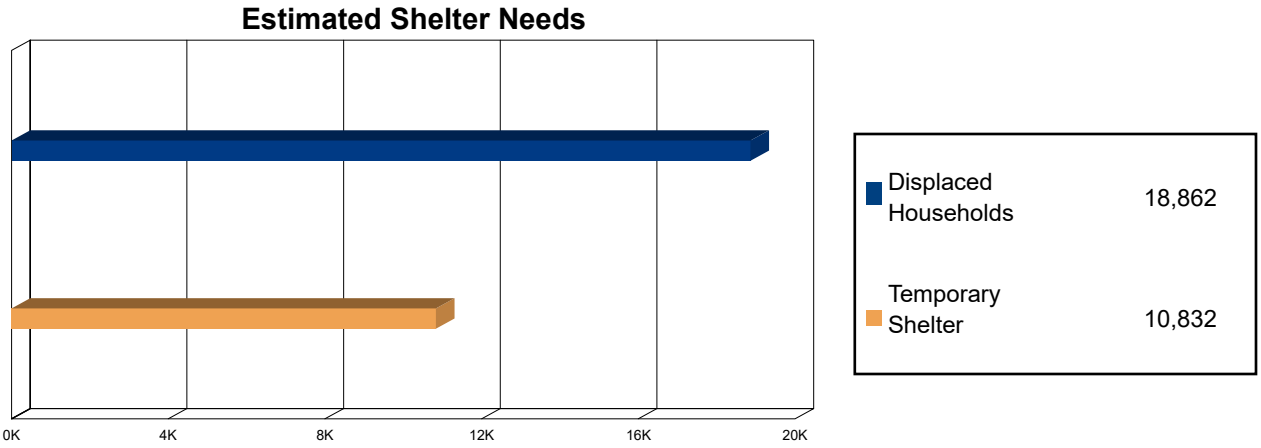


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 243,332 tons of debris will be generated. Of the total amount, 75,021 tons (31%) is Other Tree Debris. Of the remaining 168,311 tons, Brick/Wood comprises 30% of the total, Reinforced Concrete/Steel comprises of 39% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 4602 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 53,257 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 18,862 households to be displaced due to the hurricane. Of these, 10,832 people (out of a total population of 2,230,623) will seek temporary shelter in public shelters.

Economic Loss

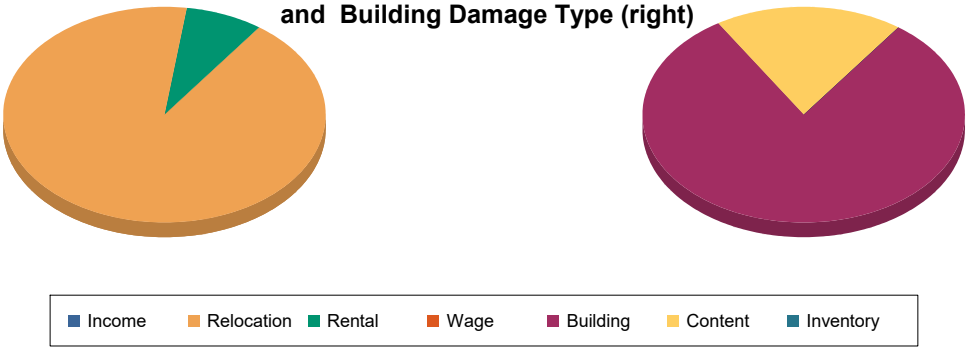
The total economic loss estimated for the hurricane is 26440.6 million dollars, which represents 7.74 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 26,441 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

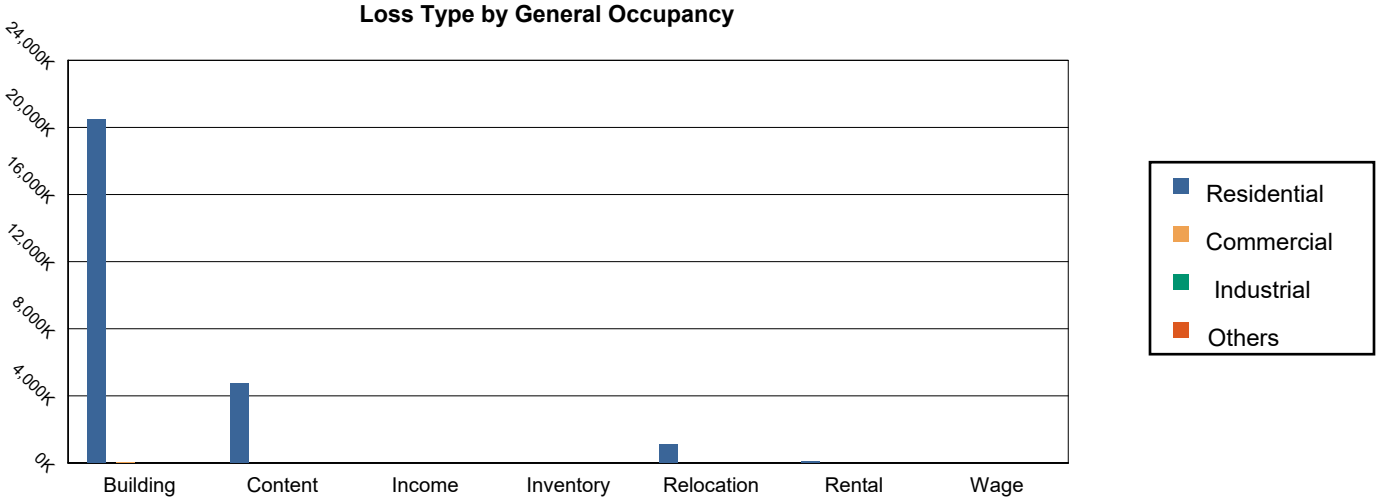


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	20,491,764.03	10,541.38	1,257.18	2,234.68	20,505,797.27
	Content	4,750,833.12	1.43	106.29	35.42	4,750,976.27
	Inventory	0.00	0.06	21.14	3.92	25.12
	Subtotal	**25,242,597.15**	**10,542.87**	**1,384.61**	**2,274.02**	**25,256,798.66**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	1,092,529.17	246.61	8.77	14.58	1,092,799.13
	Rental	91,028.46	0.00	0.00	0.00	91,028.46
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**1,183,557.63**	**246.61**	**8.77**	**14.58**	**1,183,827.59**

Total

Total	**26,426,154.78**	**10,789.49**	**1,393.39**	**2,288.59**	**26,440,626.25**

Appendix A: County Listing for the Region

Virginia

- Arlington
- Fairfax
- Loudoun
- Prince William
- Alexandria
- Fairfax City
- Falls Church
- Manassas
- Manassas Park

Appendix B: Regional Population and Building Value Data

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Study Region Total	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**

Hazus: Hurricane Global Risk Report

Region Name: NOVA_EQ_FL_HU_Test

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Monday, July 26, 2021

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- Virginia

Note:
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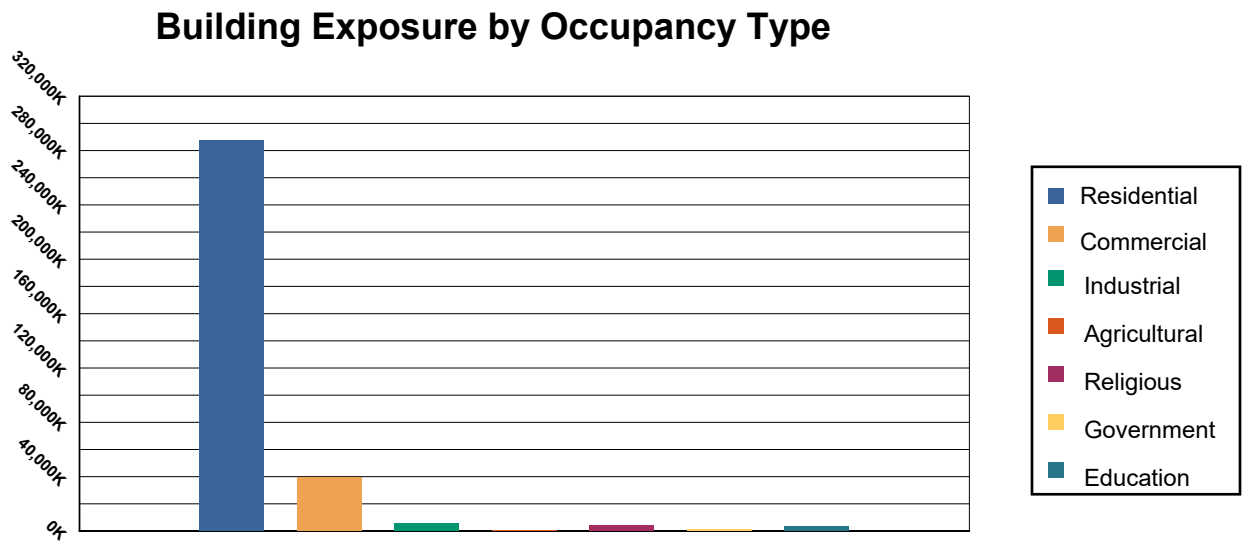
General Building Stock

Hazus estimates that there are 663,685 buildings in the region which have an aggregate total replacement value of 341,516 million (2014 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.



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Occupancy	Exposure ($1000)	Percent of Tot
Residential	287,641,972	84.23%
Commercial	39,194,388	11.48%
Industrial	5,227,982	1.53%
Agricultural	688,752	0.20%
Religious	4,026,943	1.18%
Government	1,401,093	0.41%
Education	3,334,545	0.98%
Total	**341,515,675**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 19 hospitals in the region with a total bed capacity of 3,149 beds. There are 846 schools, 110 fire stations, 46 police stations and 14 emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 522,677 buildings will be at least moderately damaged. This is over 79% of the total number of buildings in the region. There are an estimated 307 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

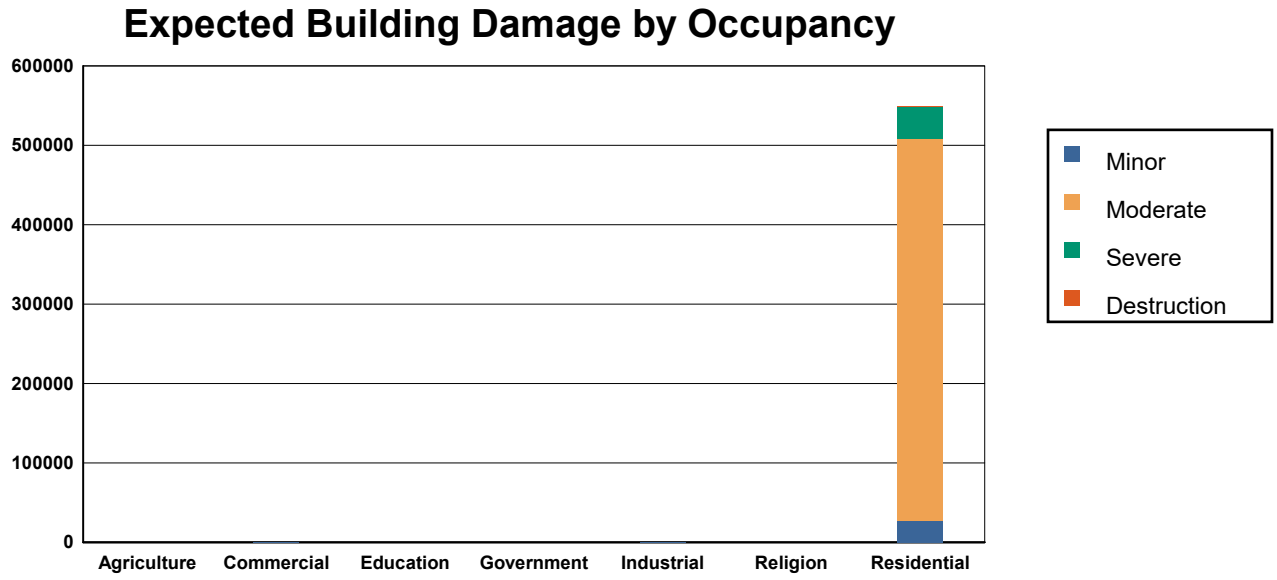


Table 2: Expected Building Damage by Occupancy : 1000 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1,601.50	97.06	41.10	2.49	5.32	0.32	1.99	0.12	0.09	0.01
Commercial	33,486.76	97.83	672.22	1.96	64.71	0.19	4.30	0.01	0.00	0.00
Education	1,818.84	98.10	34.05	1.84	1.11	0.06	0.00	0.00	0.00	0.00
Government	1,161.89	98.22	20.45	1.73	0.66	0.06	0.00	0.00	0.00	0.00
Industrial	7,958.59	97.71	173.85	2.13	10.71	0.13	1.79	0.02	0.06	0.00
Religion	3,499.54	98.19	62.62	1.76	1.84	0.05	0.00	0.00	0.00	0.00
Residential	63,857.26	10.42	26,619.35	4.34	481,896.40	78.60	40,380.71	6.59	307.29	0.05
Total	**113,384.38**		**27,623.65**		**481,980.75**		**40,388.80**		**307.44**	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	5,338	97.47	133	2.42	6	0.10	0	0.00	0	0.00
Masonry	50,331	30.05	6,531	3.90	101,815	60.79	8,747	5.22	61	0.04
MH	5,118	99.68	12	0.24	3	0.06	0	0.00	1	0.02
Steel	22,062	97.79	448	1.98	46	0.20	5	0.02	0	0.00
Wood	52,387	11.32	19,746	4.27	360,406	77.88	29,987	6.48	232	0.05

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 3149 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

Thematic Map of Essential Facilities with greater than 50% moderate

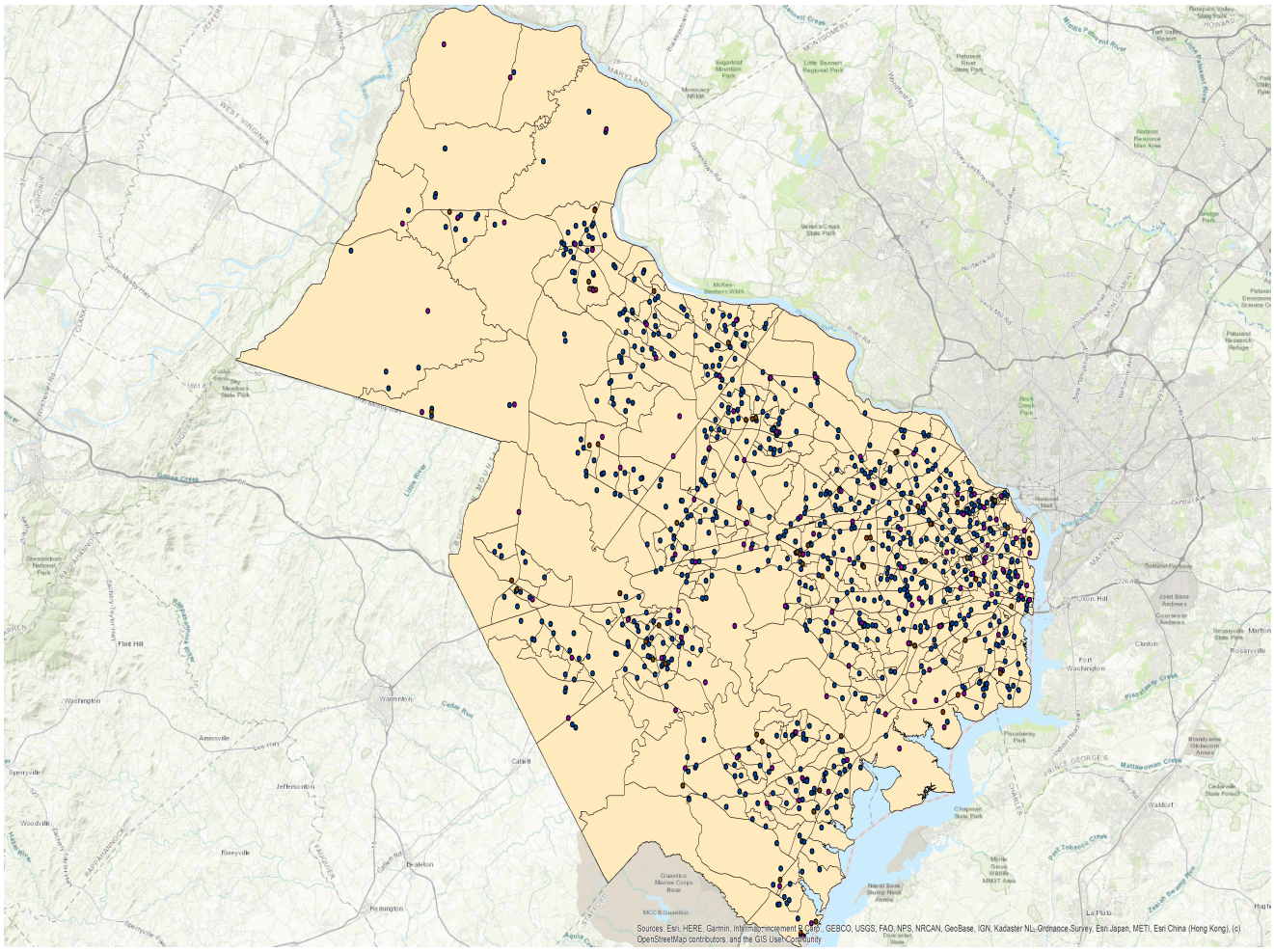
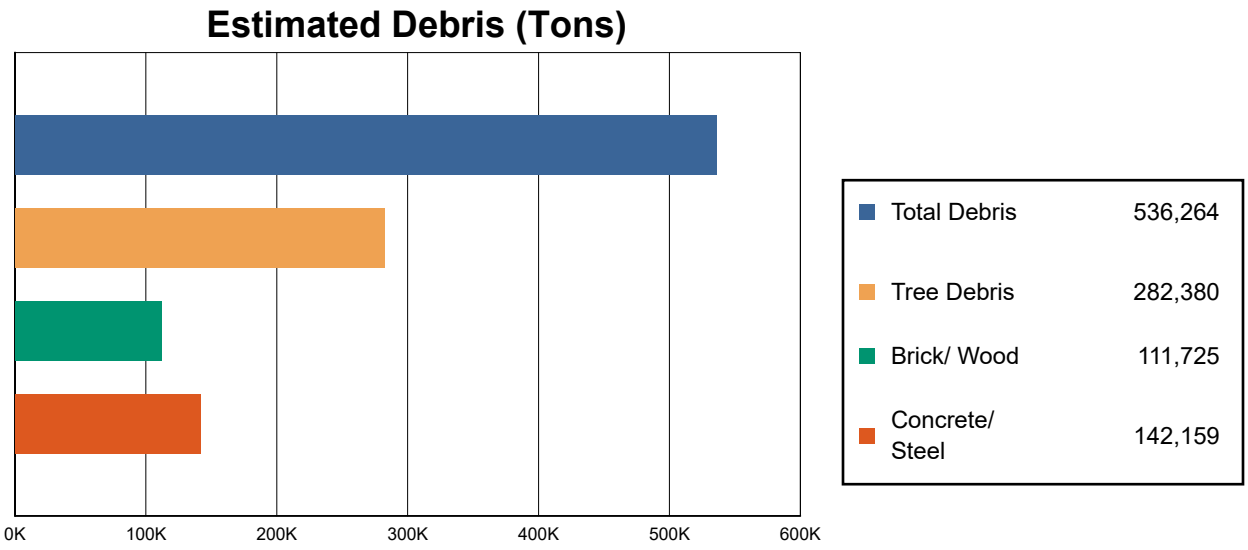


Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	14	0	0	14
Fire Stations	110	0	0	110
Hospitals	19	0	0	19
Police Stations	46	0	0	46
Schools	846	0	0	846

Induced Hurricane Damage

Debris Generation

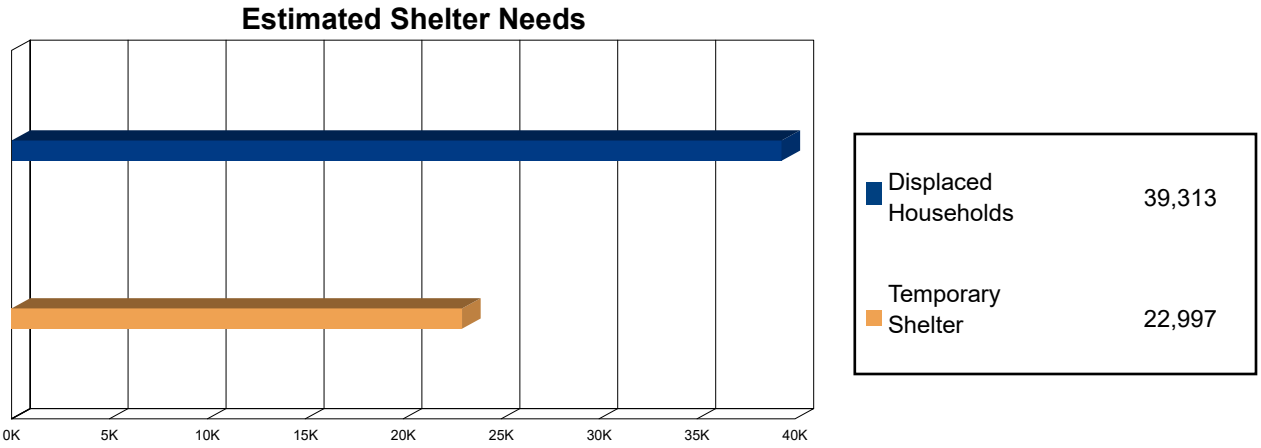


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 536,264 tons of debris will be generated. Of the total amount, 187,726 tons (35%) is Other Tree Debris. Of the remaining 348,538 tons, Brick/Wood comprises 32% of the total, Reinforced Concrete/Steel comprises of 41% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 10155 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 94,654 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 39,313 households to be displaced due to the hurricane. Of these, 22,997 people (out of a total population of 2,230,623) will seek temporary shelter in public shelters.

Economic Loss

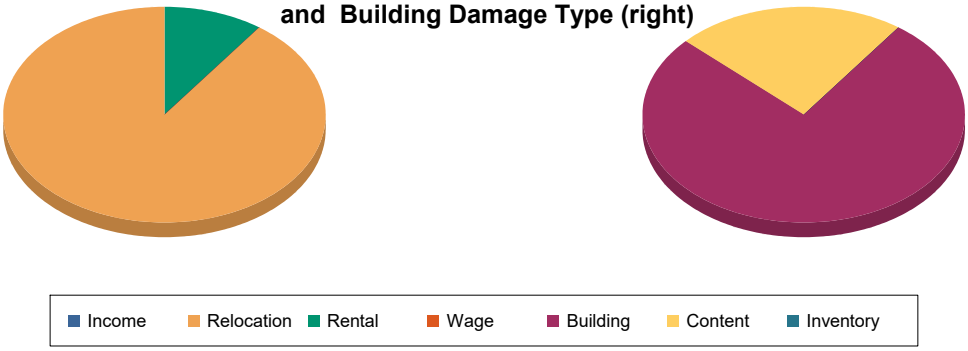
The total economic loss estimated for the hurricane is 41055.8 million dollars, which represents 12.02 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 41,056 million dollars. 5% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

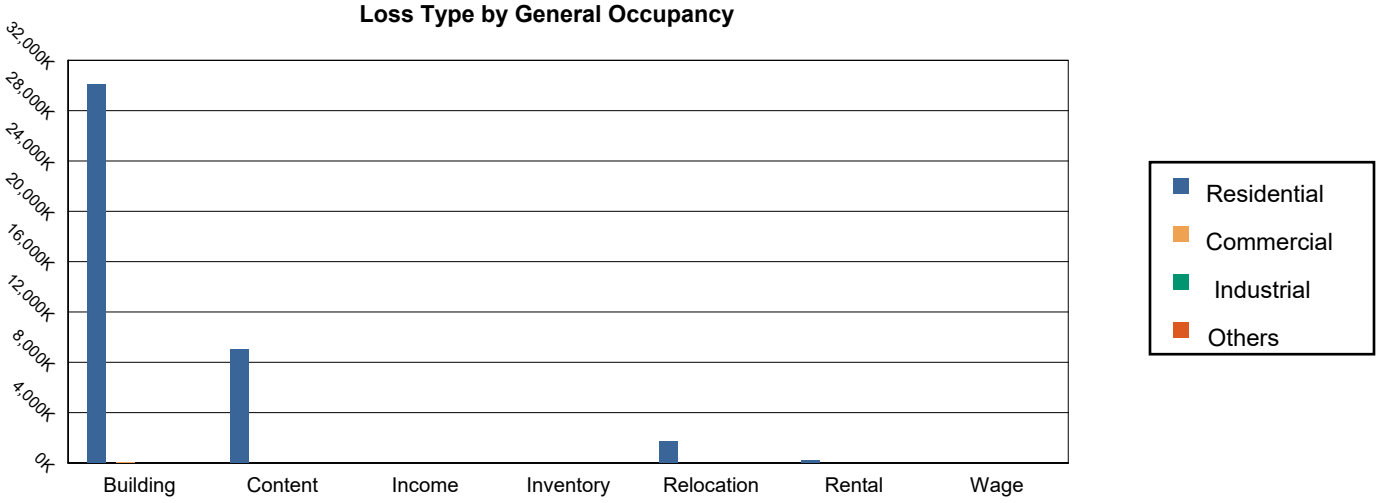


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	30,106,709.85	18,317.49	2,792.18	4,019.43	30,131,838.96
	Content	8,986,837.01	1,215.87	706.03	380.17	8,989,139.08
	Inventory	0.00	31.33	121.92	30.12	183.37
	Subtotal	**39,093,546.86**	**19,564.70**	**3,620.13**	**4,429.72**	**39,121,161.42**
Business Interruption Loss						
	Income	0.00	818.01	8.03	20.81	846.84
	Relocation	1,737,879.20	1,080.30	64.95	130.37	1,739,154.81
	Rental	193,928.08	379.74	6.55	4.65	194,319.02
	Wage	0.00	299.63	13.28	50.42	363.33
	Subtotal	**1,931,807.28**	**2,577.68**	**92.81**	**206.25**	**1,934,684.01**

Total

Total	**41,025,354.15**	**22,142.37**	**3,712.94**	**4,635.97**	**41,055,845.43**

Appendix A: County Listing for the Region

Virginia

- Arlington
- Fairfax
- Loudoun
- Prince William
- Alexandria
- Fairfax City
- Falls Church
- Manassas
- Manassas Park

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Virginia				
Alexandria	139,966	18,477,776	5,549,311	24,027,087
Arlington	207,627	27,386,560	6,025,940	33,412,500
Fairfax	1,081,726	144,188,703	26,638,455	170,827,158
Fairfax City	22,565	3,164,151	1,516,956	4,681,107
Falls Church	12,332	1,766,161	599,641	2,365,802
Loudoun	312,311	39,257,243	6,070,731	45,327,974
Manassas	37,821	3,672,496	1,274,759	4,947,255
Manassas Park	14,273	1,298,379	261,805	1,560,184
Prince William	402,002	48,430,503	5,936,105	54,366,608
Total	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**
Study Region Total	**2,230,623**	**287,641,972**	**53,873,703**	**341,515,675**

Quick Assessment Report

July 26, 2021

Study Region : NOVA_EQ_FL_HU_Test

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	1,322
Number of Census Tracts	520
Number of People in the Region	2,230,623

General Building Stock

Occupancy	*Building Count*	*Dollar Exposure ($ K)*
Residential	613,061	287,641,972
Commercial	34,228	39,194,388
Other	16,396	14,679,315
Total	663,685	341,515,675

Scenario Results

Number of Residential Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	0	0	0	0	0
20	0	0	0	0	0
50	219	5,454	0	0	5,673
100	448	32,857	1	0	33,305
200	2,326	121,667	1,095	0	125,088
500	9,623	354,623	11,603	1	375,850
1000	26,619	481,896	40,381	307	549,204

Number of Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	0	0	0	0	0
20	0	0	0	0	0
50	326	5,454	0	0	5,780
100	591	32,857	1	0	33,448
200	2,591	121,671	1,095	0	125,358
500	10,237	354,654	11,604	1	376,496
1000	27,624	481,981	40,389	307	550,301

Shelter Requirements

Return Period	*Displaced Households (#Households)*	*Short Term Shelter (#People)*
10	0	0
20	0	0
50	7	7
100	828	487
200	4,769	2,733
500	18,862	10,832
1000	39,313	22,997

Economic Loss (x 1000)

	Property Damage (Capital Stock) Losses		***Business Interruption***
ReturnPeriod	***Residential***	***Total***	***(Income) Losses***
10	0	0	0
20	0	0	0
50	1,496,141	1,496,141	12,321
100	4,128,549	4,132,092	82,135
200	9,715,913	9,721,865	360,734
500	25,242,597	25,256,799	1,183,828
1000	39,093,547	39,121,161	1,934,684
Annualized	234,474	234,711	9,922

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Building Damage by Building Type: 10 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Alexandria					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Arlington					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Fairfax					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00

Building Damage by Building Type: 10 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Fairfax City					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Falls Church					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Loudoun					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00

Building Damage by Building Type: 10 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Manassas					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Manassas Park					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Prince William					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00

Building Damage by Building Type: 10 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Study Region Average	100.00	0.00	0.00	0.00	0.00

Building Damage by Building Type: 20 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Alexandria					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Arlington					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Fairfax					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00

Building Damage by Building Type: 20 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Fairfax City					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Falls Church					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Loudoun					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00

Building Damage by Building Type: 20 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Manassas					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Manassas Park					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Prince William					
Concrete	100.00	0.00	0.00	0.00	0.00
Masonry	100.00	0.00	0.00	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	100.00	0.00	0.00	0.00	0.00
Wood	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00
Total	100.00	0.00	0.00	0.00	0.00

Building Damage by Building Type: 20 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Study Region Average	100.00	0.00	0.00	0.00	0.00

Building Damage by Building Type: 50 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Alexandria					
Concrete	99.67	0.33	0.00	0.00	0.00
Masonry	99.29	0.39	0.32	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.73	0.27	0.00	0.00	0.00
Wood	99.55	0.00	0.45	0.00	0.00
Total	99.58	0.25	0.17	0.00	0.00
Arlington					
Concrete	99.66	0.34	0.00	0.00	0.00
Masonry	99.26	0.39	0.34	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.72	0.28	0.00	0.00	0.00
Wood	99.55	0.00	0.45	0.00	0.00
Total	99.57	0.25	0.18	0.00	0.00
Fairfax					
Concrete	99.71	0.29	0.00	0.00	0.00
Masonry	99.26	0.18	0.56	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.75	0.25	0.00	0.00	0.00
Wood	99.30	0.00	0.70	0.00	0.00
Total	99.55	0.17	0.28	0.00	0.00

Building Damage by Building Type: 50 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Fairfax City					
Concrete	99.71	0.29	0.00	0.00	0.00
Masonry	99.38	0.19	0.43	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.75	0.25	0.00	0.00	0.00
Wood	99.29	0.00	0.71	0.00	0.00
Total	99.59	0.17	0.24	0.00	0.00
Falls Church					
Concrete	99.69	0.31	0.00	0.00	0.00
Masonry	99.27	0.27	0.46	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.73	0.27	0.00	0.00	0.00
Wood	99.30	0.00	0.70	0.00	0.00
Total	99.54	0.20	0.25	0.00	0.00
Loudoun					
Concrete	99.67	0.33	0.00	0.00	0.00
Masonry	98.72	0.14	1.14	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.72	0.28	0.00	0.00	0.00
Wood	98.62	0.00	1.38	0.00	0.00
Total	99.26	0.16	0.58	0.00	0.00

Building Damage by Building Type: 50 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Manassas					
Concrete	99.70	0.30	0.00	0.00	0.00
Masonry	99.20	0.17	0.63	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.74	0.26	0.00	0.00	0.00
Wood	99.11	0.00	0.89	0.00	0.00
Total	99.50	0.17	0.34	0.00	0.00
Manassas Park					
Concrete	99.70	0.30	0.00	0.00	0.00
Masonry	99.06	0.12	0.82	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.73	0.27	0.00	0.00	0.00
Wood	98.98	0.00	1.02	0.00	0.00
Total	99.43	0.15	0.42	0.00	0.00
Prince William					
Concrete	99.70	0.30	0.00	0.00	0.00
Masonry	99.18	0.10	0.72	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.75	0.25	0.00	0.00	0.00
Wood	99.15	0.00	0.85	0.00	0.00
Total	99.50	0.14	0.36	0.00	0.00
Total	99.51	0.18	0.31	0.00	0.00

Building Damage by Building Type: 50 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Study Region Average	99.51	0.18	0.31	0.00	0.00

Building Damage by Building Type: 100 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Alexandria					
Concrete	99.51	0.49	0.00	0.00	0.00
Masonry	96.20	0.71	3.08	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.60	0.40	0.00	0.00	0.00
Wood	95.54	0.01	4.45	0.00	0.00
Total	97.93	0.41	1.66	0.00	0.00
Arlington					
Concrete	99.50	0.50	0.00	0.00	0.00
Masonry	96.28	0.70	3.02	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.60	0.40	0.00	0.00	0.00
Wood	95.98	0.01	4.00	0.00	0.00
Total	98.01	0.41	1.58	0.00	0.00
Fairfax					
Concrete	99.59	0.41	0.00	0.00	0.00
Masonry	95.54	0.31	4.15	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.66	0.34	0.00	0.00	0.00
Wood	94.68	0.01	5.31	0.00	0.00
Total	97.61	0.25	2.14	0.00	0.00

Building Damage by Building Type: 100 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Fairfax City					
Concrete	99.60	0.40	0.00	0.00	0.00
Masonry	96.65	0.29	3.07	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.66	0.34	0.00	0.00	0.00
Wood	94.88	0.01	5.10	0.00	0.00
Total	98.02	0.24	1.74	0.00	0.00
Falls Church					
Concrete	99.54	0.46	0.00	0.00	0.00
Masonry	95.47	0.49	4.04	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.61	0.39	0.00	0.00	0.00
Wood	93.72	0.02	6.26	0.00	0.00
Total	97.44	0.33	2.23	0.00	0.00
Loudoun					
Concrete	99.61	0.39	0.00	0.00	0.00
Masonry	96.02	0.20	3.78	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.67	0.33	0.00	0.00	0.00
Wood	95.34	0.01	4.65	0.00	0.00
Total	97.87	0.20	1.92	0.00	0.00

Building Damage by Building Type: 100 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Manassas					
Concrete	99.67	0.33	0.00	0.00	0.00
Masonry	97.40	0.21	2.39	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.70	0.30	0.00	0.00	0.00
Wood	96.59	0.01	3.41	0.00	0.00
Total	98.53	0.19	1.28	0.00	0.00
Manassas Park					
Concrete	99.65	0.35	0.00	0.00	0.00
Masonry	96.34	0.15	3.51	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.70	0.30	0.00	0.00	0.00
Wood	95.61	0.01	4.39	0.00	0.00
Total	98.03	0.18	1.79	0.00	0.00
Prince William					
Concrete	99.63	0.37	0.00	0.00	0.00
Masonry	96.20	0.15	3.64	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.69	0.31	0.00	0.00	0.00
Wood	95.53	0.01	4.46	0.00	0.00
Total	97.97	0.18	1.85	0.00	0.00
Total	97.79	0.26	1.95	0.00	0.00

Building Damage by Building Type: 100 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Study Region Average	97.79	0.26	1.95	0.00	0.00

Building Damage by Building Type: 200 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Alexandria					
Concrete	98.72	1.27	0.01	0.00	0.00
Masonry	80.40	2.37	17.02	0.21	0.00
Manufactured Homes	99.98	0.01	0.01	0.00	0.00
Steel	98.98	1.00	0.02	0.00	0.00
Wood	74.79	0.47	24.44	0.30	0.00
Total	89.44	1.30	9.14	0.11	0.00
Arlington					
Concrete	98.78	1.21	0.01	0.00	0.00
Masonry	82.99	2.22	14.67	0.12	0.00
Manufactured Homes	99.99	0.00	0.01	0.00	0.00
Steel	99.05	0.94	0.01	0.00	0.00
Wood	80.11	0.33	19.40	0.15	0.00
Total	91.08	1.21	7.65	0.06	0.00
Fairfax					
Concrete	99.23	0.76	0.00	0.00	0.00
Masonry	83.67	0.78	15.43	0.12	0.00
Manufactured Homes	99.99	0.00	0.00	0.00	0.00
Steel	99.37	0.62	0.01	0.00	0.00
Wood	79.84	0.24	19.77	0.14	0.00
Total	91.42	0.56	7.96	0.06	0.00

Building Damage by Building Type: 200 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Fairfax City					
Concrete	99.37	0.63	0.00	0.00	0.00
Masonry	90.62	0.52	8.85	0.01	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.48	0.51	0.00	0.00	0.00
Wood	85.08	0.11	14.80	0.01	0.00
Total	94.55	0.41	5.04	0.00	0.00
Falls Church					
Concrete	99.10	0.90	0.00	0.00	0.00
Masonry	83.28	1.26	15.35	0.11	0.00
Manufactured Homes	99.99	0.00	0.00	0.00	0.00
Steel	99.26	0.72	0.01	0.00	0.00
Wood	75.55	0.33	23.96	0.16	0.00
Total	90.66	0.78	8.51	0.06	0.00
Loudoun					
Concrete	99.74	0.26	0.00	0.00	0.00
Masonry	98.50	0.12	1.38	0.00	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.78	0.22	0.00	0.00	0.00
Wood	98.32	0.00	1.68	0.00	0.00
Total	99.17	0.13	0.70	0.00	0.00

Building Damage by Building Type: 200 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Manassas					
Concrete	99.47	0.53	0.00	0.00	0.00
Masonry	91.18	0.42	8.39	0.01	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.54	0.46	0.00	0.00	0.00
Wood	87.77	0.08	12.14	0.01	0.00
Total	95.14	0.34	4.52	0.00	0.00
Manassas Park					
Concrete	99.46	0.54	0.00	0.00	0.00
Masonry	88.65	0.34	11.01	0.01	0.00
Manufactured Homes	100.00	0.00	0.00	0.00	0.00
Steel	99.53	0.46	0.00	0.00	0.00
Wood	85.86	0.09	14.04	0.01	0.00
Total	94.01	0.32	5.67	0.00	0.00
Prince William					
Concrete	99.15	0.85	0.00	0.00	0.00
Masonry	78.17	0.61	20.93	0.29	0.00
Manufactured Homes	99.99	0.01	0.00	0.00	0.00
Steel	99.29	0.69	0.02	0.00	0.00
Wood	73.44	0.40	25.80	0.36	0.00
Total	88.64	0.56	10.66	0.15	0.00
Total	91.84	0.63	7.45	0.07	0.00

Building Damage by Building Type: 200 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Study Region Average	91.84	0.63	7.45	0.07	0.00

Building Damage by Building Type: 500 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Alexandria					
Concrete	98.36	1.62	0.02	0.00	0.00
Masonry	74.66	3.10	21.76	0.49	0.00
Manufactured Homes	99.96	0.03	0.01	0.00	0.00
Steel	98.69	1.26	0.05	0.00	0.00
Wood	67.57	0.81	30.94	0.69	0.00
Total	86.37	1.71	11.65	0.26	0.00
Arlington					
Concrete	98.20	1.77	0.03	0.00	0.00
Masonry	71.85	3.22	24.31	0.62	0.00
Manufactured Homes	99.96	0.03	0.01	0.00	0.00
Steel	98.61	1.34	0.04	0.00	0.00
Wood	66.50	0.88	31.82	0.80	0.00
Total	85.23	1.81	12.64	0.32	0.00
Fairfax					
Concrete	98.34	1.64	0.02	0.00	0.00
Masonry	55.36	2.01	41.25	1.38	0.00
Manufactured Homes	99.94	0.04	0.01	0.00	0.00
Steel	98.61	1.32	0.08	0.00	0.00
Wood	43.75	1.37	53.14	1.74	0.00
Total	76.52	1.44	21.33	0.71	0.00

Building Damage by Building Type: 500 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Fairfax City					
Concrete	98.15	1.82	0.03	0.00	0.00
Masonry	62.86	1.94	33.82	1.38	0.00
Manufactured Homes	99.91	0.07	0.02	0.00	0.00
Steel	98.48	1.44	0.08	0.00	0.00
Wood	39.21	1.67	56.86	2.25	0.00
Total	78.40	1.52	19.31	0.78	0.00
Falls Church					
Concrete	98.19	1.78	0.02	0.00	0.00
Masonry	61.92	2.68	34.30	1.10	0.00
Manufactured Homes	99.94	0.05	0.01	0.00	0.01
Steel	98.49	1.42	0.09	0.00	0.00
Wood	43.48	1.50	53.34	1.68	0.00
Total	78.67	1.73	18.99	0.61	0.00
Loudoun					
Concrete	98.41	1.57	0.02	0.00	0.00
Masonry	54.74	1.55	42.46	1.24	0.00
Manufactured Homes	99.95	0.04	0.01	0.00	0.00
Steel	98.65	1.28	0.07	0.00	0.00
Wood	44.41	1.27	52.82	1.49	0.00
Total	76.43	1.25	21.70	0.63	0.00

Building Damage by Building Type: 500 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Manassas					
Concrete	98.05	1.91	0.03	0.00	0.00
Masonry	49.45	2.27	46.13	2.15	0.00
Manufactured Homes	99.86	0.11	0.02	0.00	0.01
Steel	98.24	1.65	0.11	0.01	0.00
Wood	27.99	2.15	66.83	3.03	0.00
Total	72.22	1.76	24.87	1.15	0.00
Manassas Park					
Concrete	97.94	2.02	0.04	0.00	0.00
Masonry	34.14	2.22	60.61	3.03	0.00
Manufactured Homes	99.84	0.12	0.03	0.00	0.01
Steel	98.11	1.72	0.16	0.01	0.00
Wood	16.93	2.47	76.89	3.72	0.00
Total	65.44	1.82	31.20	1.54	0.00
Prince William					
Concrete	98.25	1.72	0.03	0.00	0.00
Masonry	45.16	1.61	51.32	1.91	0.00
Manufactured Homes	99.92	0.06	0.01	0.00	0.00
Steel	98.51	1.39	0.09	0.00	0.00
Wood	33.04	1.67	63.02	2.27	0.00
Total	71.55	1.38	26.11	0.96	0.00
Total	77.35	1.47	20.50	0.67	0.00

Building Damage by Building Type: 500 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Study Region Average	77.35	1.47	20.50	0.67	0.00

Building Damage by Building Type: 1000 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Alexandria					
Concrete	98.71	1.28	0.01	0.00	0.00
Masonry	81.12	2.46	16.24	0.18	0.00
Manufactured Homes	99.98	0.01	0.01	0.00	0.00
Steel	98.97	1.01	0.02	0.00	0.00
Wood	76.11	0.45	23.18	0.26	0.00
Total	89.86	1.33	8.70	0.10	0.00
Arlington					
Concrete	98.61	1.38	0.01	0.00	0.00
Masonry	78.62	2.47	18.62	0.29	0.00
Manufactured Homes	99.98	0.01	0.01	0.00	0.00
Steel	98.92	1.06	0.02	0.00	0.00
Wood	74.67	0.50	24.45	0.37	0.00
Total	88.79	1.37	9.69	0.15	0.00
Fairfax					
Concrete	97.90	2.04	0.06	0.00	0.00
Masonry	47.08	2.75	47.42	2.75	0.01
Manufactured Homes	99.87	0.10	0.03	0.00	0.01
Steel	98.19	1.65	0.14	0.01	0.00
Wood	33.40	2.35	60.81	3.44	0.01
Total	72.11	1.97	24.50	1.41	0.00

Building Damage by Building Type: 1000 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Fairfax City					
Concrete	97.72	2.23	0.06	0.00	0.00
Masonry	56.44	2.43	38.96	2.17	0.00
Manufactured Homes	99.85	0.12	0.03	0.00	0.01
Steel	98.11	1.76	0.12	0.01	0.00
Wood	28.61	2.36	65.46	3.56	0.00
Total	74.60	1.92	22.25	1.23	0.00
Falls Church					
Concrete	98.38	1.60	0.02	0.00	0.00
Masonry	66.16	2.38	30.59	0.87	0.00
Manufactured Homes	99.95	0.04	0.01	0.00	0.00
Steel	98.65	1.28	0.07	0.00	0.00
Wood	49.86	1.24	47.59	1.32	0.00
Total	81.05	1.53	16.94	0.48	0.00
Loudoun					
Concrete	95.34	4.36	0.31	0.00	0.00
Masonry	-1.95	7.43	84.42	10.02	0.08
Manufactured Homes	99.41	0.44	0.10	0.00	0.05
Steel	95.91	3.58	0.46	0.05	0.00
Wood	-24.79	8.29	104.30	12.09	0.11
Total	46.47	5.23	43.17	5.08	0.05

Building Damage by Building Type: 1000 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Virginia					
Manassas					
Concrete	94.84	4.81	0.35	0.00	0.00
Masonry	0.51	9.30	78.92	11.16	0.11
Manufactured Homes	99.08	0.69	0.16	0.00	0.07
Steel	95.19	4.18	0.56	0.06	0.00
Wood	-40.30	11.20	113.21	15.72	0.17
Total	44.91	6.51	42.55	5.96	0.07
Manassas Park					
Concrete	95.13	4.56	0.30	0.00	0.00
Masonry	-18.82	9.38	96.22	13.11	0.12
Manufactured Homes	99.14	0.65	0.15	0.00	0.07
Steel	95.37	3.95	0.61	0.07	0.00
Wood	-48.33	10.96	121.19	16.02	0.16
Total	37.32	6.40	49.53	6.67	0.07
Prince William					
Concrete	96.02	3.73	0.25	0.00	0.00
Masonry	0.90	6.02	83.67	9.31	0.09
Manufactured Homes	99.52	0.35	0.09	0.00	0.04
Steel	96.49	3.07	0.40	0.04	0.00
Wood	-20.29	7.10	102.06	11.01	0.12
Total	48.32	4.36	42.58	4.69	0.05
Total	67.87	2.72	27.16	2.23	0.02

Building Damage by Building Type: 1000 - year Event

July 26, 2021

	Average Damage State (%)				
	None	Minor	Moderate	Severe	Destruction
Study Region Average	67.87	2.72	27.16	2.23	0.02

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Building Damage by Count by Building Type: 10 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Concrete	516	0	0	0	0	516
Masonry	8,853	0	0	0	0	8,853
Manufactured Homes	204	0	0	0	0	204
Steel	1,796	0	0	0	0	1,796
Wood	22,755	0	0	0	0	22,755
Total	**34,124**	**0**	**0**	**0**	**0**	**34,124**
Arlington						
Concrete	654	0	0	0	0	654
Masonry	12,418	0	0	0	0	12,418
Manufactured Homes	374	0	0	0	0	374
Steel	2,344	0	0	0	0	2,344
Wood	32,513	0	0	0	0	32,513
Total	**48,303**	**0**	**0**	**0**	**0**	**48,303**
Fairfax						
Concrete	2,593	0	0	0	0	2,593
Masonry	82,848	0	0	0	0	82,848
Manufactured Homes	2,657	0	0	0	0	2,657
Steel	10,858	0	0	0	0	10,858
Wood	229,636	0	0	0	0	229,636
Total	**328,592**	**0**	**0**	**0**	**0**	**328,592**

Building Damage by Count by Building Type: 10 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Concrete	125	0	0	0	0	125
Masonry	2,069	0	0	0	0	2,069
Manufactured Homes	52	0	0	0	0	52
Steel	548	0	0	0	0	548
Wood	5,330	0	0	0	0	5,330
Total	**8,124**	**0**	**0**	**0**	**0**	**8,124**
Falls Church						
Concrete	62	0	0	0	0	62
Masonry	1,067	0	0	0	0	1,067
Manufactured Homes	0	0	0	0	0	0
Steel	286	0	0	0	0	286
Wood	2,721	0	0	0	0	2,721
Total	**4,136**	**0**	**0**	**0**	**0**	**4,136**
Loudoun						
Concrete	621	0	0	0	0	621
Masonry	24,949	0	0	0	0	24,949
Manufactured Homes	403	0	0	0	0	403
Steel	2,799	0	0	0	0	2,799
Wood	70,375	0	0	0	0	70,375
Total	**99,147**	**0**	**0**	**0**	**0**	**99,147**

Building Damage by Count by Building Type: 10 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Concrete	133	0	0	0	0	133
Masonry	2,970	0	0	0	0	2,970
Manufactured Homes	224	0	0	0	0	224
Steel	577	0	0	0	0	577
Wood	7,957	0	0	0	0	7,957
Total	**11,861**	**0**	**0**	**0**	**0**	**11,861**
Manassas Park						
Concrete	32	0	0	0	0	32
Masonry	1,097	0	0	0	0	1,097
Manufactured Homes	8	0	0	0	0	8
Steel	150	0	0	0	0	150
Wood	3,072	0	0	0	0	3,072
Total	**4,359**	**0**	**0**	**0**	**0**	**4,359**
Prince William						
Concrete	741	0	0	0	0	741
Masonry	31,215	0	0	0	0	31,215
Manufactured Homes	1,212	0	0	0	0	1,212
Steel	3,202	0	0	0	0	3,202
Wood	88,398	0	0	0	0	88,398
Total	**124,768**	**0**	**0**	**0**	**0**	**124,768**
Total	**663,414**	**0**	**0**	**0**	**0**	**663,414**

Study Region : NOVA_EQ_FL_HU_Test

Scenario : Probabilistic

Building Damage by Count by Building Type: 10 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Study Region Total	**663,414**	**0**	**0**	**0**	**0**	**663,414**

Building Damage by Count by Building Type: 20 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Concrete	516	0	0	0	0	516
Masonry	8,853	0	0	0	0	8,853
Manufactured Homes	204	0	0	0	0	204
Steel	1,796	0	0	0	0	1,796
Wood	22,755	0	0	0	0	22,755
Total	**34,124**	**0**	**0**	**0**	**0**	**34,124**
Arlington						
Concrete	654	0	0	0	0	654
Masonry	12,418	0	0	0	0	12,418
Manufactured Homes	374	0	0	0	0	374
Steel	2,344	0	0	0	0	2,344
Wood	32,513	0	0	0	0	32,513
Total	**48,303**	**0**	**0**	**0**	**0**	**48,303**
Fairfax						
Concrete	2,593	0	0	0	0	2,593
Masonry	82,848	0	0	0	0	82,848
Manufactured Homes	2,657	0	0	0	0	2,657
Steel	10,858	0	0	0	0	10,858
Wood	229,636	0	0	0	0	229,636
Total	**328,592**	**0**	**0**	**0**	**0**	**328,592**

Building Damage by Count by Building Type: 20 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Concrete	125	0	0	0	0	125
Masonry	2,069	0	0	0	0	2,069
Manufactured Homes	52	0	0	0	0	52
Steel	548	0	0	0	0	548
Wood	5,330	0	0	0	0	5,330
Total	**8,124**	**0**	**0**	**0**	**0**	**8,124**
Falls Church						
Concrete	62	0	0	0	0	62
Masonry	1,067	0	0	0	0	1,067
Manufactured Homes	0	0	0	0	0	0
Steel	286	0	0	0	0	286
Wood	2,721	0	0	0	0	2,721
Total	**4,136**	**0**	**0**	**0**	**0**	**4,136**
Loudoun						
Concrete	621	0	0	0	0	621
Masonry	24,949	0	0	0	0	24,949
Manufactured Homes	403	0	0	0	0	403
Steel	2,799	0	0	0	0	2,799
Wood	70,375	0	0	0	0	70,375
Total	**99,147**	**0**	**0**	**0**	**0**	**99,147**

Building Damage by Count by Building Type: 20 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Concrete	133	0	0	0	0	133
Masonry	2,970	0	0	0	0	2,970
Manufactured Homes	224	0	0	0	0	224
Steel	577	0	0	0	0	577
Wood	7,957	0	0	0	0	7,957
Total	**11,861**	**0**	**0**	**0**	**0**	**11,861**
Manassas Park						
Concrete	32	0	0	0	0	32
Masonry	1,097	0	0	0	0	1,097
Manufactured Homes	8	0	0	0	0	8
Steel	150	0	0	0	0	150
Wood	3,072	0	0	0	0	3,072
Total	**4,359**	**0**	**0**	**0**	**0**	**4,359**
Prince William						
Concrete	741	0	0	0	0	741
Masonry	31,215	0	0	0	0	31,215
Manufactured Homes	1,212	0	0	0	0	1,212
Steel	3,202	0	0	0	0	3,202
Wood	88,398	0	0	0	0	88,398
Total	**124,768**	**0**	**0**	**0**	**0**	**124,768**
Total	**663,414**	**0**	**0**	**0**	**0**	**663,414**

Building Damage by Count by Building Type: 20 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Study Region Total	**663,414**	**0**	**0**	**0**	**0**	**663,414**

Building Damage by Count by Building Type: 50 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Concrete	514	2	0	0	0	516
Masonry	8,792	26	34	0	0	8,853
Manufactured Homes	204	0	0	0	0	204
Steel	1,791	5	0	0	0	1,796
Wood	22,629	0	126	0	0	22,755
Total	**33,931**	**33**	**160**	**0**	**0**	**34,124**
Arlington						
Concrete	652	2	0	0	0	654
Masonry	12,325	33	61	0	0	12,418
Manufactured Homes	374	0	0	0	0	374
Steel	2,338	6	0	0	0	2,344
Wood	32,306	0	207	0	0	32,513
Total	**47,994**	**42**	**268**	**0**	**0**	**48,303**
Fairfax						
Concrete	2,585	8	0	0	0	2,593
Masonry	82,231	113	503	0	0	82,848
Manufactured Homes	2,657	0	0	0	0	2,657
Steel	10,831	27	0	0	0	10,858
Wood	227,882	0	1,754	0	0	229,636
Total	**326,187**	**148**	**2,257**	**0**	**0**	**328,592**

Building Damage by Count by Building Type: 50 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Concrete	125	0	0	0	0	125
Masonry	2,056	4	9	0	0	2,069
Manufactured Homes	52	0	0	0	0	52
Steel	547	1	0	0	0	548
Wood	5,292	0	38	0	0	5,330
Total	**8,072**	**6**	**47**	**0**	**0**	**8,124**
Falls Church						
Concrete	62	0	0	0	0	62
Masonry	1,059	3	5	0	0	1,067
Manufactured Homes	0	0	0	0	0	0
Steel	285	1	0	0	0	286
Wood	2,701	0	20	0	0	2,721
Total	**4,108**	**4**	**25**	**0**	**0**	**4,136**
Loudoun						
Concrete	619	2	0	0	0	621
Masonry	24,617	25	307	0	0	24,949
Manufactured Homes	403	0	0	0	0	403
Steel	2,791	8	0	0	0	2,799
Wood	69,328	0	1,047	0	0	70,375
Total	**97,758**	**35**	**1,354**	**0**	**0**	**99,147**

Building Damage by Count by Building Type: 50 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Concrete	133	0	0	0	0	133
Masonry	2,946	5	20	0	0	2,970
Manufactured Homes	224	0	0	0	0	224
Steel	575	2	0	0	0	577
Wood	7,884	0	73	0	0	7,957
Total	**11,762**	**7**	**93**	**0**	**0**	**11,861**
Manassas Park						
Concrete	32	0	0	0	0	32
Masonry	1,087	1	9	0	0	1,097
Manufactured Homes	8	0	0	0	0	8
Steel	150	0	0	0	0	150
Wood	3,041	0	31	0	0	3,072
Total	**4,318**	**2**	**39**	**0**	**0**	**4,359**
Prince William						
Concrete	739	2	0	0	0	741
Masonry	30,958	30	227	0	0	31,215
Manufactured Homes	1,212	0	0	0	0	1,212
Steel	3,194	8	0	0	0	3,202
Wood	87,629	0	769	0	0	88,398
Total	**123,732**	**40**	**996**	**0**	**0**	**124,768**
Total	**657,860**	**316**	**5,238**	**0**	**0**	**663,414**

Building Damage by Count by Building Type: 50 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Study Region Total	**657,860**	**316**	**5,238**	**0**	**0**	**663,414**

Building Damage by Count by Building Type: 100 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Concrete	514	2	0	0	0	516
Masonry	8,475	48	330	0	0	8,853
Manufactured Homes	204	0	0	0	0	204
Steel	1,789	7	0	0	0	1,796
Wood	21,508	4	1,243	0	0	22,755
Total	**32,490**	**61**	**1,573**	**0**	**0**	**34,124**
Arlington						
Concrete	651	3	0	0	0	654
Masonry	11,833	59	526	0	0	12,418
Manufactured Homes	374	0	0	0	0	374
Steel	2,335	9	0	0	0	2,344
Wood	30,676	5	1,832	0	0	32,513
Total	**45,869**	**77**	**2,357**	**0**	**0**	**48,303**
Fairfax						
Concrete	2,582	11	0	0	0	2,593
Masonry	78,936	189	3,723	0	0	82,848
Manufactured Homes	2,657	0	0	0	0	2,657
Steel	10,821	37	0	0	0	10,858
Wood	216,419	33	13,184	0	0	229,636
Total	**311,415**	**270**	**16,907**	**0**	**0**	**328,592**

Building Damage by Count by Building Type: 100 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Concrete	125	0	0	0	0	125
Masonry	2,000	6	63	0	0	2,069
Manufactured Homes	52	0	0	0	0	52
Steel	546	2	0	0	0	548
Wood	5,058	1	272	0	0	5,330
Total	**7,780**	**9**	**335**	**0**	**0**	**8,124**
Falls Church						
Concrete	62	0	0	0	0	62
Masonry	1,017	5	45	0	0	1,067
Manufactured Homes	0	0	0	0	0	0
Steel	285	1	0	0	0	286
Wood	2,545	1	175	0	0	2,721
Total	**3,909**	**7**	**220**	**0**	**0**	**4,136**
Loudoun						
Concrete	619	2	0	0	0	621
Masonry	23,917	35	997	0	0	24,949
Manufactured Homes	403	0	0	0	0	403
Steel	2,790	9	0	0	0	2,799
Wood	66,920	8	3,447	0	0	70,375
Total	**94,649**	**54**	**4,444**	**0**	**0**	**99,147**

Building Damage by Count by Building Type: 100 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Concrete	133	0	0	0	0	133
Masonry	2,891	6	74	0	0	2,970
Manufactured Homes	224	0	0	0	0	224
Steel	575	2	0	0	0	577
Wood	7,679	0	278	0	0	7,957
Total	**11,501**	**8**	**352**	**0**	**0**	**11,861**
Manassas Park						
Concrete	32	0	0	0	0	32
Masonry	1,058	2	38	0	0	1,097
Manufactured Homes	8	0	0	0	0	8
Steel	150	0	0	0	0	150
Wood	2,938	0	134	0	0	3,072
Total	**4,185**	**3**	**171**	**0**	**0**	**4,359**
Prince William						
Concrete	738	3	0	0	0	741
Masonry	30,017	44	1,153	0	0	31,215
Manufactured Homes	1,212	0	0	0	0	1,212
Steel	3,192	10	0	0	0	3,202
Wood	84,398	10	3,990	0	0	88,398
Total	**119,557**	**67**	**5,144**	**1**	**0**	**124,768**
Total	**631,355**	**555**	**31,503**	**1**	**0**	**663,414**

Study Region : NOVA_EQ_FL_HU_Test

Scenario : Probabilistic

Building Damage by Count by Building Type: 100 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Study Region Total	**631,355**	**555**	**31,503**	**1**	**0**	**663,414**

Building Damage by Count by Building Type: 200 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Concrete	510	6	0	0	0	516
Masonry	6,843	165	1,822	24	0	8,853
Manufactured Homes	204	0	0	0	0	204
Steel	1,778	18	0	0	0	1,796
Wood	15,663	123	6,882	87	0	22,755
Total	**24,997**	**312**	**8,704**	**111**	**0**	**34,124**
Arlington						
Concrete	646	8	0	0	0	654
Masonry	9,741	191	2,467	19	0	12,418
Manufactured Homes	374	0	0	0	0	374
Steel	2,323	21	0	0	0	2,344
Wood	23,684	123	8,641	66	0	32,513
Total	**36,768**	**343**	**11,107**	**85**	**0**	**48,303**
Fairfax						
Concrete	2,573	19	0	0	0	2,593
Masonry	68,624	491	13,632	100	0	82,848
Manufactured Homes	2,657	0	0	0	0	2,657
Steel	10,792	65	1	0	0	10,858
Wood	180,248	572	48,469	346	0	229,636
Total	**264,895**	**1,148**	**62,102**	**447**	**0**	**328,592**

Building Damage by Count by Building Type: 200 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Concrete	124	1	0	0	0	125
Masonry	1,875	11	183	0	0	2,069
Manufactured Homes	52	0	0	0	0	52
Steel	545	3	0	0	0	548
Wood	4,535	6	789	1	0	5,330
Total	**7,131**	**20**	**972**	**1**	**0**	**8,124**
Falls Church						
Concrete	61	1	0	0	0	62
Masonry	885	12	168	1	0	1,067
Manufactured Homes	0	0	0	0	0	0
Steel	284	2	0	0	0	286
Wood	2,044	9	664	4	0	2,721
Total	**3,275**	**24**	**832**	**5**	**0**	**4,136**
Loudoun						
Concrete	620	1	0	0	0	621
Masonry	24,561	20	368	0	0	24,949
Manufactured Homes	403	0	0	0	0	403
Steel	2,794	5	0	0	0	2,799
Wood	69,107	1	1,267	0	0	70,375
Total	**97,484**	**28**	**1,635**	**0**	**0**	**99,147**

Building Damage by Count by Building Type: 200 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Concrete	132	1	0	0	0	133
Masonry	2,703	11	256	0	0	2,970
Manufactured Homes	224	0	0	0	0	224
Steel	574	3	0	0	0	577
Wood	6,975	6	975	1	0	7,957
Total	**10,608**	**21**	**1,231**	**1**	**0**	**11,861**
Manassas Park						
Concrete	32	0	0	0	0	32
Masonry	973	4	120	0	0	1,097
Manufactured Homes	8	0	0	0	0	8
Steel	149	1	0	0	0	150
Wood	2,636	3	433	0	0	3,072
Total	**3,798**	**8**	**553**	**0**	**0**	**4,359**
Prince William						
Concrete	734	7	0	0	0	741
Masonry	24,287	181	6,656	91	0	31,215
Manufactured Homes	1,212	0	0	0	0	1,212
Steel	3,179	22	1	0	0	3,202
Wood	64,515	357	23,214	312	0	88,398
Total	**93,927**	**567**	**29,871**	**402**	**0**	**124,768**
Total	**542,884**	**2,470**	**117,008**	**1,052**	**0**	**663,414**

Study Region : NOVA_EQ_FL_HU_Test

Scenario : Probabilistic

Building Damage by Count by Building Type: 200 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Study Region Total	**542,884**	**2,470**	**117,008**	**1,052**	**0**	**663,414**

Building Damage by Count by Building Type: 500 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Concrete	508	8	0	0	0	516
Masonry	6,308	211	2,283	51	0	8,853
Manufactured Homes	204	0	0	0	0	204
Steel	1,774	21	1	0	0	1,796
Wood	13,785	200	8,581	188	0	22,755
Total	**22,579**	**441**	**10,865**	**240**	**0**	**34,124**
Arlington						
Concrete	642	11	0	0	0	654
Masonry	7,770	298	4,240	110	0	12,418
Manufactured Homes	374	0	0	0	0	374
Steel	2,312	31	1	0	0	2,344
Wood	16,983	348	14,805	377	0	32,513
Total	**28,081**	**689**	**19,046**	**487**	**0**	**48,303**
Fairfax						
Concrete	2,549	43	1	0	0	2,593
Masonry	42,871	1,404	37,314	1,260	0	82,848
Manufactured Homes	2,655	1	0	0	0	2,657
Steel	10,708	141	8	0	0	10,858
Wood	88,457	3,303	133,492	4,384	0	229,636
Total	**147,240**	**4,892**	**170,815**	**5,644**	**0**	**328,592**

Building Damage by Count by Building Type: 500 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Concrete	123	2	0	0	0	125
Masonry	1,304	40	696	28	0	2,069
Manufactured Homes	52	0	0	0	0	52
Steel	540	8	0	0	0	548
Wood	2,104	88	3,018	119	0	5,330
Total	**4,123**	**139**	**3,715**	**147**	**0**	**8,124**
Falls Church						
Concrete	61	1	0	0	0	62
Masonry	647	27	381	12	0	1,067
Manufactured Homes	0	0	0	0	0	0
Steel	282	4	0	0	0	286
Wood	1,136	42	1,496	47	0	2,721
Total	**2,125**	**74**	**1,876**	**60**	**0**	**4,136**
Loudoun						
Concrete	612	9	0	0	0	621
Masonry	13,080	318	11,224	326	0	24,949
Manufactured Homes	403	0	0	0	0	403
Steel	2,764	33	2	0	0	2,799
Wood	28,956	917	39,395	1,106	0	70,375
Total	**45,815**	**1,278**	**50,621**	**1,432**	**0**	**99,147**

Building Damage by Count by Building Type: 500 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Concrete	130	3	0	0	0	133
Masonry	1,415	65	1,424	66	0	2,970
Manufactured Homes	224	0	0	0	0	224
Steel	567	10	1	0	0	577
Wood	2,084	173	5,455	246	0	7,957
Total	**4,419**	**250**	**6,880**	**312**	**0**	**11,861**
Manassas Park						
Concrete	31	1	0	0	0	32
Masonry	394	25	646	32	0	1,097
Manufactured Homes	8	0	0	0	0	8
Steel	147	3	0	0	0	150
Wood	556	75	2,329	112	0	3,072
Total	**1,136**	**103**	**2,975**	**145**	**0**	**4,359**
Prince William						
Concrete	728	13	0	0	0	741
Masonry	13,812	488	16,312	603	0	31,215
Manufactured Homes	1,211	1	0	0	0	1,212
Steel	3,154	45	3	0	0	3,202
Wood	28,002	1,483	56,874	2,038	1	88,398
Total	**46,906**	**2,031**	**73,190**	**2,640**	**1**	**124,768**
Total	**302,426**	**9,896**	**339,983**	**11,108**	**1**	**663,414**

Study Region : NOVA_EQ_FL_HU_Test

Scenario : Probabilistic

Building Damage by Count by Building Type: 500 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Study Region Total	**302,426**	**9,896**	**339,983**	**11,108**	**1**	**663,414**

Building Damage by Count by Building Type: 1000 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Concrete	510	6	0	0	0	516
Masonry	6,977	162	1,695	19	0	8,853
Manufactured Homes	204	0	0	0	0	204
Steel	1,779	17	0	0	0	1,796
Wood	16,200	109	6,377	68	0	22,755
Total	**25,669**	**295**	**8,073**	**87**	**0**	**34,124**
Arlington						
Concrete	645	9	0	0	0	654
Masonry	8,823	227	3,312	56	0	12,418
Manufactured Homes	374	0	0	0	0	374
Steel	2,319	24	0	0	0	2,344
Wood	20,533	216	11,573	191	0	32,513
Total	**32,694**	**476**	**14,886**	**247**	**0**	**48,303**
Fairfax						
Concrete	2,538	53	1	0	0	2,593
Masonry	35,009	2,062	43,229	2,542	6	82,848
Manufactured Homes	2,651	4	1	0	0	2,657
Steel	10,665	176	15	1	0	10,858
Wood	60,745	5,762	154,279	8,827	24	229,636
Total	**111,609**	**8,058**	**197,526**	**11,370**	**30**	**328,592**

Building Damage by Count by Building Type: 1000 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Concrete	122	3	0	0	0	125
Masonry	1,175	50	800	44	0	2,069
Manufactured Homes	52	0	0	0	0	52
Steel	538	9	1	0	0	548
Wood	1,554	124	3,465	187	0	5,330
Total	**3,441**	**187**	**4,265**	**231**	**0**	**8,124**
Falls Church						
Concrete	61	1	0	0	0	62
Masonry	693	24	340	10	0	1,067
Manufactured Homes	0	0	0	0	0	0
Steel	282	4	0	0	0	286
Wood	1,311	35	1,338	37	0	2,721
Total	**2,347**	**64**	**1,678**	**47**	**0**	**4,136**
Loudoun						
Concrete	595	25	2	0	0	621
Masonry	-1,847	1,764	22,368	2,643	21	24,949
Manufactured Homes	400	2	1	0	0	403
Steel	2,695	91	12	1	0	2,799
Wood	-22,755	5,946	78,127	8,979	79	70,375
Total	**-20,912**	**7,828**	**100,508**	**11,623**	**100**	**99,147**

Building Damage by Count by Building Type: 1000 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Concrete	126	6	0	0	0	133
Masonry	-96	278	2,439	346	3	2,970
Manufactured Homes	222	2	0	0	0	224
Steel	549	24	3	0	0	577
Wood	-3,517	906	9,266	1,288	14	7,957
Total	**-2,717**	**1,217**	**11,709**	**1,634**	**18**	**11,861**
Manassas Park						
Concrete	30	1	0	0	0	32
Masonry	-165	101	1,023	138	1	1,097
Manufactured Homes	8	0	0	0	0	8
Steel	143	6	1	0	0	150
Wood	-1,402	328	3,661	480	5	3,072
Total	**-1,385**	**436**	**4,685**	**617**	**6**	**4,359**
Prince William						
Concrete	711	28	2	0	0	741
Masonry	-236	1,863	26,609	2,950	30	31,215
Manufactured Homes	1,207	4	1	0	0	1,212
Steel	3,091	97	13	2	0	3,202
Wood	-20,282	6,319	92,321	9,931	110	88,398
Total	**-15,509**	**8,310**	**118,945**	**12,883**	**140**	**124,768**
Total	**135,236**	**26,870**	**462,276**	**38,738**	**294**	**663,414**

Building Damage by Count by Building Type: 1000 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Study Region Total	**135,236**	**26,870**	**462,276**	**38,738**	**294**	**663,414**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Building Damage by Count by General Occupancy 10 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Agriculture	67	0	0	0	0	67
Commercial	2,757	0	0	0	0	2,757
Education	222	0	0	0	0	222
Government	103	0	0	0	0	103
Industrial	499	0	0	0	0	499
Religion	381	0	0	0	0	381
Residential	30,112	0	0	0	0	30,112
Total	**34,141**	**0**	**0**	**0**	**0**	**34,141**
Arlington						
Agriculture	101	0	0	0	0	101
Commercial	3,630	0	0	0	0	3,630
Education	188	0	0	0	0	188
Government	277	0	0	0	0	277
Industrial	644	0	0	0	0	644
Religion	418	0	0	0	0	418
Residential	43,073	0	0	0	0	43,073
Total	**48,331**	**0**	**0**	**0**	**0**	**48,331**
Fairfax						
Agriculture	760	0	0	0	0	760
Commercial	16,787	0	0	0	0	16,787
Education	869	0	0	0	0	869
Government	502	0	0	0	0	502
Industrial	3,872	0	0	0	0	3,872
Religion	1,694	0	0	0	0	1,694
Residential	304,254	0	0	0	0	304,254
Total	**328,738**	**0**	**0**	**0**	**0**	**328,738**

Study Region : NOVA_EQ_FL_HU_Test
Scenario : Probabilistic

Building Damage by Count by General Occupancy 10 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Agriculture	42	0	0	0	0	42
Commercial	841	0	0	0	0	841
Education	29	0	0	0	0	29
Government	14	0	0	0	0	14
Industrial	195	0	0	0	0	195
Religion	92	0	0	0	0	92
Residential	6,902	0	0	0	0	6,902
Total	**8,115**	**0**	**0**	**0**	**0**	**8,115**
Falls Church						
Agriculture	21	0	0	0	0	21
Commercial	456	0	0	0	0	456
Education	28	0	0	0	0	28
Government	9	0	0	0	0	9
Industrial	89	0	0	0	0	89
Religion	49	0	0	0	0	49
Residential	3,483	0	0	0	0	3,483
Total	**4,135**	**0**	**0**	**0**	**0**	**4,135**
Loudoun						
Agriculture	324	0	0	0	0	324
Commercial	4,095	0	0	0	0	4,095
Education	184	0	0	0	0	184
Government	121	0	0	0	0	121
Industrial	1,187	0	0	0	0	1,187
Religion	384	0	0	0	0	384
Residential	92,887	0	0	0	0	92,887
Total	**99,182**	**0**	**0**	**0**	**0**	**99,182**

Building Damage by Count by General Occupancy 10 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Agriculture	29	0	0	0	0	29
Commercial	826	0	0	0	0	826
Education	40	0	0	0	0	40
Government	28	0	0	0	0	28
Industrial	255	0	0	0	0	255
Religion	85	0	0	0	0	85
Residential	10,595	0	0	0	0	10,595
Total	**11,858**	**0**	**0**	**0**	**0**	**11,858**
Manassas Park						
Agriculture	24	0	0	0	0	24
Commercial	180	0	0	0	0	180
Education	19	0	0	0	0	19
Government	8	0	0	0	0	8
Industrial	80	0	0	0	0	80
Religion	14	0	0	0	0	14
Residential	4,034	0	0	0	0	4,034
Total	**4,359**	**0**	**0**	**0**	**0**	**4,359**
Prince William						
Agriculture	282	0	0	0	0	282
Commercial	4,656	0	0	0	0	4,656
Education	275	0	0	0	0	275
Government	121	0	0	0	0	121
Industrial	1,324	0	0	0	0	1,324
Religion	447	0	0	0	0	447
Residential	117,721	0	0	0	0	117,721
Total	**124,826**	**0**	**0**	**0**	**0**	**124,826**

Building Damage by Count by General Occupancy 10 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Total	**663,685**	**0**	**0**	**0**	**0**	**663,685**
Study Region Total	**663,685**	**0**	**0**	**0**	**0**	**663,685**

Building Damage by Count by General Occupancy 20 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Agriculture	67	0	0	0	0	67
Commercial	2,757	0	0	0	0	2,757
Education	222	0	0	0	0	222
Government	103	0	0	0	0	103
Industrial	499	0	0	0	0	499
Religion	381	0	0	0	0	381
Residential	30,112	0	0	0	0	30,112
Total	**34,141**	**0**	**0**	**0**	**0**	**34,141**
Arlington						
Agriculture	101	0	0	0	0	101
Commercial	3,630	0	0	0	0	3,630
Education	188	0	0	0	0	188
Government	277	0	0	0	0	277
Industrial	644	0	0	0	0	644
Religion	418	0	0	0	0	418
Residential	43,073	0	0	0	0	43,073
Total	**48,331**	**0**	**0**	**0**	**0**	**48,331**
Fairfax						
Agriculture	760	0	0	0	0	760
Commercial	16,787	0	0	0	0	16,787
Education	869	0	0	0	0	869
Government	502	0	0	0	0	502
Industrial	3,872	0	0	0	0	3,872
Religion	1,694	0	0	0	0	1,694
Residential	304,254	0	0	0	0	304,254
Total	**328,738**	**0**	**0**	**0**	**0**	**328,738**

Building Damage by Count by General Occupancy 20 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Agriculture	42	0	0	0	0	42
Commercial	841	0	0	0	0	841
Education	29	0	0	0	0	29
Government	14	0	0	0	0	14
Industrial	195	0	0	0	0	195
Religion	92	0	0	0	0	92
Residential	6,902	0	0	0	0	6,902
Total	**8,115**	**0**	**0**	**0**	**0**	**8,115**
Falls Church						
Agriculture	21	0	0	0	0	21
Commercial	456	0	0	0	0	456
Education	28	0	0	0	0	28
Government	9	0	0	0	0	9
Industrial	89	0	0	0	0	89
Religion	49	0	0	0	0	49
Residential	3,483	0	0	0	0	3,483
Total	**4,135**	**0**	**0**	**0**	**0**	**4,135**
Loudoun						
Agriculture	324	0	0	0	0	324
Commercial	4,095	0	0	0	0	4,095
Education	184	0	0	0	0	184
Government	121	0	0	0	0	121
Industrial	1,187	0	0	0	0	1,187
Religion	384	0	0	0	0	384
Residential	92,887	0	0	0	0	92,887
Total	**99,182**	**0**	**0**	**0**	**0**	**99,182**

Building Damage by Count by General Occupancy 20 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Agriculture	29	0	0	0	0	29
Commercial	826	0	0	0	0	826
Education	40	0	0	0	0	40
Government	28	0	0	0	0	28
Industrial	255	0	0	0	0	255
Religion	85	0	0	0	0	85
Residential	10,595	0	0	0	0	10,595
Total	**11,858**	**0**	**0**	**0**	**0**	**11,858**
Manassas Park						
Agriculture	24	0	0	0	0	24
Commercial	180	0	0	0	0	180
Education	19	0	0	0	0	19
Government	8	0	0	0	0	8
Industrial	80	0	0	0	0	80
Religion	14	0	0	0	0	14
Residential	4,034	0	0	0	0	4,034
Total	**4,359**	**0**	**0**	**0**	**0**	**4,359**
Prince William						
Agriculture	282	0	0	0	0	282
Commercial	4,656	0	0	0	0	4,656
Education	275	0	0	0	0	275
Government	121	0	0	0	0	121
Industrial	1,324	0	0	0	0	1,324
Religion	447	0	0	0	0	447
Residential	117,721	0	0	0	0	117,721
Total	**124,826**	**0**	**0**	**0**	**0**	**124,826**

Building Damage by Count by General Occupancy 20 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Total	**663,685**	**0**	**0**	**0**	**0**	**663,685**
Study Region Total	**663,685**	**0**	**0**	**0**	**0**	**663,685**

Building Damage by Count by General Occupancy 50 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Agriculture	67	0	0	0	0	67
Commercial	2,751	6	0	0	0	2,757
Education	221	1	0	0	0	222
Government	103	0	0	0	0	103
Industrial	498	1	0	0	0	499
Religion	380	1	0	0	0	381
Residential	29,915	28	169	0	0	30,112
Total	**33,935**	**37**	**169**	**0**	**0**	**34,141**
Arlington						
Agriculture	101	0	0	0	0	101
Commercial	3,622	8	0	0	0	3,630
Education	188	0	0	0	0	188
Government	276	1	0	0	0	277
Industrial	642	2	0	0	0	644
Religion	417	1	0	0	0	418
Residential	42,767	35	271	0	0	43,073
Total	**48,014**	**46**	**271**	**0**	**0**	**48,331**
Fairfax						
Agriculture	759	1	0	0	0	760
Commercial	16,752	35	0	0	0	16,787
Education	867	2	0	0	0	869
Government	501	1	0	0	0	502
Industrial	3,863	9	0	0	0	3,872
Religion	1,691	3	0	0	0	1,694
Residential	301,792	102	2,360	0	0	304,254
Total	**326,226**	**152**	**2,360**	**0**	**0**	**328,738**

Building Damage by Count by General Occupancy 50 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Agriculture	42	0	0	0	0	42
Commercial	839	2	0	0	0	841
Education	29	0	0	0	0	29
Government	14	0	0	0	0	14
Industrial	195	0	0	0	0	195
Religion	92	0	0	0	0	92
Residential	6,846	3	53	0	0	6,902
Total	**8,056**	**6**	**53**	**0**	**0**	**8,115**
Falls Church						
Agriculture	21	0	0	0	0	21
Commercial	455	1	0	0	0	456
Education	28	0	0	0	0	28
Government	9	0	0	0	0	9
Industrial	89	0	0	0	0	89
Religion	49	0	0	0	0	49
Residential	3,453	2	27	0	0	3,483
Total	**4,104**	**4**	**27**	**0**	**0**	**4,135**
Loudoun						
Agriculture	323	1	0	0	0	324
Commercial	4,086	9	0	0	0	4,095
Education	184	0	0	0	0	184
Government	121	0	0	0	0	121
Industrial	1,184	3	0	0	0	1,187
Religion	383	1	0	0	0	384
Residential	91,466	20	1,401	0	0	92,887
Total	**97,746**	**34**	**1,401**	**0**	**0**	**99,182**

Building Damage by Count by General Occupancy 50 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Agriculture	29	0	0	0	0	29
Commercial	824	2	0	0	0	826
Education	40	0	0	0	0	40
Government	28	0	0	0	0	28
Industrial	254	1	0	0	0	255
Religion	85	0	0	0	0	85
Residential	10,491	3	100	0	0	10,595
Total	**11,751**	**6**	**100**	**0**	**0**	**11,858**
Manassas Park						
Agriculture	24	0	0	0	0	24
Commercial	180	0	0	0	0	180
Education	19	0	0	0	0	19
Government	8	0	0	0	0	8
Industrial	80	0	0	0	0	80
Religion	14	0	0	0	0	14
Residential	3,992	1	41	0	0	4,034
Total	**4,316**	**2**	**41**	**0**	**0**	**4,359**
Prince William						
Agriculture	282	0	0	0	0	282
Commercial	4,646	10	0	0	0	4,656
Education	274	1	0	0	0	275
Government	121	0	0	0	0	121
Industrial	1,321	3	0	0	0	1,324
Religion	446	1	0	0	0	447
Residential	116,666	25	1,031	0	0	117,721
Total	**123,756**	**40**	**1,031**	**0**	**0**	**124,826**

Building Damage by Count by General Occupancy 50 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Total	**657,905**	**326**	**5,454**	**0**	**0**	**663,685**
Study Region Total	**657,905**	**326**	**5,454**	**0**	**0**	**663,685**

Building Damage by Count by General Occupancy 100 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Agriculture	67	0	0	0	0	67
Commercial	2,748	9	0	0	0	2,757
Education	221	1	0	0	0	222
Government	103	0	0	0	0	103
Industrial	497	2	0	0	0	499
Religion	380	1	0	0	0	381
Residential	28,393	56	1,663	0	0	30,112
Total	**32,409**	**69**	**1,663**	**0**	**0**	**34,141**
Arlington						
Agriculture	101	0	0	0	0	101
Commercial	3,619	11	0	0	0	3,630
Education	187	1	0	0	0	188
Government	276	1	0	0	0	277
Industrial	642	2	0	0	0	644
Religion	417	1	0	0	0	418
Residential	40,619	69	2,386	0	0	43,073
Total	**45,861**	**85**	**2,386**	**0**	**0**	**48,331**
Fairfax						
Agriculture	758	2	0	0	0	760
Commercial	16,739	48	0	0	0	16,787
Education	866	3	0	0	0	869
Government	500	2	0	0	0	502
Industrial	3,860	12	0	0	0	3,872
Religion	1,690	4	0	0	0	1,694
Residential	286,350	216	17,688	0	0	304,254
Total	**310,765**	**285**	**17,688**	**0**	**0**	**328,738**

Building Damage by Count by General Occupancy 100 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Agriculture	42	0	0	0	0	42
Commercial	839	2	0	0	0	841
Education	29	0	0	0	0	29
Government	14	0	0	0	0	14
Industrial	194	1	0	0	0	195
Religion	92	0	0	0	0	92
Residential	6,513	6	384	0	0	6,902
Total	**7,722**	**9**	**384**	**0**	**0**	**8,115**
Falls Church						
Agriculture	21	0	0	0	0	21
Commercial	455	1	0	0	0	456
Education	28	0	0	0	0	28
Government	9	0	0	0	0	9
Industrial	89	0	0	0	0	89
Religion	49	0	0	0	0	49
Residential	3,238	5	239	0	0	3,483
Total	**3,888**	**7**	**239**	**0**	**0**	**4,135**
Loudoun						
Agriculture	323	1	0	0	0	324
Commercial	4,084	11	0	0	0	4,095
Education	183	1	0	0	0	184
Government	121	0	0	0	0	121
Industrial	1,183	4	0	0	0	1,187
Religion	383	1	0	0	0	384
Residential	88,235	39	4,613	0	0	92,887
Total	**94,513**	**56**	**4,613**	**0**	**0**	**99,182**

Building Damage by Count by General Occupancy 100 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Agriculture	29	0	0	0	0	29
Commercial	824	2	0	0	0	826
Education	40	0	0	0	0	40
Government	28	0	0	0	0	28
Industrial	254	1	0	0	0	255
Religion	85	0	0	0	0	85
Residential	10,209	5	381	0	0	10,595
Total	**11,469**	**8**	**381**	**0**	**0**	**11,858**
Manassas Park						
Agriculture	24	0	0	0	0	24
Commercial	180	0	0	0	0	180
Education	19	0	0	0	0	19
Government	8	0	0	0	0	8
Industrial	80	0	0	0	0	80
Religion	14	0	0	0	0	14
Residential	3,854	2	178	0	0	4,034
Total	**4,178**	**3**	**178**	**0**	**0**	**4,359**
Prince William						
Agriculture	281	1	0	0	0	282
Commercial	4,644	12	0	0	0	4,656
Education	274	1	0	0	0	275
Government	121	0	0	0	0	121
Industrial	1,320	4	0	0	0	1,324
Religion	446	1	0	0	0	447
Residential	112,345	51	5,325	1	0	117,721
Total	**119,431**	**69**	**5,325**	**1**	**0**	**124,826**

Building Damage by Count by General Occupancy 100 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Total	**630,237**	**591**	**32,857**	**1**	**0**	**663,685**
Study Region Total	**630,237**	**591**	**32,857**	**1**	**0**	**663,685**

Building Damage by Count by General Occupancy 200 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Agriculture	66	1	0	0	0	67
Commercial	2,733	23	1	0	0	2,757
Education	220	2	0	0	0	222
Government	102	1	0	0	0	103
Industrial	495	4	0	0	0	499
Religion	378	3	0	0	0	381
Residential	20,476	306	9,211	118	0	30,112
Total	**24,471**	**340**	**9,212**	**118**	**0**	**34,141**
Arlington						
Agriculture	100	1	0	0	0	101
Commercial	3,603	26	1	0	0	3,630
Education	187	1	0	0	0	188
Government	275	2	0	0	0	277
Industrial	639	5	0	0	0	644
Religion	416	2	0	0	0	418
Residential	31,421	327	11,239	86	0	43,073
Total	**36,641**	**364**	**11,240**	**86**	**0**	**48,331**
Fairfax						
Agriculture	757	3	0	0	0	760
Commercial	16,700	85	2	0	0	16,787
Education	864	5	0	0	0	869
Government	499	3	0	0	0	502
Industrial	3,850	22	0	0	0	3,872
Religion	1,687	7	0	0	0	1,694
Residential	237,979	1,077	64,732	466	0	304,254
Total	**262,336**	**1,202**	**64,734**	**466**	**0**	**328,738**

Building Damage by Count by General Occupancy 200 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Agriculture	42	0	0	0	0	42
Commercial	837	4	0	0	0	841
Education	29	0	0	0	0	29
Government	14	0	0	0	0	14
Industrial	194	1	0	0	0	195
Religion	92	0	0	0	0	92
Residential	5,773	16	1,112	1	0	6,902
Total	**6,980**	**21**	**1,112**	**1**	**0**	**8,115**
Falls Church						
Agriculture	21	0	0	0	0	21
Commercial	453	3	0	0	0	456
Education	28	0	0	0	0	28
Government	9	0	0	0	0	9
Industrial	88	1	0	0	0	89
Religion	49	0	0	0	0	49
Residential	2,552	22	903	6	0	3,483
Total	**3,200**	**26**	**903**	**6**	**0**	**4,135**
Loudoun						
Agriculture	324	0	0	0	0	324
Commercial	4,089	6	0	0	0	4,095
Education	184	0	0	0	0	184
Government	121	0	0	0	0	121
Industrial	1,185	2	0	0	0	1,187
Religion	384	0	0	0	0	384
Residential	91,171	17	1,699	0	0	92,887
Total	**97,457**	**27**	**1,699**	**0**	**0**	**99,182**

Building Damage by Count by General Occupancy 200 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Agriculture	29	0	0	0	0	29
Commercial	823	3	0	0	0	826
Education	40	0	0	0	0	40
Government	28	0	0	0	0	28
Industrial	254	1	0	0	0	255
Religion	85	0	0	0	0	85
Residential	9,242	16	1,336	1	0	10,595
Total	**10,500**	**21**	**1,336**	**1**	**0**	**11,858**
Manassas Park						
Agriculture	24	0	0	0	0	24
Commercial	179	1	0	0	0	180
Education	19	0	0	0	0	19
Government	8	0	0	0	0	8
Industrial	80	0	0	0	0	80
Religion	14	0	0	0	0	14
Residential	3,450	7	577	1	0	4,034
Total	**3,773**	**8**	**577**	**1**	**0**	**4,359**
Prince William						
Agriculture	281	1	0	0	0	282
Commercial	4,627	29	1	0	0	4,656
Education	273	2	0	0	0	275
Government	120	1	0	0	0	121
Industrial	1,315	8	0	0	0	1,324
Religion	445	2	0	0	0	447
Residential	85,909	538	30,858	416	0	117,721
Total	**92,970**	**581**	**30,859**	**416**	**0**	**124,826**

Building Damage by Count by General Occupancy 200 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Total	**538,327**	**2,591**	**121,671**	**1,095**	**0**	**663,685**
Study Region Total	**538,327**	**2,591**	**121,671**	**1,095**	**0**	**663,685**

Building Damage by Count by General Occupancy 500 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Agriculture	66	1	0	0	0	67
Commercial	2,727	28	1	0	0	2,757
Education	220	2	0	0	0	222
Government	102	1	0	0	0	103
Industrial	494	5	0	0	0	499
Religion	378	3	0	0	0	381
Residential	17,961	435	11,464	252	0	30,112
Total	**21,947**	**476**	**11,466**	**252**	**0**	**34,141**
Arlington						
Agriculture	100	1	0	0	0	101
Commercial	3,588	40	2	0	0	3,630
Education	186	2	0	0	0	188
Government	274	3	0	0	0	277
Industrial	637	7	0	0	0	644
Religion	414	4	0	0	0	418
Residential	22,646	661	19,273	493	0	43,073
Total	**27,844**	**719**	**19,275**	**493**	**0**	**48,331**
Fairfax						
Agriculture	750	9	1	0	0	760
Commercial	16,566	207	13	0	0	16,787
Education	858	10	0	0	0	869
Government	496	6	0	0	0	502
Industrial	3,822	48	1	0	0	3,872
Religion	1,676	18	0	0	0	1,694
Residential	114,752	4,771	178,816	5,915	0	304,254
Total	**138,921**	**5,070**	**178,832**	**5,915**	**0**	**328,738**

Building Damage by Count by General Occupancy 500 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Agriculture	41	1	0	0	0	42
Commercial	829	12	1	0	0	841
Education	29	0	0	0	0	29
Government	14	0	0	0	0	14
Industrial	192	3	0	0	0	195
Religion	91	1	0	0	0	92
Residential	2,352	130	4,251	169	0	6,902
Total	**3,547**	**147**	**4,252**	**169**	**0**	**8,115**
Falls Church						
Agriculture	21	0	0	0	0	21
Commercial	449	6	0	0	0	456
Education	28	0	0	0	0	28
Government	9	0	0	0	0	9
Industrial	88	1	0	0	0	89
Religion	48	1	0	0	0	49
Residential	1,309	70	2,038	65	0	3,483
Total	**1,952**	**79**	**2,039**	**65**	**0**	**4,135**
Loudoun						
Agriculture	321	3	0	0	0	324
Commercial	4,047	46	3	0	0	4,095
Education	182	2	0	0	0	184
Government	120	1	0	0	0	121
Industrial	1,173	14	0	0	0	1,187
Religion	380	4	0	0	0	384
Residential	37,637	1,233	52,531	1,487	0	92,887
Total	**43,859**	**1,302**	**52,535**	**1,487**	**0**	**99,182**

Building Damage by Count by General Occupancy 500 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Agriculture	28	1	0	0	0	29
Commercial	811	14	1	0	0	826
Education	39	1	0	0	0	40
Government	28	0	0	0	0	28
Industrial	250	4	0	0	0	255
Religion	84	1	0	0	0	85
Residential	2,566	239	7,451	338	0	10,595
Total	**3,807**	**260**	**7,452**	**338**	**0**	**11,858**
Manassas Park						
Agriculture	23	0	0	0	0	24
Commercial	177	3	0	0	0	180
Education	19	0	0	0	0	19
Government	8	0	0	0	0	8
Industrial	78	1	0	0	0	80
Religion	14	0	0	0	0	14
Residential	687	100	3,097	150	0	4,034
Total	**1,006**	**106**	**3,097**	**151**	**0**	**4,359**
Prince William						
Agriculture	278	4	0	0	0	282
Commercial	4,590	61	4	0	0	4,656
Education	271	4	0	0	0	275
Government	119	2	0	0	0	121
Industrial	1,305	18	1	0	0	1,324
Religion	442	5	0	0	0	447
Residential	37,301	1,984	75,701	2,734	1	117,721
Total	**44,307**	**2,078**	**75,706**	**2,734**	**1**	**124,826**

Building Damage by Count by General Occupancy 500 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Total	**287,189**	**10,237**	**354,654**	**11,604**	**1**	**663,685**
Study Region Total	**287,189**	**10,237**	**354,654**	**11,604**	**1**	**663,685**

Building Damage by Count by General Occupancy 1000 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Alexandria						
Agriculture	67	0	0	0	0	67
Commercial	2,735	22	1	0	0	2,757
Education	220	2	0	0	0	222
Government	102	1	0	0	0	103
Industrial	495	4	0	0	0	499
Religion	379	2	0	0	0	381
Residential	21,217	291	8,513	91	0	30,112
Total	**25,214**	**322**	**8,513**	**91**	**0**	**34,141**
Arlington						
Agriculture	100	1	0	0	0	101
Commercial	3,598	31	1	0	0	3,630
Education	186	2	0	0	0	188
Government	275	2	0	0	0	277
Industrial	638	6	0	0	0	644
Religion	415	3	0	0	0	418
Residential	27,303	456	15,065	250	0	43,073
Total	**32,515**	**500**	**15,066**	**250**	**0**	**48,331**
Fairfax						
Agriculture	745	13	1	0	0	760
Commercial	16,492	271	23	1	0	16,787
Education	856	13	0	0	0	869
Government	494	8	0	0	0	502
Industrial	3,807	62	3	0	0	3,872
Religion	1,670	24	0	0	0	1,694
Residential	77,465	7,938	206,881	11,937	33	304,254
Total	**101,529**	**8,328**	**206,909**	**11,939**	**33**	**328,738**

Building Damage by Count by General Occupancy 1000 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Fairfax City						
Agriculture	41	1	0	0	0	42
Commercial	825	15	1	0	0	841
Education	29	0	0	0	0	29
Government	14	0	0	0	0	14
Industrial	191	3	0	0	0	195
Religion	91	1	0	0	0	92
Residential	1,583	176	4,878	264	0	6,902
Total	**2,774**	**197**	**4,880**	**264**	**0**	**8,115**
Falls Church						
Agriculture	21	0	0	0	0	21
Commercial	450	6	0	0	0	456
Education	28	0	0	0	0	28
Government	9	0	0	0	0	9
Industrial	88	1	0	0	0	89
Religion	48	1	0	0	0	49
Residential	1,548	60	1,824	51	0	3,483
Total	**2,192**	**68**	**1,824**	**51**	**0**	**4,135**
Loudoun						
Agriculture	310	11	2	1	0	324
Commercial	3,938	140	16	1	0	4,095
Education	177	7	0	0	0	184
Government	117	4	0	0	0	121
Industrial	1,144	40	3	1	0	1,187
Religion	370	13	1	0	0	384
Residential	-31,275	7,778	104,227	12,051	105	92,887
Total	**-25,219**	**7,994**	**104,249**	**12,054**	**105**	**99,182**

Building Damage by Count by General Occupancy 1000 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Virginia						
Manassas						
Agriculture	27	2	0	0	0	29
Commercial	783	38	4	0	0	826
Education	38	2	0	0	0	40
Government	27	1	0	0	0	28
Industrial	242	11	1	0	0	255
Religion	81	4	0	0	0	85
Residential	-5,086	1,219	12,674	1,770	19	10,595
Total	**-3,888**	**1,277**	**12,680**	**1,770**	**19**	**11,858**
Manassas Park						
Agriculture	23	1	0	0	0	24
Commercial	172	7	1	0	0	180
Education	18	1	0	0	0	19
Government	8	0	0	0	0	8
Industrial	76	3	0	0	0	80
Religion	13	1	0	0	0	14
Residential	-1,921	433	4,874	641	6	4,034
Total	**-1,611**	**446**	**4,876**	**642**	**6**	**4,359**
Prince William						
Agriculture	268	12	2	1	0	282
Commercial	4,494	143	17	2	0	4,656
Education	267	8	0	0	0	275
Government	117	3	0	0	0	121
Industrial	1,277	43	3	1	0	1,324
Religion	433	14	1	0	0	447
Residential	-26,977	8,269	122,960	13,324	145	117,721
Total	**-20,121**	**8,492**	**122,984**	**13,327**	**145**	**124,826**

Study Region : NOVA_EQ_FL_HU_Test
Scenario : Probabilistic

Building Damage by Count by General Occupancy 1000 - year Event

July 26, 2021

	# of Buildings					
	None	Minor	Moderate	Severe	Destruction	Total
Total	**113,384**	**27,624**	**481,981**	**40,389**	**307**	**663,685**
Study Region Total	**113,384**	**27,624**	**481,981**	**40,389**	**307**	**663,685**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Building Damage by General Occupancy: 10 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Alexandria						
Agriculture	185.19	100.00	0.00	0.00	0.00	0.00
Commercial	23,003.38	100.00	0.00	0.00	0.00	0.00
Education	5,481.96	100.00	0.00	0.00	0.00	0.00
Government	859.97	100.00	0.00	0.00	0.00	0.00
Industrial	2,525.69	100.00	0.00	0.00	0.00	0.00
Religion	3,204.13	100.00	0.00	0.00	0.00	0.00
Residential	98,187.41	100.00	0.00	0.00	0.00	0.00
Total	133,447.73	100.00	0.00	0.00	0.00	0.00
Arlington						
Agriculture	231.98	100.00	0.00	0.00	0.00	0.00
Commercial	27,725.62	100.00	0.00	0.00	0.00	0.00
Education	1,582.71	100.00	0.00	0.00	0.00	0.00
Government	2,526.46	100.00	0.00	0.00	0.00	0.00
Industrial	2,826.60	100.00	0.00	0.00	0.00	0.00
Religion	3,432.34	100.00	0.00	0.00	0.00	0.00
Residential	145,233.15	100.00	0.00	0.00	0.00	0.00
Total	183,558.85	100.00	0.00	0.00	0.00	0.00

Building Damage by General Occupancy: 10 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Fairfax						
Agriculture	2,437.78	100.00	0.00	0.00	0.00	0.00
Commercial	132,269.18	100.00	0.00	0.00	0.00	0.00
Education	7,503.85	100.00	0.00	0.00	0.00	0.00
Government	3,866.87	100.00	0.00	0.00	0.00	0.00
Industrial	20,666.37	100.00	0.00	0.00	0.00	0.00
Religion	10,316.26	100.00	0.00	0.00	0.00	0.00
Residential	728,210.52	100.00	0.00	0.00	0.00	0.00
Total	905,270.82	100.00	0.00	0.00	0.00	0.00
Fairfax City						
Agriculture	111.99	100.00	0.00	0.00	0.00	0.00
Commercial	7,943.76	100.00	0.00	0.00	0.00	0.00
Education	183.53	100.00	0.00	0.00	0.00	0.00
Government	96.70	100.00	0.00	0.00	0.00	0.00
Industrial	1,117.04	100.00	0.00	0.00	0.00	0.00
Religion	625.49	100.00	0.00	0.00	0.00	0.00
Residential	16,253.12	100.00	0.00	0.00	0.00	0.00
Total	26,331.62	100.00	0.00	0.00	0.00	0.00

Building Damage by General Occupancy: 10 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Falls Church						
Agriculture	66.25	100.00	0.00	0.00	0.00	0.00
Commercial	3,126.60	100.00	0.00	0.00	0.00	0.00
Education	112.32	100.00	0.00	0.00	0.00	0.00
Government	79.45	100.00	0.00	0.00	0.00	0.00
Industrial	345.11	100.00	0.00	0.00	0.00	0.00
Religion	330.85	100.00	0.00	0.00	0.00	0.00
Residential	9,077.57	100.00	0.00	0.00	0.00	0.00
Total	13,138.13	100.00	0.00	0.00	0.00	0.00
Loudoun						
Agriculture	1,396.97	100.00	0.00	0.00	0.00	0.00
Commercial	27,790.84	100.00	0.00	0.00	0.00	0.00
Education	1,559.67	100.00	0.00	0.00	0.00	0.00
Government	912.67	100.00	0.00	0.00	0.00	0.00
Industrial	7,288.11	100.00	0.00	0.00	0.00	0.00
Religion	2,113.38	100.00	0.00	0.00	0.00	0.00
Residential	211,121.39	100.00	0.00	0.00	0.00	0.00
Total	252,183.03	100.00	0.00	0.00	0.00	0.00

Building Damage by General Occupancy: 10 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Manassas						
Agriculture	101.42	100.00	0.00	0.00	0.00	0.00
Commercial	5,641.14	100.00	0.00	0.00	0.00	0.00
Education	296.80	100.00	0.00	0.00	0.00	0.00
Government	198.31	100.00	0.00	0.00	0.00	0.00
Industrial	1,809.78	100.00	0.00	0.00	0.00	0.00
Religion	329.01	100.00	0.00	0.00	0.00	0.00
Residential	22,247.16	100.00	0.00	0.00	0.00	0.00
Total	30,623.62	100.00	0.00	0.00	0.00	0.00
Manassas Park						
Agriculture	65.08	100.00	0.00	0.00	0.00	0.00
Commercial	1,114.23	100.00	0.00	0.00	0.00	0.00
Education	113.13	100.00	0.00	0.00	0.00	0.00
Government	32.84	100.00	0.00	0.00	0.00	0.00
Industrial	527.46	100.00	0.00	0.00	0.00	0.00
Religion	44.27	100.00	0.00	0.00	0.00	0.00
Residential	8,109.77	100.00	0.00	0.00	0.00	0.00
Total	10,006.78	100.00	0.00	0.00	0.00	0.00

Building Damage by General Occupancy: 10 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Prince William						
Agriculture	1,522.90	100.00	0.00	0.00	0.00	0.00
Commercial	28,211.86	100.00	0.00	0.00	0.00	0.00
Education	1,758.00	100.00	0.00	0.00	0.00	0.00
Government	794.66	100.00	0.00	0.00	0.00	0.00
Industrial	6,316.46	100.00	0.00	0.00	0.00	0.00
Religion	2,216.61	100.00	0.00	0.00	0.00	0.00
Residential	256,108.53	100.00	0.00	0.00	0.00	0.00
Total	296,929.01	100.00	0.00	0.00	0.00	0.00
Total	1,851,489.59	100.00	0.00	0.00	0.00	0.00
Study Region Average	1,851,489.59	100.00	0.00	0.00	0.00	0.00

Building Damage by General Occupancy: 20 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Alexandria						
Agriculture	185.19	100.00	0.00	0.00	0.00	0.00
Commercial	23,003.38	100.00	0.00	0.00	0.00	0.00
Education	5,481.96	100.00	0.00	0.00	0.00	0.00
Government	859.97	100.00	0.00	0.00	0.00	0.00
Industrial	2,525.69	100.00	0.00	0.00	0.00	0.00
Religion	3,204.13	100.00	0.00	0.00	0.00	0.00
Residential	98,187.41	100.00	0.00	0.00	0.00	0.00
Total	133,447.73	100.00	0.00	0.00	0.00	0.00
Arlington						
Agriculture	231.98	100.00	0.00	0.00	0.00	0.00
Commercial	27,725.62	100.00	0.00	0.00	0.00	0.00
Education	1,582.71	100.00	0.00	0.00	0.00	0.00
Government	2,526.46	100.00	0.00	0.00	0.00	0.00
Industrial	2,826.60	100.00	0.00	0.00	0.00	0.00
Religion	3,432.34	100.00	0.00	0.00	0.00	0.00
Residential	145,233.15	100.00	0.00	0.00	0.00	0.00
Total	183,558.85	100.00	0.00	0.00	0.00	0.00

Building Damage by General Occupancy: 20 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Fairfax						
Agriculture	2,437.78	100.00	0.00	0.00	0.00	0.00
Commercial	132,269.18	100.00	0.00	0.00	0.00	0.00
Education	7,503.85	100.00	0.00	0.00	0.00	0.00
Government	3,866.87	100.00	0.00	0.00	0.00	0.00
Industrial	20,666.37	100.00	0.00	0.00	0.00	0.00
Religion	10,316.26	100.00	0.00	0.00	0.00	0.00
Residential	728,210.52	100.00	0.00	0.00	0.00	0.00
Total	905,270.82	100.00	0.00	0.00	0.00	0.00
Fairfax City						
Agriculture	111.99	100.00	0.00	0.00	0.00	0.00
Commercial	7,943.76	100.00	0.00	0.00	0.00	0.00
Education	183.53	100.00	0.00	0.00	0.00	0.00
Government	96.70	100.00	0.00	0.00	0.00	0.00
Industrial	1,117.04	100.00	0.00	0.00	0.00	0.00
Religion	625.49	100.00	0.00	0.00	0.00	0.00
Residential	16,253.12	100.00	0.00	0.00	0.00	0.00
Total	26,331.62	100.00	0.00	0.00	0.00	0.00

Building Damage by General Occupancy: 20 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Falls Church						
Agriculture	66.25	100.00	0.00	0.00	0.00	0.00
Commercial	3,126.60	100.00	0.00	0.00	0.00	0.00
Education	112.32	100.00	0.00	0.00	0.00	0.00
Government	79.45	100.00	0.00	0.00	0.00	0.00
Industrial	345.11	100.00	0.00	0.00	0.00	0.00
Religion	330.85	100.00	0.00	0.00	0.00	0.00
Residential	9,077.57	100.00	0.00	0.00	0.00	0.00
Total	13,138.13	100.00	0.00	0.00	0.00	0.00
Loudoun						
Agriculture	1,396.97	100.00	0.00	0.00	0.00	0.00
Commercial	27,790.84	100.00	0.00	0.00	0.00	0.00
Education	1,559.67	100.00	0.00	0.00	0.00	0.00
Government	912.67	100.00	0.00	0.00	0.00	0.00
Industrial	7,288.11	100.00	0.00	0.00	0.00	0.00
Religion	2,113.38	100.00	0.00	0.00	0.00	0.00
Residential	211,121.39	100.00	0.00	0.00	0.00	0.00
Total	252,183.03	100.00	0.00	0.00	0.00	0.00

Building Damage by General Occupancy: 20 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Manassas						
Agriculture	101.42	100.00	0.00	0.00	0.00	0.00
Commercial	5,641.14	100.00	0.00	0.00	0.00	0.00
Education	296.80	100.00	0.00	0.00	0.00	0.00
Government	198.31	100.00	0.00	0.00	0.00	0.00
Industrial	1,809.78	100.00	0.00	0.00	0.00	0.00
Religion	329.01	100.00	0.00	0.00	0.00	0.00
Residential	22,247.16	100.00	0.00	0.00	0.00	0.00
Total	30,623.62	100.00	0.00	0.00	0.00	0.00
Manassas Park						
Agriculture	65.08	100.00	0.00	0.00	0.00	0.00
Commercial	1,114.23	100.00	0.00	0.00	0.00	0.00
Education	113.13	100.00	0.00	0.00	0.00	0.00
Government	32.84	100.00	0.00	0.00	0.00	0.00
Industrial	527.46	100.00	0.00	0.00	0.00	0.00
Religion	44.27	100.00	0.00	0.00	0.00	0.00
Residential	8,109.77	100.00	0.00	0.00	0.00	0.00
Total	10,006.78	100.00	0.00	0.00	0.00	0.00

Building Damage by General Occupancy: 20 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Prince William						
Agriculture	1,522.90	100.00	0.00	0.00	0.00	0.00
Commercial	28,211.86	100.00	0.00	0.00	0.00	0.00
Education	1,758.00	100.00	0.00	0.00	0.00	0.00
Government	794.66	100.00	0.00	0.00	0.00	0.00
Industrial	6,316.46	100.00	0.00	0.00	0.00	0.00
Religion	2,216.61	100.00	0.00	0.00	0.00	0.00
Residential	256,108.53	100.00	0.00	0.00	0.00	0.00
Total	296,929.01	100.00	0.00	0.00	0.00	0.00
Total	1,851,489.59	100.00	0.00	0.00	0.00	0.00
Study Region Average	1,851,489.59	100.00	0.00	0.00	0.00	0.00

Building Damage by General Occupancy: 50 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Alexandria						
Agriculture	185.19	99.86	0.14	0.00	0.00	0.00
Commercial	23,003.38	99.79	0.21	0.00	0.00	0.00
Education	5,481.96	99.76	0.24	0.00	0.00	0.00
Government	859.97	99.76	0.24	0.00	0.00	0.00
Industrial	2,525.69	99.77	0.23	0.00	0.00	0.00
Religion	3,204.13	99.83	0.17	0.00	0.00	0.00
Residential	98,187.41	99.35	0.09	0.56	0.00	0.00
Total	133,447.73	99.40	0.11	0.50	0.00	0.00
Arlington						
Agriculture	231.98	99.86	0.14	0.00	0.00	0.00
Commercial	27,725.62	99.78	0.22	0.00	0.00	0.00
Education	1,582.71	99.77	0.23	0.00	0.00	0.00
Government	2,526.46	99.75	0.25	0.00	0.00	0.00
Industrial	2,826.60	99.76	0.24	0.00	0.00	0.00
Religion	3,432.34	99.83	0.17	0.00	0.00	0.00
Residential	145,233.15	99.29	0.08	0.63	0.00	0.00
Total	183,558.85	99.34	0.10	0.56	0.00	0.00

Building Damage by General Occupancy: 50 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Fairfax						
Agriculture	2,437.78	99.86	0.14	0.00	0.00	0.00
Commercial	132,269.18	99.79	0.21	0.00	0.00	0.00
Education	7,503.85	99.78	0.22	0.00	0.00	0.00
Government	3,866.87	99.77	0.23	0.00	0.00	0.00
Industrial	20,666.37	99.77	0.23	0.00	0.00	0.00
Religion	10,316.26	99.84	0.16	0.00	0.00	0.00
Residential	728,210.52	99.19	0.03	0.78	0.00	0.00
Total	905,270.82	99.24	0.05	0.72	0.00	0.00
Fairfax City						
Agriculture	111.99	99.86	0.14	0.00	0.00	0.00
Commercial	7,943.76	99.79	0.21	0.00	0.00	0.00
Education	183.53	99.78	0.22	0.00	0.00	0.00
Government	96.70	99.76	0.24	0.00	0.00	0.00
Industrial	1,117.04	99.77	0.23	0.00	0.00	0.00
Religion	625.49	99.84	0.16	0.00	0.00	0.00
Residential	16,253.12	99.19	0.04	0.77	0.00	0.00
Total	26,331.62	99.28	0.07	0.66	0.00	0.00

Building Damage by General Occupancy: 50 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Falls Church						
Agriculture	66.25	99.85	0.15	0.00	0.00	0.00
Commercial	3,126.60	99.78	0.22	0.00	0.00	0.00
Education	112.32	99.76	0.24	0.00	0.00	0.00
Government	79.45	99.74	0.26	0.00	0.00	0.00
Industrial	345.11	99.76	0.24	0.00	0.00	0.00
Religion	330.85	99.83	0.17	0.00	0.00	0.00
Residential	9,077.57	99.15	0.07	0.78	0.00	0.00
Total	13,138.13	99.25	0.09	0.66	0.00	0.00
Loudoun						
Agriculture	1,396.97	99.84	0.16	0.00	0.00	0.00
Commercial	27,790.84	99.77	0.23	0.00	0.00	0.00
Education	1,559.67	99.75	0.25	0.00	0.00	0.00
Government	912.67	99.74	0.26	0.00	0.00	0.00
Industrial	7,288.11	99.74	0.26	0.00	0.00	0.00
Religion	2,113.38	99.82	0.18	0.00	0.00	0.00
Residential	211,121.39	98.47	0.02	1.51	0.00	0.00
Total	252,183.03	98.55	0.03	1.41	0.00	0.00

Building Damage by General Occupancy: 50 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Manassas						
Agriculture	101.42	99.85	0.15	0.00	0.00	0.00
Commercial	5,641.14	99.77	0.23	0.00	0.00	0.00
Education	296.80	99.76	0.24	0.00	0.00	0.00
Government	198.31	99.74	0.26	0.00	0.00	0.00
Industrial	1,809.78	99.75	0.25	0.00	0.00	0.00
Religion	329.01	99.83	0.17	0.00	0.00	0.00
Residential	22,247.16	99.02	0.03	0.95	0.00	0.00
Total	30,623.62	99.10	0.05	0.85	0.00	0.00
Manassas Park						
Agriculture	65.08	99.85	0.15	0.00	0.00	0.00
Commercial	1,114.23	99.79	0.21	0.00	0.00	0.00
Education	113.13	99.76	0.24	0.00	0.00	0.00
Government	32.84	99.74	0.26	0.00	0.00	0.00
Industrial	527.46	99.74	0.26	0.00	0.00	0.00
Religion	44.27	99.83	0.18	0.00	0.00	0.00
Residential	8,109.77	98.96	0.03	1.02	0.00	0.00
Total	10,006.78	99.02	0.04	0.94	0.00	0.00

Building Damage by General Occupancy: 50 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Prince William						
Agriculture	1,522.90	99.86	0.14	0.00	0.00	0.00
Commercial	28,211.86	99.79	0.21	0.00	0.00	0.00
Education	1,758.00	99.77	0.23	0.00	0.00	0.00
Government	794.66	99.77	0.23	0.00	0.00	0.00
Industrial	6,316.46	99.76	0.24	0.00	0.00	0.00
Religion	2,216.61	99.83	0.17	0.00	0.00	0.00
Residential	256,108.53	99.10	0.02	0.88	0.00	0.00
Total	296,929.01	99.14	0.03	0.83	0.00	0.00
Total	1,851,489.59	99.13	0.05	0.82	0.00	0.00
Study Region Average	1,851,489.59	99.13	0.05	0.82	0.00	0.00

Building Damage by General Occupancy: 100 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Alexandria						
Agriculture	185.19	99.77	0.23	0.00	0.00	0.00
Commercial	23,003.38	99.69	0.31	0.00	0.00	0.00
Education	5,481.96	99.66	0.34	0.00	0.00	0.00
Government	859.97	99.64	0.36	0.00	0.00	0.00
Industrial	2,525.69	99.66	0.34	0.00	0.00	0.00
Religion	3,204.13	99.76	0.24	0.00	0.00	0.00
Residential	98,187.41	94.29	0.19	5.52	0.00	0.00
Total	133,447.73	94.93	0.20	4.87	0.00	0.00
Arlington						
Agriculture	231.98	99.78	0.22	0.00	0.00	0.00
Commercial	27,725.62	99.69	0.31	0.00	0.00	0.00
Education	1,582.71	99.67	0.33	0.00	0.00	0.00
Government	2,526.46	99.65	0.35	0.00	0.00	0.00
Industrial	2,826.60	99.67	0.33	0.00	0.00	0.00
Religion	3,432.34	99.77	0.24	0.00	0.00	0.00
Residential	145,233.15	94.30	0.16	5.54	0.00	0.00
Total	183,558.85	94.89	0.18	4.94	0.00	0.00

Building Damage by General Occupancy: 100 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Fairfax						
Agriculture	2,437.78	99.79	0.21	0.00	0.00	0.00
Commercial	132,269.18	99.72	0.28	0.00	0.00	0.00
Education	7,503.85	99.69	0.31	0.00	0.00	0.00
Government	3,866.87	99.68	0.32	0.00	0.00	0.00
Industrial	20,666.37	99.69	0.31	0.00	0.00	0.00
Religion	10,316.26	99.78	0.22	0.00	0.00	0.00
Residential	728,210.52	94.12	0.07	5.81	0.00	0.00
Total	905,270.82	94.53	0.09	5.38	0.00	0.00
Fairfax City						
Agriculture	111.99	99.79	0.21	0.00	0.00	0.00
Commercial	7,943.76	99.72	0.28	0.00	0.00	0.00
Education	183.53	99.69	0.31	0.00	0.00	0.00
Government	96.70	99.67	0.33	0.00	0.00	0.00
Industrial	1,117.04	99.68	0.32	0.00	0.00	0.00
Religion	625.49	99.78	0.22	0.00	0.00	0.00
Residential	16,253.12	94.36	0.09	5.56	0.00	0.00
Total	26,331.62	95.16	0.11	4.73	0.00	0.00

Building Damage by General Occupancy: 100 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Falls Church						
Agriculture	66.25	99.76	0.24	0.00	0.00	0.00
Commercial	3,126.60	99.68	0.32	0.00	0.00	0.00
Education	112.32	99.65	0.35	0.00	0.00	0.00
Government	79.45	99.63	0.37	0.00	0.00	0.00
Industrial	345.11	99.65	0.35	0.00	0.00	0.00
Religion	330.85	99.75	0.25	0.00	0.00	0.00
Residential	9,077.57	92.98	0.15	6.87	0.00	0.00
Total	13,138.13	94.03	0.18	5.79	0.00	0.00
Loudoun						
Agriculture	1,396.97	99.81	0.19	0.00	0.00	0.00
Commercial	27,790.84	99.73	0.27	0.00	0.00	0.00
Education	1,559.67	99.70	0.30	0.00	0.00	0.00
Government	912.67	99.69	0.31	0.00	0.00	0.00
Industrial	7,288.11	99.70	0.30	0.00	0.00	0.00
Religion	2,113.38	99.79	0.21	0.00	0.00	0.00
Residential	211,121.39	94.99	0.04	4.97	0.00	0.00
Total	252,183.03	95.29	0.06	4.65	0.00	0.00

Building Damage by General Occupancy: 100 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Manassas						
Agriculture	101.42	99.82	0.18	0.00	0.00	0.00
Commercial	5,641.14	99.74	0.26	0.00	0.00	0.00
Education	296.80	99.72	0.28	0.00	0.00	0.00
Government	198.31	99.71	0.29	0.00	0.00	0.00
Industrial	1,809.78	99.72	0.28	0.00	0.00	0.00
Religion	329.01	99.80	0.20	0.00	0.00	0.00
Residential	22,247.16	96.36	0.05	3.59	0.00	0.00
Total	30,623.62	96.72	0.07	3.21	0.00	0.00
Manassas Park						
Agriculture	65.08	99.81	0.19	0.00	0.00	0.00
Commercial	1,114.23	99.75	0.25	0.00	0.00	0.00
Education	113.13	99.71	0.29	0.00	0.00	0.00
Government	32.84	99.70	0.30	0.00	0.00	0.00
Industrial	527.46	99.70	0.30	0.00	0.00	0.00
Religion	44.27	99.80	0.20	0.00	0.00	0.00
Residential	8,109.77	95.54	0.05	4.42	0.00	0.00
Total	10,006.78	95.85	0.06	4.09	0.00	0.00

Building Damage by General Occupancy: 100 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Prince William						
Agriculture	1,522.90	99.82	0.18	0.00	0.00	0.00
Commercial	28,211.86	99.74	0.26	0.00	0.00	0.00
Education	1,758.00	99.71	0.29	0.00	0.00	0.00
Government	794.66	99.71	0.29	0.00	0.00	0.00
Industrial	6,316.46	99.71	0.29	0.00	0.00	0.00
Religion	2,216.61	99.80	0.20	0.00	0.00	0.00
Residential	256,108.53	95.43	0.04	4.52	0.00	0.00
Total	296,929.01	95.68	0.06	4.27	0.00	0.00
Total	1,851,489.59	94.96	0.09	4.95	0.00	0.00
Study Region Average	1,851,489.59	94.96	0.09	4.95	0.00	0.00

Building Damage by General Occupancy: 200 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Alexandria						
Agriculture	185.19	99.19	0.77	0.04	0.01	0.00
Commercial	23,003.38	99.13	0.84	0.03	0.00	0.00
Education	5,481.96	99.16	0.84	0.00	0.00	0.00
Government	859.97	99.09	0.91	0.00	0.00	0.00
Industrial	2,525.69	99.12	0.87	0.01	0.00	0.00
Religion	3,204.13	99.32	0.68	0.00	0.00	0.00
Residential	98,187.41	68.00	1.02	30.59	0.39	0.00
Total	133,447.73	71.68	1.00	26.98	0.35	0.00
Arlington						
Agriculture	231.98	99.36	0.61	0.02	0.01	0.00
Commercial	27,725.62	99.26	0.72	0.02	0.00	0.00
Education	1,582.71	99.25	0.75	0.00	0.00	0.00
Government	2,526.46	99.20	0.80	0.00	0.00	0.00
Industrial	2,826.60	99.24	0.76	0.00	0.00	0.00
Religion	3,432.34	99.44	0.56	0.00	0.00	0.00
Residential	145,233.15	72.95	0.76	26.09	0.20	0.00
Total	183,558.85	75.81	0.75	23.26	0.18	0.00

Building Damage by General Occupancy: 200 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Fairfax						
Agriculture	2,437.78	99.55	0.44	0.01	0.00	0.00
Commercial	132,269.18	99.48	0.51	0.01	0.00	0.00
Education	7,503.85	99.46	0.54	0.00	0.00	0.00
Government	3,866.87	99.40	0.60	0.00	0.00	0.00
Industrial	20,666.37	99.44	0.56	0.00	0.00	0.00
Religion	10,316.26	99.60	0.40	0.00	0.00	0.00
Residential	728,210.52	78.22	0.35	21.28	0.15	0.00
Total	905,270.82	79.80	0.37	19.69	0.14	0.00
Fairfax City						
Agriculture	111.99	99.64	0.36	0.00	0.00	0.00
Commercial	7,943.76	99.55	0.44	0.01	0.00	0.00
Education	183.53	99.54	0.46	0.00	0.00	0.00
Government	96.70	99.52	0.48	0.00	0.00	0.00
Industrial	1,117.04	99.52	0.48	0.00	0.00	0.00
Religion	625.49	99.66	0.34	0.00	0.00	0.00
Residential	16,253.12	83.64	0.23	16.12	0.02	0.00
Total	26,331.62	86.02	0.26	13.71	0.01	0.00

Building Damage by General Occupancy: 200 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Falls Church						
Agriculture	66.25	99.43	0.55	0.02	0.00	0.00
Commercial	3,126.60	99.35	0.64	0.01	0.00	0.00
Education	112.32	99.33	0.67	0.00	0.00	0.00
Government	79.45	99.31	0.69	0.00	0.00	0.00
Industrial	345.11	99.34	0.66	0.00	0.00	0.00
Religion	330.85	99.48	0.52	0.00	0.00	0.00
Residential	9,077.57	73.27	0.63	25.94	0.17	0.00
Total	13,138.13	77.38	0.63	21.85	0.14	0.00
Loudoun						
Agriculture	1,396.97	99.92	0.08	0.00	0.00	0.00
Commercial	27,790.84	99.84	0.16	0.00	0.00	0.00
Education	1,559.67	99.82	0.18	0.00	0.00	0.00
Government	912.67	99.83	0.17	0.00	0.00	0.00
Industrial	7,288.11	99.83	0.17	0.00	0.00	0.00
Religion	2,113.38	99.88	0.12	0.00	0.00	0.00
Residential	211,121.39	98.15	0.02	1.83	0.00	0.00
Total	252,183.03	98.26	0.03	1.71	0.00	0.00

Building Damage by General Occupancy: 200 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Manassas						
Agriculture	101.42	99.69	0.31	0.00	0.00	0.00
Commercial	5,641.14	99.59	0.40	0.00	0.00	0.00
Education	296.80	99.58	0.42	0.00	0.00	0.00
Government	198.31	99.56	0.44	0.00	0.00	0.00
Industrial	1,809.78	99.56	0.44	0.00	0.00	0.00
Religion	329.01	99.69	0.31	0.00	0.00	0.00
Residential	22,247.16	87.23	0.15	12.61	0.01	0.00
Total	30,623.62	88.55	0.18	11.26	0.01	0.00
Manassas Park						
Agriculture	65.08	99.66	0.33	0.01	0.00	0.00
Commercial	1,114.23	99.60	0.39	0.01	0.00	0.00
Education	113.13	99.55	0.45	0.00	0.00	0.00
Government	32.84	99.54	0.46	0.00	0.00	0.00
Industrial	527.46	99.53	0.47	0.00	0.00	0.00
Religion	44.27	99.68	0.32	0.00	0.00	0.00
Residential	8,109.77	85.52	0.17	14.30	0.01	0.00
Total	10,006.78	86.56	0.19	13.24	0.01	0.00

Building Damage by General Occupancy: 200 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Prince William						
Agriculture	1,522.90	99.52	0.46	0.02	0.00	0.00
Commercial	28,211.86	99.37	0.61	0.02	0.00	0.00
Education	1,758.00	99.29	0.71	0.00	0.00	0.00
Government	794.66	99.35	0.65	0.00	0.00	0.00
Industrial	6,316.46	99.36	0.63	0.01	0.00	0.00
Religion	2,216.61	99.54	0.46	0.00	0.00	0.00
Residential	256,108.53	72.98	0.46	26.21	0.35	0.00
Total	296,929.01	74.48	0.47	24.72	0.33	0.00
Total	1,851,489.59	81.11	0.39	18.33	0.17	0.00
Study Region Average	1,851,489.59	81.11	0.39	18.33	0.17	0.00

Building Damage by General Occupancy: 500 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Alexandria						
Agriculture	185.19	98.93	0.99	0.06	0.01	0.00
Commercial	23,003.38	98.92	1.03	0.05	0.00	0.00
Education	5,481.96	98.94	1.05	0.01	0.00	0.00
Government	859.97	98.94	1.05	0.01	0.00	0.00
Industrial	2,525.69	98.91	1.06	0.02	0.00	0.00
Religion	3,204.13	99.14	0.85	0.01	0.00	0.00
Residential	98,187.41	59.65	1.44	38.07	0.84	0.00
Total	133,447.73	64.28	1.39	33.58	0.74	0.00
Arlington						
Agriculture	231.98	98.81	1.10	0.08	0.02	0.00
Commercial	27,725.62	98.84	1.11	0.05	0.00	0.00
Education	1,582.71	98.88	1.11	0.01	0.00	0.00
Government	2,526.46	98.86	1.13	0.01	0.00	0.00
Industrial	2,826.60	98.85	1.13	0.02	0.00	0.00
Religion	3,432.34	99.06	0.93	0.01	0.00	0.00
Residential	145,233.15	52.58	1.53	44.75	1.14	0.00
Total	183,558.85	57.61	1.49	39.88	1.02	0.00

Building Damage by General Occupancy: 500 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Fairfax						
Agriculture	2,437.78	98.63	1.24	0.10	0.03	0.00
Commercial	132,269.18	98.69	1.23	0.08	0.00	0.00
Education	7,503.85	98.78	1.21	0.01	0.00	0.00
Government	3,866.87	98.77	1.22	0.02	0.00	0.00
Industrial	20,666.37	98.71	1.25	0.03	0.00	0.00
Religion	10,316.26	98.94	1.05	0.01	0.00	0.00
Residential	728,210.52	37.72	1.57	58.77	1.94	0.00
Total	905,270.82	42.26	1.54	54.40	1.80	0.00
Fairfax City						
Agriculture	111.99	98.36	1.47	0.13	0.04	0.00
Commercial	7,943.76	98.52	1.39	0.09	0.00	0.00
Education	183.53	98.61	1.37	0.02	0.00	0.00
Government	96.70	98.57	1.41	0.02	0.00	0.00
Industrial	1,117.04	98.50	1.44	0.05	0.01	0.00
Religion	625.49	98.77	1.21	0.02	0.00	0.00
Residential	16,253.12	34.08	1.89	61.59	2.45	0.00
Total	26,331.62	43.71	1.81	52.39	2.08	0.00

Building Damage by General Occupancy: 500 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Falls Church						
Agriculture	66.25	98.43	1.43	0.11	0.03	0.00
Commercial	3,126.60	98.56	1.37	0.07	0.00	0.00
Education	112.32	98.62	1.36	0.02	0.00	0.00
Government	79.45	98.57	1.41	0.02	0.00	0.00
Industrial	345.11	98.63	1.34	0.03	0.00	0.00
Religion	330.85	98.79	1.19	0.02	0.00	0.00
Residential	9,077.57	37.60	2.01	58.52	1.87	0.00
Total	13,138.13	47.21	1.91	49.31	1.57	0.00
Loudoun						
Agriculture	1,396.97	98.99	0.94	0.06	0.02	0.00
Commercial	27,790.84	98.82	1.12	0.07	0.00	0.00
Education	1,559.67	98.87	1.12	0.01	0.00	0.00
Government	912.67	98.86	1.13	0.01	0.00	0.00
Industrial	7,288.11	98.81	1.16	0.03	0.00	0.00
Religion	2,113.38	99.04	0.95	0.01	0.00	0.00
Residential	211,121.39	40.52	1.33	56.55	1.60	0.00
Total	252,183.03	44.22	1.31	52.97	1.50	0.00

Building Damage by General Occupancy: 500 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Manassas						
Agriculture	101.42	97.99	1.79	0.17	0.05	0.00
Commercial	5,641.14	98.22	1.67	0.11	0.00	0.00
Education	296.80	98.34	1.63	0.03	0.00	0.00
Government	198.31	98.31	1.66	0.02	0.00	0.00
Industrial	1,809.78	98.23	1.69	0.06	0.01	0.00
Religion	329.01	98.48	1.49	0.03	0.00	0.00
Residential	22,247.16	24.22	2.26	70.33	3.19	0.00
Total	30,623.62	32.11	2.19	62.85	2.85	0.00
Manassas Park						
Agriculture	65.08	97.88	1.88	0.18	0.06	0.00
Commercial	1,114.23	98.19	1.62	0.18	0.01	0.00
Education	113.13	98.29	1.68	0.03	0.00	0.00
Government	32.84	98.24	1.73	0.03	0.00	0.00
Industrial	527.46	98.10	1.82	0.07	0.01	0.00
Religion	44.27	98.37	1.60	0.03	0.00	0.00
Residential	8,109.77	17.02	2.48	76.76	3.73	0.00
Total	10,006.78	23.07	2.42	71.05	3.45	0.00

Building Damage by General Occupancy: 500 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Prince William						
Agriculture	1,522.90	98.47	1.38	0.12	0.03	0.00
Commercial	28,211.86	98.59	1.32	0.09	0.00	0.00
Education	1,758.00	98.64	1.34	0.02	0.00	0.00
Government	794.66	98.70	1.28	0.02	0.00	0.00
Industrial	6,316.46	98.57	1.38	0.04	0.01	0.00
Religion	2,216.61	98.85	1.13	0.02	0.00	0.00
Residential	256,108.53	31.69	1.69	64.31	2.32	0.00
Total	296,929.01	35.49	1.66	60.65	2.19	0.00
Total	1,851,489.59	43.27	1.54	53.44	1.75	0.00
Study Region Average	1,851,489.59	43.27	1.54	53.44	1.75	0.00

Building Damage by General Occupancy: 1000 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Alexandria						
Agriculture	185.19	99.28	0.68	0.02	0.01	0.00
Commercial	23,003.38	99.19	0.79	0.02	0.00	0.00
Education	5,481.96	99.18	0.82	0.00	0.00	0.00
Government	859.97	99.18	0.82	0.00	0.00	0.00
Industrial	2,525.69	99.16	0.83	0.01	0.00	0.00
Religion	3,204.13	99.38	0.62	0.00	0.00	0.00
Residential	98,187.41	70.46	0.97	28.27	0.30	0.00
Total	133,447.73	73.85	0.94	24.94	0.27	0.00
Arlington						
Agriculture	231.98	99.16	0.79	0.04	0.01	0.00
Commercial	27,725.62	99.12	0.86	0.03	0.00	0.00
Education	1,582.71	99.14	0.86	0.00	0.00	0.00
Government	2,526.46	99.12	0.88	0.00	0.00	0.00
Industrial	2,826.60	99.11	0.88	0.01	0.00	0.00
Religion	3,432.34	99.31	0.69	0.00	0.00	0.00
Residential	145,233.15	63.39	1.06	34.97	0.58	0.00
Total	183,558.85	67.28	1.03	31.17	0.52	0.00

Building Damage by General Occupancy: 1000 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Fairfax						
Agriculture	2,437.78	98.06	1.70	0.18	0.06	0.00
Commercial	132,269.18	98.24	1.61	0.14	0.01	0.00
Education	7,503.85	98.47	1.50	0.03	0.00	0.00
Government	3,866.87	98.43	1.53	0.03	0.00	0.00
Industrial	20,666.37	98.33	1.60	0.06	0.01	0.00
Religion	10,316.26	98.56	1.42	0.03	0.00	0.00
Residential	728,210.52	25.46	2.61	68.00	3.92	0.01
Total	905,270.82	30.88	2.53	62.94	3.63	0.01
Fairfax City						
Agriculture	111.99	97.83	1.90	0.20	0.06	0.00
Commercial	7,943.76	98.14	1.73	0.12	0.00	0.00
Education	183.53	98.28	1.69	0.03	0.00	0.00
Government	96.70	98.24	1.72	0.03	0.00	0.00
Industrial	1,117.04	98.13	1.78	0.08	0.01	0.00
Religion	625.49	98.43	1.55	0.03	0.00	0.00
Residential	16,253.12	22.94	2.55	70.68	3.83	0.00
Total	26,331.62	34.18	2.43	60.13	3.26	0.00

Building Damage by General Occupancy: 1000 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Falls Church						
Agriculture	66.25	98.65	1.23	0.09	0.03	0.00
Commercial	3,126.60	98.72	1.22	0.06	0.00	0.00
Education	112.32	98.77	1.22	0.01	0.00	0.00
Government	79.45	98.71	1.28	0.01	0.00	0.00
Industrial	345.11	98.78	1.20	0.02	0.00	0.00
Religion	330.85	98.93	1.05	0.01	0.00	0.00
Residential	9,077.57	44.44	1.72	52.36	1.48	0.00
Total	13,138.13	53.01	1.64	44.11	1.24	0.00
Loudoun						
Agriculture	1,396.97	95.82	3.50	0.49	0.19	0.01
Commercial	27,790.84	96.16	3.42	0.39	0.03	0.00
Education	1,559.67	96.27	3.55	0.18	0.00	0.00
Government	912.67	96.43	3.40	0.17	0.00	0.00
Industrial	7,288.11	96.34	3.34	0.27	0.05	0.00
Religion	2,113.38	96.43	3.44	0.14	0.00	0.00
Residential	211,121.39	-33.67	8.37	112.21	12.97	0.11
Total	252,183.03	-25.43	8.06	105.11	12.15	0.11

Building Damage by General Occupancy: 1000 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Manassas						
Agriculture	101.42	93.42	5.37	0.85	0.34	0.02
Commercial	5,641.14	94.83	4.60	0.53	0.04	0.00
Education	296.80	95.24	4.48	0.28	0.00	0.00
Government	198.31	95.36	4.37	0.27	0.00	0.00
Industrial	1,809.78	94.97	4.50	0.45	0.08	0.00
Religion	329.01	95.19	4.59	0.22	0.00	0.00
Residential	22,247.16	-48.01	11.50	119.62	16.70	0.18
Total	30,623.62	-32.79	10.77	106.93	14.93	0.16
Manassas Park						
Agriculture	65.08	94.14	4.82	0.73	0.28	0.02
Commercial	1,114.23	95.40	3.92	0.61	0.07	0.00
Education	113.13	95.94	3.86	0.20	0.00	0.00
Government	32.84	95.81	3.97	0.22	0.00	0.00
Industrial	527.46	95.38	4.18	0.37	0.07	0.00
Religion	44.27	95.46	4.35	0.20	0.00	0.00
Residential	8,109.77	-47.62	10.74	120.83	15.90	0.15
Total	10,006.78	-36.96	10.24	111.86	14.72	0.14

Building Damage by General Occupancy: 1000 - year Event

July 26, 2021

	Square Footage (Thousand. sq.ft)	Damage State Probability (%)				
		None	Minor	Moderate	Severe	Destruction
Virginia						
Prince William						
Agriculture	1,522.90	94.90	4.19	0.64	0.26	0.01
Commercial	28,211.86	96.52	3.08	0.37	0.03	0.00
Education	1,758.00	97.09	2.79	0.12	0.00	0.00
Government	794.66	97.00	2.86	0.14	0.00	0.00
Industrial	6,316.46	96.46	3.25	0.25	0.04	0.00
Religion	2,216.61	96.79	3.08	0.13	0.00	0.00
Residential	256,108.53	-22.92	7.02	104.45	11.32	0.12
Total	296,929.01	-16.12	6.80	98.52	10.68	0.12
Total	1,851,489.59	17.08	4.16	72.62	6.09	0.05
Study Region Average	1,851,489.59	17.08	4.16	72.62	6.09	0.05

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Debris Summary Report: 10 - year Event

July 26, 2021

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Virginia					
Alexandria	0	0	0	0	0
Arlington	0	0	0	0	0
Fairfax	0	0	0	0	0
Fairfax City	0	0	0	0	0
Falls Church	0	0	0	0	0
Loudoun	0	0	0	0	0
Manassas	0	0	0	0	0
Manassas Park	0	0	0	0	0
Prince William	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**
Study Region Total	**0**	**0**	**0**	**0**	**0**

Debris Summary Report: 20 - year Event

July 26, 2021

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Virginia					
Alexandria	0	0	0	0	0
Arlington	0	0	0	0	0
Fairfax	0	0	0	0	0
Fairfax City	0	0	0	0	0
Falls Church	0	0	0	0	0
Loudoun	0	0	0	0	0
Manassas	0	0	0	0	0
Manassas Park	0	0	0	0	0
Prince William	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**
Study Region Total	**0**	**0**	**0**	**0**	**0**

Debris Summary Report: 50 - year Event

July 26, 2021

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Virginia					
Alexandria	0	0	0	0	0
Arlington	0	0	0	0	0
Fairfax	0	0	0	0	0
Fairfax City	0	0	0	0	0
Falls Church	0	0	0	0	0
Loudoun	0	7	394	496	897
Manassas	0	0	0	0	0
Manassas Park	0	0	0	0	0
Prince William	0	5	32	39	76
Total	**0**	**12**	**425**	**536**	**973**
Study Region Total	**0**	**12**	**425**	**536**	**973**

Debris Summary Report: 100 - year Event

July 26, 2021

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Virginia					
Alexandria	408	377	514	80	1,379
Arlington	567	441	506	159	1,673
Fairfax	1,213	1,618	3,597	2,333	8,761
Fairfax City	28	29	22	3	82
Falls Church	30	50	38	4	122
Loudoun	60	451	1,450	2,576	4,537
Manassas	5	40	107	90	242
Manassas Park	1	15	0	0	16
Prince William	182	571	1,032	3,113	4,898
Total	**2,494**	**3,592**	**7,267**	**8,357**	**21,710**
Study Region Total	**2,494**	**3,592**	**7,267**	**8,357**	**21,710**

Debris Summary Report: 200 - year Event

July 26, 2021

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Virginia					
Alexandria	2,457	1,646	1,336	227	5,666
Arlington	3,266	1,926	1,432	476	7,100
Fairfax	5,907	8,770	8,591	5,561	28,829
Fairfax City	91	144	164	38	437
Falls Church	141	143	95	8	387
Loudoun	5	124	649	912	1,690
Manassas	103	169	288	188	748
Manassas Park	50	75	64	17	206
Prince William	2,613	4,470	3,051	8,794	18,928
Total	**14,633**	**17,467**	**15,668**	**16,223**	**63,991**
Study Region Total	**14,633**	**17,467**	**15,668**	**16,223**	**63,991**

Debris Summary Report: 500 - year Event

July 26, 2021

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Virginia					
Alexandria	3,597	2,258	1,684	288	7,827
Arlington	5,722	3,731	2,407	633	12,493
Fairfax	23,960	32,956	25,664	18,718	101,298
Fairfax City	639	865	750	179	2,433
Falls Church	409	426	193	14	1,042
Loudoun	5,774	9,234	9,840	21,979	46,827
Manassas	1,067	1,424	1,160	608	4,259
Manassas Park	391	580	322	84	1,377
Prince William	8,419	13,602	11,236	32,519	65,776
Total	**49,978**	**65,076**	**53,257**	**75,021**	**243,332**
Study Region Total	**49,978**	**65,076**	**53,257**	**75,021**	**243,332**

Debris Summary Report: 1000 - year Event

July 26, 2021

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Virginia					
Alexandria	2,579	1,581	1,366	240	5,766
Arlington	3,882	2,692	1,721	492	8,787
Fairfax	36,184	48,066	35,856	30,546	150,652
Fairfax City	860	1,096	872	199	3,027
Falls Church	353	361	155	12	881
Loudoun	29,031	38,208	23,906	72,681	163,826
Manassas	4,326	5,026	2,237	1,121	12,710
Manassas Park	1,362	1,717	604	152	3,835
Prince William	33,148	43,412	27,937	82,283	186,780
Total	**111,725**	**142,159**	**94,654**	**187,726**	**536,264**
Study Region Total	**111,725**	**142,159**	**94,654**	**187,726**	**536,264**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings: Annualized Losses

July 26, 2021

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Virginia									
Alexandria	11,570	2,976	0	0.05	528	2	3	88	15,168
Arlington	15,425	3,893	0	0.05	692	2	3	112	20,128
Fairfax	95,769	23,052	1	0.06	4,178	5	6	564	123,575
Fairfax City	2,012	470	0	0.04	89	0	0	12	2,584
Falls Church	1,343	340	0	0.06	62	0	0	10	1,755
Loudoun	23,570	5,396	0	0.05	1,182	1	1	174	30,325
Manassas	2,503	601	0	0.05	141	0	0	21	3,266
Manassas Park	940	223	0	0.06	56	0	0	8	1,228
Prince William	35,903	8,722	0	0.07	1,729	1	2	247	46,603
Total	**189,035**	**45,674**	**2**	**0.06**	**8,657**	**13**	**15**	**1,236**	**244,632**
Study Region Total	**189,035**	**45,674**	**2**	**0.06**	**8,657**	**13**	**15**	**1,236**	**244,632**

Direct Economic Losses For Buildings: 10 - year Event

July 26, 2021

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Virginia									
Alexandria	0	0	0	0.00	0	0	0	0	0
Arlington	0	0	0	0.00	0	0	0	0	0
Fairfax	0	0	0	0.00	0	0	0	0	0
Fairfax City	0	0	0	0.00	0	0	0	0	0
Falls Church	0	0	0	0.00	0	0	0	0	0
Loudoun	0	0	0	0.00	0	0	0	0	0
Manassas	0	0	0	0.00	0	0	0	0	0
Manassas Park	0	0	0	0.00	0	0	0	0	0
Prince William	0	0	0	0.00	0	0	0	0	0
Total	**0**	**0**	**0**	**0.00**	**0**	**0**	**0**	**0**	**0**
Study Region Total	**0**	**0**	**0**	**0.00**	**0**	**0**	**0**	**0**	**0**

Direct Economic Losses For Buildings: 20 - year Event

July 26, 2021

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Virginia									
Alexandria	0	0	0	0.00	0	0	0	0	0
Arlington	0	0	0	0.00	0	0	0	0	0
Fairfax	0	0	0	0.00	0	0	0	0	0
Fairfax City	0	0	0	0.00	0	0	0	0	0
Falls Church	0	0	0	0.00	0	0	0	0	0
Loudoun	0	0	0	0.00	0	0	0	0	0
Manassas	0	0	0	0.00	0	0	0	0	0
Manassas Park	0	0	0	0.00	0	0	0	0	0
Prince William	0	0	0	0.00	0	0	0	0	0
Total	**0**	**0**	**0**	**0.00**	**0**	**0**	**0**	**0**	**0**
Study Region Total	**0**	**0**	**0**	**0.00**	**0**	**0**	**0**	**0**	**0**

Direct Economic Losses For Buildings: 50 - year Event

July 26, 2021

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Virginia									
Alexandria	61,903	1,678	0	0.26	449	0	0	0	64,030
Arlington	93,879	2,248	0	0.28	696	0	0	0	96,823
Fairfax	701,842	16,748	0	0.41	5,385	0	0	0	723,975
Fairfax City	15,461	405	0	0.33	124	0	0	0	15,989
Falls Church	8,617	215	0	0.36	69	0	0	0	8,901
Loudoun	284,813	10,378	0	0.63	3,101	0	0	0	298,292
Manassas	20,354	631	0	0.41	206	0	0	0	21,192
Manassas Park	7,571	230	0	0.49	80	0	0	0	7,881
Prince William	261,916	7,251	0	0.48	2,212	0	0	0	271,379
Total	**1,456,355**	**39,785**	**0**	**0.43**	**12,321**	**0**	**0**	**0**	**1,508,462**
Study Region Total	**1,456,355**	**39,785**	**0**	**0.43**	**12,321**	**0**	**0**	**0**	**1,508,462**

Direct Economic Losses For Buildings: 100 - year Event

July 26, 2021

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Virginia									
Alexandria	223,631	18,852	0	0.93	5,602	0	0	395	248,480
Arlington	315,039	25,315	0	0.94	7,375	0	0	410	348,139
Fairfax	2,080,848	167,085	0	1.22	41,853	0	0	500	2,290,285
Fairfax City	44,971	3,485	0	0.96	892	0	0	0	49,349
Falls Church	29,738	2,455	0	1.26	764	0	0	53	33,010
Loudoun	501,503	37,633	0	1.11	10,566	0	0	108	549,810
Manassas	36,037	2,365	0	0.73	786	0	0	0	39,188
Manassas Park	14,454	1,015	0	0.93	351	0	0	0	15,820
Prince William	584,426	43,241	0	1.07	12,212	0	0	267	640,146
Total	**3,830,647**	**301,445**	**0**	**1.12**	**80,402**	**0**	**0**	**1,734**	**4,214,227**
Study Region Total	**3,830,647**	**301,445**	**0**	**1.12**	**80,402**	**0**	**0**	**1,734**	**4,214,227**

Direct Economic Losses For Buildings: 200 - year Event

July 26, 2021

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Virginia									
Alexandria	674,246	125,061	0	2.81	30,735	0	0	2,255	832,298
Arlington	843,085	139,902	0	2.52	36,208	0	0	2,646	1,021,841
Fairfax	4,559,636	688,462	0	2.67	176,426	0	0	9,618	5,434,142
Fairfax City	88,728	10,252	0	1.90	2,898	0	0	102	101,980
Falls Church	69,393	10,474	0	2.93	2,803	0	0	171	82,840
Loudoun	244,635	13,195	0	0.54	3,743	0	0	0	261,573
Manassas	91,424	9,133	0	1.85	3,287	0	0	175	104,018
Manassas Park	35,644	3,602	0	2.28	1,415	0	0	87	40,747
Prince William	1,805,093	309,898	2	3.32	82,761	0	0	5,405	2,203,158
Total	**8,411,884**	**1,309,980**	**2**	**2.46**	**340,275**	**0**	**0**	**20,459**	**10,082,598**
Study Region Total	**8,411,884**	**1,309,980**	**2**	**2.46**	**340,275**	**0**	**0**	**20,459**	**10,082,598**

Direct Economic Losses For Buildings: 500 - year Event

July 26, 2021

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Virginia									
Alexandria	826,912	171,222	1	3.44	40,536	0	0	3,601	1,042,272
Arlington	1,319,577	283,448	1	3.95	66,024	0	0	6,036	1,675,086
Fairfax	10,638,684	2,514,285	5	6.23	554,921	0	0	45,667	13,753,562
Fairfax City	252,578	61,635	1	5.40	13,824	0	0	1,200	329,238
Falls Church	135,182	30,293	0	5.71	7,049	0	0	611	173,135
Loudoun	2,875,382	617,937	7	6.34	156,695	0	0	12,408	3,662,429
Manassas	335,366	82,739	2	6.78	21,992	0	0	2,011	442,109
Manassas Park	127,034	31,522	1	8.14	8,786	0	0	820	168,163
Prince William	3,995,083	957,896	7	7.35	222,972	0	0	18,675	5,194,632
Total	**20,505,797**	**4,750,976**	**25**	**6.00**	**1,092,799**	**0**	**0**	**91,028**	**26,440,626**
Study Region Total	**20,505,797**	**4,750,976**	**25**	**6.00**	**1,092,799**	**0**	**0**	**91,028**	**26,440,626**

Direct Economic Losses For Buildings: 1000 - year Event

July 26, 2021

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Virginia									
Alexandria	642,248	115,292	0	2.67	28,885	0	0	2,148	788,572
Arlington	1,050,560	202,349	0	3.14	49,194	0	0	3,823	1,305,927
Fairfax	12,881,507	3,504,069	31	7.54	695,584	38	13	67,354	17,148,596
Fairfax City	296,715	79,210	2	6.34	16,627	0	0	1,583	394,137
Falls Church	121,529	26,177	0	5.14	6,144	0	0	505	154,356
Loudoun	6,571,365	2,179,669	72	14.50	412,575	463	171	52,166	9,216,481
Manassas	690,045	242,493	18	13.95	49,686	107	39	6,801	989,190
Manassas Park	233,893	79,303	6	14.99	17,610	13	5	2,324	333,153
Prince William	7,643,975	2,560,577	55	14.06	462,850	227	135	57,614	10,725,433
Total	**30,131,839**	**8,989,139**	**183**	**8.82**	**1,739,155**	**847**	**363**	**194,319**	**41,055,846**
Study Region Total	**30,131,839**	**8,989,139**	**183**	**8.82**	**1,739,155**	**847**	**363**	**194,319**	**41,055,846**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : NOVA_EQ_FL_HU_Test

Scenario : Probabilistic

Combined Wind and Flood Direct Economic Losses For Buildings:

July 26, 2021

All values are in thousands of dollars

	Capital Stock Losses				
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Total Loss	Loss Ratio %
Virginia					
Alexandria	0	0	0	0	0.00
Arlington	0	0	0	0	0.00
Fairfax	0	0	0	0	0.00
Fairfax City	0	0	0	0	0.00
Falls Church	0	0	0	0	0.00
Loudoun	0	0	0	0	0.00
Manassas	0	0	0	0	0.00
Manassas Park	0	0	0	0	0.00
Prince William	0	0	0	0	0.00
Total	**0**	**0**	**0**	**0**	**0.00**
Study Region Total	**0**	**0**	**0**	**0**	**0.00**

Study Region :

Scenario : Probabilistic

Combined Wind and Flood Direct Economic Losses For Buildings:

July 26, 2021

All values are in thousands of dollars

Capital Stock Losses				
Cost Building Damage	**Cost Contents Damage**	**Inventory Loss**	**Total Loss**	**Loss Ratio %**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region :

Scenario : Probabilistic

Building Stock Exposure by Building Type

July 26, 2021

All values are in thousands of dollars

	Wood	Masonry	Concrete	Steel	MH	Total
Virginia						
Alexandria	13,874,211	6,760,696	937,328	2,444,440	10,412	24,027,087
Arlington	20,219,879	9,286,142	1,127,100	2,760,146	19,237	33,412,504
Fairfax	110,453,647	45,040,384	3,514,344	11,682,373	136,371	170,827,119
Fairfax City	2,562,197	1,261,785	186,363	668,095	2,664	4,681,104
Falls Church	1,403,013	640,441	65,936	256,409	0	2,365,799
Loudoun	30,133,340	11,727,077	738,262	2,708,697	20,612	45,327,988
Manassas	2,885,555	1,299,759	158,543	591,951	11,447	4,947,255
Manassas Park	997,903	404,166	30,356	127,347	411	1,560,183
Prince William	36,808,835	14,004,637	776,682	2,714,117	62,345	54,366,616
Total	**219,338,580**	**90,425,087**	**7,534,914**	**23,953,575**	**263,499**	**341,515,655**
Study Region Total	**219,338,580**	**90,425,087**	**7,534,914**	**23,953,575**	**263,499**	**341,515,655**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : NOVA_EQ_FL_HU_Test

Scenario : Probabilistic

HAZUS
EARTHQUAKE · WIND · FLOOD · TSUNAMI

FEMA

RiskMAP
Increasing Resilience Together

Building Stock Exposure By General Occupancy

July 26, 2021

All values are in thousands of dollars

	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Virginia								
Alexandria	18,477,776	3,608,216	304,079	20,665	567,753	128,869	919,729	24,027,087
Arlington	27,386,560	4,390,075	345,710	26,163	614,708	371,546	277,738	33,412,500
Fairfax	144,188,703	20,116,524	2,464,611	272,032	1,827,947	579,222	1,378,119	170,827,158
Fairfax City	3,164,151	1,210,584	135,723	12,501	110,826	13,954	33,368	4,681,107
Falls Church	1,766,161	461,373	39,966	7,392	58,626	11,611	20,673	2,365,802
Loudoun	39,257,243	4,211,047	886,538	159,244	382,528	134,762	296,612	45,327,974
Manassas	3,672,496	885,410	229,191	11,562	59,555	32,685	56,356	4,947,255
Manassas Park	1,298,379	155,463	64,064	7,422	8,011	5,174	21,671	1,560,184
Prince William	48,430,503	4,155,696	758,100	171,771	396,989	123,270	330,279	54,366,608
Total	**287,641,972**	**39,194,388**	**5,227,982**	**688,752**	**4,026,943**	**1,401,093**	**3,334,545**	**341,515,675**
Study Region Total	**287,641,972**	**39,194,388**	**5,227,982**	**688,752**	**4,026,943**	**1,401,093**	**3,334,545**	**341,515,675**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : NOVA_EQ_FL_HU_Test
Scenario : Probabilistic

Emergency Response Center Facility Functionality: 10 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	2	100.00
Arlington	2	100.00
Fairfax	4	100.00
Fairfax City	1	100.00
Falls Church	1	100.00
Loudoun	1	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	1	100.00
Total	**14**	**100.00**
Study Region Total	**14**	**100.00**

Emergency Response Center Facility Functionality: 20 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	2	100.00
Arlington	2	100.00
Fairfax	4	100.00
Fairfax City	1	100.00
Falls Church	1	100.00
Loudoun	1	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	1	100.00
Total	**14**	**100.00**
Study Region Total	**14**	**100.00**

Emergency Response Center Facility Functionality: 50 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	2	100.00
Arlington	2	100.00
Fairfax	4	100.00
Fairfax City	1	100.00
Falls Church	1	100.00
Loudoun	1	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	1	100.00
Total	**14**	**100.00**
Study Region Total	**14**	**100.00**

Emergency Response Center Facility Functionality: 100 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	2	100.00
Arlington	2	100.00
Fairfax	4	100.00
Fairfax City	1	100.00
Falls Church	1	100.00
Loudoun	1	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	1	100.00
Total	**14**	**100.00**
Study Region Total	**14**	**100.00**

Emergency Response Center Facility Functionality: 200 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	2	100.00
Arlington	2	100.00
Fairfax	4	100.00
Fairfax City	1	100.00
Falls Church	1	100.00
Loudoun	1	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	1	100.00
Total	**14**	**100.00**
Study Region Total	**14**	**100.00**

Emergency Response Center Facility Functionality: 500 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	2	100.00
Arlington	2	100.00
Fairfax	4	100.00
Fairfax City	1	100.00
Falls Church	1	100.00
Loudoun	1	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	1	100.00
Total	**14**	**100.00**
Study Region Total	**14**	**100.00**

Emergency Response Center Facility Functionality: 1000 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	2	100.00
Arlington	2	100.00
Fairfax	4	100.00
Fairfax City	1	100.00
Falls Church	1	100.00
Loudoun	1	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	1	100.00
Total	**14**	**100.00**
Study Region Total	**14**	**100.00**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Fire Station Facility Functionality: 10 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	8	100.00
Arlington	15	100.00
Fairfax	42	100.00
Fairfax City	2	100.00
Loudoun	20	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	21	100.00
Total	**110**	**100.00**
Study Region Total	**110**	**100.00**

Fire Station Facility Functionality: 20 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	8	100.00
Arlington	15	100.00
Fairfax	42	100.00
Fairfax City	2	100.00
Loudoun	20	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	21	100.00
Total	**110**	**100.00**
Study Region Total	**110**	**100.00**

Fire Station Facility Functionality: 50 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	8	100.00
Arlington	15	100.00
Fairfax	42	100.00
Fairfax City	2	100.00
Loudoun	20	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	21	100.00
Total	**110**	**100.00**
Study Region Total	**110**	**100.00**

Fire Station Facility Functionality: 100 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	8	100.00
Arlington	15	100.00
Fairfax	42	100.00
Fairfax City	2	100.00
Loudoun	20	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	21	100.00
Total	**110**	**100.00**
Study Region Total	**110**	**100.00**

Fire Station Facility Functionality: 200 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	8	100.00
Arlington	15	100.00
Fairfax	42	100.00
Fairfax City	2	100.00
Loudoun	20	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	21	100.00
Total	**110**	**100.00**
Study Region Total	**110**	**100.00**

Fire Station Facility Functionality: 500 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	8	100.00
Arlington	15	100.00
Fairfax	42	100.00
Fairfax City	2	100.00
Loudoun	20	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	21	100.00
Total	**110**	**100.00**
Study Region Total	**110**	**100.00**

Fire Station Facility Functionality: 1000 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	8	100.00
Arlington	15	100.00
Fairfax	42	100.00
Fairfax City	2	100.00
Loudoun	20	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	21	100.00
Total	**110**	**100.00**
Study Region Total	**110**	**100.00**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Hospital Functionality: 10 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Alexandria											
Large Hospital (greater than 150 beds)	318	318	100.0	318	100.0	318	100.0	318	100.0	318	100.0
Total	**318**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**
Arlington											
Large Hospital (greater than 150 beds)	334	334	100.0	334	100.0	334	100.0	334	100.0	334	100.0
Total	**334**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**
Fairfax											
Large Hospital (greater than 150 beds)	1,439	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0
Medium Hospital (50 to 150 Beds)	223	223	100.0	223	100.0	223	100.0	223	100.0	223	100.0
Small Hospital (less than 50 Beds)											
Total	**1,662**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**

Hospital Functionality: 10 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Loudoun											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	279	279	100.0	279	100.0	279	100.0	279	100.0	279	100.0
Total	**462**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**
Manassas											
Medium Hospital (50 to 150 Beds)	130	130	100.0	130	100.0	130	100.0	130	100.0	130	100.0
Total	**130**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**
Prince William											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	60	60	100.0	60	100.0	60	100.0	60	100.0	60	100.0
Small Hospital (less than 50 Beds)											
Total	**243**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**
Total	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Study RegionTotal	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Hospital Functionality: 20 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Alexandria											
Large Hospital (greater than 150 beds)	318	318	100.0	318	100.0	318	100.0	318	100.0	318	100.0
Total	**318**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**
Arlington											
Large Hospital (greater than 150 beds)	334	334	100.0	334	100.0	334	100.0	334	100.0	334	100.0
Total	**334**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**
Fairfax											
Large Hospital (greater than 150 beds)	1,439	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0
Medium Hospital (50 to 150 Beds)	223	223	100.0	223	100.0	223	100.0	223	100.0	223	100.0
Small Hospital (less than 50 Beds)											
Total	**1,662**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**

Hospital Functionality: 20 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Loudoun											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	279	279	100.0	279	100.0	279	100.0	279	100.0	279	100.0
Total	**462**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**
Manassas											
Medium Hospital (50 to 150 Beds)	130	130	100.0	130	100.0	130	100.0	130	100.0	130	100.0
Total	**130**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**
Prince William											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	60	60	100.0	60	100.0	60	100.0	60	100.0	60	100.0
Small Hospital (less than 50 Beds)											
Total	**243**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**
Total	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Study RegionTotal	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Hospital Functionality: 50 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Alexandria											
Large Hospital (greater than 150 beds)	318	318	100.0	318	100.0	318	100.0	318	100.0	318	100.0
Total	**318**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**
Arlington											
Large Hospital (greater than 150 beds)	334	334	100.0	334	100.0	334	100.0	334	100.0	334	100.0
Total	**334**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**
Fairfax											
Large Hospital (greater than 150 beds)	1,439	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0
Medium Hospital (50 to 150 Beds)	223	223	100.0	223	100.0	223	100.0	223	100.0	223	100.0
Small Hospital (less than 50 Beds)											
Total	**1,662**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**

Hospital Functionality: 50 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Loudoun											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	279	279	100.0	279	100.0	279	100.0	279	100.0	279	100.0
Total	**462**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**
Manassas											
Medium Hospital (50 to 150 Beds)	130	130	100.0	130	100.0	130	100.0	130	100.0	130	100.0
Total	**130**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**
Prince William											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	60	60	100.0	60	100.0	60	100.0	60	100.0	60	100.0
Small Hospital (less than 50 Beds)											
Total	**243**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**
Total	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Study RegionTotal	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Hospital Functionality: 100 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Alexandria											
Large Hospital (greater than 150 beds)	318	318	100.0	318	100.0	318	100.0	318	100.0	318	100.0
Total	**318**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**
Arlington											
Large Hospital (greater than 150 beds)	334	334	100.0	334	100.0	334	100.0	334	100.0	334	100.0
Total	**334**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**
Fairfax											
Large Hospital (greater than 150 beds)	1,439	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0
Medium Hospital (50 to 150 Beds)	223	223	100.0	223	100.0	223	100.0	223	100.0	223	100.0
Small Hospital (less than 50 Beds)											
Total	**1,662**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**

Hospital Functionality: 100 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Loudoun											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	279	279	100.0	279	100.0	279	100.0	279	100.0	279	100.0
Total	**462**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**
Manassas											
Medium Hospital (50 to 150 Beds)	130	130	100.0	130	100.0	130	100.0	130	100.0	130	100.0
Total	**130**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**
Prince William											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	60	60	100.0	60	100.0	60	100.0	60	100.0	60	100.0
Small Hospital (less than 50 Beds)											
Total	**243**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**
Total	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Study RegionTotal	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Hospital Functionality: 200 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Alexandria											
Large Hospital (greater than 150 beds)	318	318	100.0	318	100.0	318	100.0	318	100.0	318	100.0
Total	**318**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**
Arlington											
Large Hospital (greater than 150 beds)	334	334	100.0	334	100.0	334	100.0	334	100.0	334	100.0
Total	**334**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**
Fairfax											
Large Hospital (greater than 150 beds)	1,439	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0
Medium Hospital (50 to 150 Beds)	223	223	100.0	223	100.0	223	100.0	223	100.0	223	100.0
Small Hospital (less than 50 Beds)											
Total	**1,662**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**

Hospital Functionality: 200 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Loudoun											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	279	279	100.0	279	100.0	279	100.0	279	100.0	279	100.0
Total	**462**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**
Manassas											
Medium Hospital (50 to 150 Beds)	130	130	100.0	130	100.0	130	100.0	130	100.0	130	100.0
Total	**130**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**
Prince William											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	60	60	100.0	60	100.0	60	100.0	60	100.0	60	100.0
Small Hospital (less than 50 Beds)											
Total	**243**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**
Total	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Study RegionTotal	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Hospital Functionality: 500 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Alexandria											
Large Hospital (greater than 150 beds)	318	318	100.0	318	100.0	318	100.0	318	100.0	318	100.0
Total	**318**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**
Arlington											
Large Hospital (greater than 150 beds)	334	334	100.0	334	100.0	334	100.0	334	100.0	334	100.0
Total	**334**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**
Fairfax											
Large Hospital (greater than 150 beds)	1,439	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0
Medium Hospital (50 to 150 Beds)	223	223	100.0	223	100.0	223	100.0	223	100.0	223	100.0
Small Hospital (less than 50 Beds)											
Total	**1,662**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**

Hospital Functionality: 500 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Loudoun											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	279	279	100.0	279	100.0	279	100.0	279	100.0	279	100.0
Total	**462**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**
Manassas											
Medium Hospital (50 to 150 Beds)	130	130	100.0	130	100.0	130	100.0	130	100.0	130	100.0
Total	**130**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**
Prince William											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	60	60	100.0	60	100.0	60	100.0	60	100.0	60	100.0
Small Hospital (less than 50 Beds)											
Total	**243**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**
Total	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Study RegionTotal	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Hospital Functionality: 1000 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Alexandria											
Large Hospital (greater than 150 beds)	318	318	100.0	318	100.0	318	100.0	318	100.0	318	100.0
Total	**318**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**	**318**	**100.0**
Arlington											
Large Hospital (greater than 150 beds)	334	334	100.0	334	100.0	334	100.0	334	100.0	334	100.0
Total	**334**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**	**334**	**100.0**
Fairfax											
Large Hospital (greater than 150 beds)	1,439	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0	1,439	100.0
Medium Hospital (50 to 150 Beds)	223	223	100.0	223	100.0	223	100.0	223	100.0	223	100.0
Small Hospital (less than 50 Beds)											
Total	**1,662**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**	**1,662**	**100.0**

Hospital Functionality: 1000 - year Event

July 26, 2021

	Total # of Beds	At Day 1 # of Beds	At Day 1 %	At day 3 # of Beds	At day 3 %	At day 7 # of Beds	At day 7 %	At day 30 # of Beds	At day 30 %	At day 90 # of Beds	At day 90 %
Virginia											
Loudoun											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	279	279	100.0	279	100.0	279	100.0	279	100.0	279	100.0
Total	**462**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**	**462**	**100.0**
Manassas											
Medium Hospital (50 to 150 Beds)	130	130	100.0	130	100.0	130	100.0	130	100.0	130	100.0
Total	**130**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**	**130**	**100.0**
Prince William											
Large Hospital (greater than 150 beds)	183	183	100.0	183	100.0	183	100.0	183	100.0	183	100.0
Medium Hospital (50 to 150 Beds)	60	60	100.0	60	100.0	60	100.0	60	100.0	60	100.0
Small Hospital (less than 50 Beds)											
Total	**243**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**	**243**	**100.0**
Total	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Study RegionTotal	**3,149**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**	**3,149**	**100.0**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Police Station Facility Functionality: 10 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	3	100.00
Arlington	5	100.00
Fairfax	15	100.00
Fairfax City	2	100.00
Falls Church	2	100.00
Loudoun	7	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	10	100.00
Total	**46**	**100.00**
Study Region Total	**46**	**100.00**

Police Station Facility Functionality: 20 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	3	100.00
Arlington	5	100.00
Fairfax	15	100.00
Fairfax City	2	100.00
Falls Church	2	100.00
Loudoun	7	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	10	100.00
Total	**46**	**100.00**
Study Region Total	**46**	**100.00**

Police Station Facility Functionality: 50 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	3	100.00
Arlington	5	100.00
Fairfax	15	100.00
Fairfax City	2	100.00
Falls Church	2	100.00
Loudoun	7	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	10	100.00
Total	**46**	**100.00**
Study Region Total	**46**	**100.00**

Police Station Facility Functionality: 100 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	3	100.00
Arlington	5	100.00
Fairfax	15	100.00
Fairfax City	2	100.00
Falls Church	2	100.00
Loudoun	7	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	10	100.00
Total	**46**	**100.00**
Study Region Total	**46**	**100.00**

Police Station Facility Functionality: 200 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	3	100.00
Arlington	5	100.00
Fairfax	15	100.00
Fairfax City	2	100.00
Falls Church	2	100.00
Loudoun	7	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	10	100.00
Total	**46**	**100.00**
Study Region Total	**46**	**100.00**

Police Station Facility Functionality: 500 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	3	100.00
Arlington	5	100.00
Fairfax	15	100.00
Fairfax City	2	100.00
Falls Church	2	100.00
Loudoun	7	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	10	100.00
Total	**46**	**100.00**
Study Region Total	**46**	**100.00**

Police Station Facility Functionality: 1000 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	3	100.00
Arlington	5	100.00
Fairfax	15	100.00
Fairfax City	2	100.00
Falls Church	2	100.00
Loudoun	7	100.00
Manassas	1	100.00
Manassas Park	1	100.00
Prince William	10	100.00
Total	**46**	**100.00**
Study Region Total	**46**	**100.00**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

School Functionality: 10 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	42	100.00
Arlington	73	100.00
Fairfax	402	100.00
Fairfax City	13	100.00
Falls Church	5	100.00
Loudoun	146	100.00
Manassas	18	100.00
Manassas Park	6	100.00
Prince William	141	100.00
Total	**846**	**100.00**
Study Region	**846**	**100.00**

School Functionality: 20 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	42	100.00
Arlington	73	100.00
Fairfax	402	100.00
Fairfax City	13	100.00
Falls Church	5	100.00
Loudoun	146	100.00
Manassas	18	100.00
Manassas Park	6	100.00
Prince William	141	100.00
Total	**846**	**100.00**
Study Region	**846**	**100.00**

School Functionality: 50 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	42	100.00
Arlington	73	100.00
Fairfax	402	100.00
Fairfax City	13	100.00
Falls Church	5	100.00
Loudoun	146	100.00
Manassas	18	100.00
Manassas Park	6	100.00
Prince William	141	100.00
Total	**846**	**100.00**
Study Region	**846**	**100.00**

School Functionality: 100 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	42	100.00
Arlington	73	100.00
Fairfax	402	100.00
Fairfax City	13	100.00
Falls Church	5	100.00
Loudoun	146	100.00
Manassas	18	100.00
Manassas Park	6	100.00
Prince William	141	100.00
Total	**846**	**100.00**
Study Region	**846**	**100.00**

School Functionality: 200 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	42	100.00
Arlington	73	100.00
Fairfax	402	100.00
Fairfax City	13	100.00
Falls Church	5	100.00
Loudoun	146	100.00
Manassas	18	100.00
Manassas Park	6	100.00
Prince William	141	100.00
Total	**846**	**100.00**
Study Region	**846**	**100.00**

School Functionality: 500 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	42	100.00
Arlington	73	100.00
Fairfax	402	100.00
Fairfax City	13	100.00
Falls Church	5	100.00
Loudoun	146	100.00
Manassas	18	100.00
Manassas Park	6	100.00
Prince William	141	100.00
Total	**846**	**100.00**
Study Region	**846**	**100.00**

School Functionality: 1000 - year Event

July 26, 2021

	Count	Functionality (%)
Virginia		
Alexandria	42	100.00
Arlington	73	100.00
Fairfax	402	100.00
Fairfax City	13	100.00
Falls Church	5	100.00
Loudoun	146	100.00
Manassas	18	100.00
Manassas Park	6	100.00
Prince William	141	100.00
Total	**846**	**100.00**
Study Region	**846**	**100.00**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Shelter Summary Report: 10 - year Event

July 26, 2021

	# of Displaced Households	# of People Needing Short Term Shelter
Virginia		
Alexandria	0	0
Arlington	0	0
Fairfax	0	0
Fairfax City	0	0
Falls Church	0	0
Loudoun	0	0
Manassas	0	0
Manassas Park	0	0
Prince William	0	0
Total	**0**	**0**
Study Region Total	**0**	**0**

Shelter Summary Report: 20 - year Event

July 26, 2021

	# of Displaced Households	# of People Needing Short Term Shelter
Virginia		
Alexandria	0	0
Arlington	0	0
Fairfax	0	0
Fairfax City	0	0
Falls Church	0	0
Loudoun	0	0
Manassas	0	0
Manassas Park	0	0
Prince William	0	0
Total	**0**	**0**
Study Region Total	**0**	**0**

Shelter Summary Report: 50 - year Event

July 26, 2021

	# of Displaced Households	# of People Needing Short Term Shelter
Virginia		
Alexandria	0	0
Arlington	0	0
Fairfax	1	1
Fairfax City	0	0
Falls Church	0	0
Loudoun	5	5
Manassas	0	0
Manassas Park	0	0
Prince William	1	1
Total	**7**	**7**
Study Region Total	**7**	**7**

Shelter Summary Report: 100 - year Event

July 26, 2021

	# of Displaced Households	# of People Needing Short Term Shelter
Virginia		
Alexandria	49	21
Arlington	63	28
Fairfax	466	275
Fairfax City	10	6
Falls Church	7	3
Loudoun	105	65
Manassas	6	6
Manassas Park	4	3
Prince William	118	80
Total	**828**	**487**
Study Region Total	**828**	**487**

Shelter Summary Report: 200 - year Event

July 26, 2021

	# of Displaced Households	# of People Needing Short Term Shelter
Virginia		
Alexandria	383	172
Arlington	434	206
Fairfax	2,501	1,418
Fairfax City	40	22
Falls Church	34	16
Loudoun	20	16
Manassas	50	35
Manassas Park	21	15
Prince William	1,286	833
Total	**4,769**	**2,733**
Study Region Total	**4,769**	**2,733**

Shelter Summary Report: 500 - year Event

July 26, 2021

	# of Displaced Households	# of People Needing Short Term Shelter
Virginia		
Alexandria	536	243
Arlington	947	455
Fairfax	9,458	5,266
Fairfax City	231	123
Falls Church	103	51
Loudoun	2,771	1,593
Manassas	435	302
Manassas Park	184	132
Prince William	4,197	2,667
Total	**18,862**	**10,832**
Study Region Total	**18,862**	**10,832**

Shelter Summary Report: 1000 - year Event

July 26, 2021

	# of Displaced Households	# of People Needing Short Term Shelter
Virginia		
Alexandria	346	155
Arlington	652	317
Fairfax	13,578	7,565
Fairfax City	301	161
Falls Church	87	42
Loudoun	10,380	5,924
Manassas	1,370	953
Manassas Park	497	359
Prince William	12,102	7,521
Total	**39,313**	**22,997**
Study Region Total	**39,313**	**22,997**

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

B-2: Natural Hazard Risk Analysis Worksheets

City of Alexandria

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	2	4	1	2.3
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	2	2.7
Flood	1	2	3	2.0
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	1	1.0
Tornado	1	1	2	1.3
Wildfire	1	1	1	1.0
Winter weather	3	4	3	3.3

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	4	3	2	1	2.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	2	1	1	1	1	1.2
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	2	2	1	1	1.6
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	2	1	1.4
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	2	1	1	2	2	1	2	1.6	4.4
Drought	2	1	1	2	3	2	1	1.7	3.3
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.5
Flood	3	3	1	2	2	2	1	2.0	4.2
High wind/severe storm	2	2	2	2	2	1	1	1.7	3.3
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	1	1	1	2	1	1	1.1	2.5
Tornado	3	3	2	3	2	2	1	2.3	4.5
Wildfire	2	2	1	1	3	1	1	1.6	3.0
Winter weather	3	2	1	2	1	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.4	5.4
Drought	2.3	3.3	5.6
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.7	2.5	5.2
Flood	2.0	4.2	6.2
High wind/severe storm	2.7	3.3	6.0
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.0	2.5	3.5
Tornado	1.3	4.5	5.8
Wildfire	1.0	3.0	4.0
Winter weather	3.3	3.5	6.8

Arlington County

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	0	0	0	0
Drought	1	3	1	1.7
Earthquake	1	2	1	1.3
Extreme temperatures (hot/cold)	1	4	2	2.3
Flood	2	3	3	2.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	2	1.3
Landslide	0	0	0	0
Tornado	1	1	2	1.3
Wildfire	1	1	1	1
Winter weather	4	4	2	3.3

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	3	3	2	1	**2.6**
Drought	1	1	3	3	1	**1.8**
Earthquake	2	2	2	1	1	**1.6**
Extreme temperatures (hot/cold)	2	1	1	1	1	**1.2**
Flood	3	3	3	2	2	**2.6**
High wind/severe storm	3	3	3	2	3	**2.8**
Karst/Sinkhole/Land subsidence	1	2	2	1	1	**1.4**
Landslide	1	2	2	1	1	**1.4**
Tornado	3	3	3	2	1	**2.4**
Wildfire	1	1	2	2	1	**1.4**
Winter weather	2	3	3	1	3	**2.4**

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	0	0	0	0	0	0	0	0	0
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	1	1	1	2	1	2	2	1.4	2.8
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.9
Flood	3	2	1	2	2	2	1	1.9	4.1
High wind/severe storm	1	2	1	2	2	1	1	1.4	3
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.7
Landslide	0	0	0	0	0	0	0	0	0
Tornado	3	2	2	2	2	2	1	2	4.2
Wildfire	2	2	1	1	3	1	1	1.6	3
Winter weather	2	3	2	2	2	2	1	2	3.8

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	0	0	0
Drought	1.7	3.2	4.8
Earthquake	1.3	2.8	4.2
Extreme temperatures (hot/cold)	2.3	2.9	5.2
Flood	2.7	4.1	6.7
High wind/severe storm	2.7	3	5.7
Karst/Sinkhole/Land subsidence	1.3	2.7	4.1
Landslide	0	0	0
Tornado	1.3	4.2	5.5
Wildfire	1	3	4
Winter weather	3.3	3.8	7.1

Fairfax County

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	1	4	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	2	2.7
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	1	1.0
Tornado	1	1	2	1.3
Wildfire	1	1	1	1.0
Winter weather	4	4	3	3.7

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	4	3	2	1	2.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	2	1	1	1	1	1.2
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	2	2	1	1	1.6
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	2	1	1.4
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	3	1	1	2	2	1	2	1.7	4.5
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.5
Flood	4	2	1	2	2	2	1	2.0	4.2
High wind/severe storm	2	2	1	2	2	1	1	1.6	3.2
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	1	1	1	2	1	1	1.1	2.5
Tornado	4	2	1	2	2	2	1	2.0	4.2
Wildfire	2	2	1	1	3	1	1	1.6	3.0
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.5	5.5
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.7	2.5	5.2
Flood	1.7	4.2	5.9
High wind/severe storm	2.7	3.2	5.8
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.0	2.5	3.5
Tornado	1.3	4.2	5.5
Wildfire	1.0	3.0	4.0
Winter weather	3.7	3.5	7.2

City of Fairfax

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	1	4	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	2	2.7
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	1	1.0
Tornado	1	1	2	1.3
Wildfire	1	1	1	1.0
Winter weather	4	4	3	3.7

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	4	3	2	1	2.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	2	1	1	1	1	1.2
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	2	2	1	1	1.6
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	2	1	1.4
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	3	1	1	2	2	1	2	1.7	4.5
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.5
Flood	4	2	1	2	2	2	1	2.0	4.2
High wind/severe storm	2	2	1	2	2	1	1	1.6	3.2
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	1	1	1	2	1	1	1.1	2.5
Tornado	4	2	1	2	2	2	1	2.0	4.2
Wildfire	2	2	1	1	3	1	1	1.6	3.0
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.5	5.5
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.7	2.5	5.2
Flood	1.7	4.2	5.9
High wind/severe storm	2.7	3.2	5.8
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.0	2.5	3.5
Tornado	1.3	4.2	5.5
Wildfire	1.0	3.0	4.0
Winter weather	3.7	3.5	7.2

City of Falls Church

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	1	4	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	2	2.7
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	1	1.0
Tornado	1	1	2	1.3
Wildfire	1	1	1	1.0
Winter weather	4	4	3	3.7

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	4	3	2	1	2.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	2	1	1	1	1	1.2
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	2	2	1	1	1.6
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	2	1	1.4
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	3	1	1	2	2	1	2	1.7	4.5
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.5
Flood	4	2	1	2	2	2	1	2.0	4.2
High wind/severe storm	2	2	1	2	2	1	1	1.6	3.2
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	1	1	1	2	1	1	1.1	2.5
Tornado	4	2	1	2	2	2	1	2.0	4.2
Wildfire	2	2	1	1	3	1	1	1.6	3.0
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.5	5.5
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.7	2.5	5.2
Flood	1.7	4.2	5.9
High wind/severe storm	2.7	3.2	5.8
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.0	2.5	3.5
Tornado	1.3	4.2	5.5
Wildfire	1.0	3.0	4.0
Winter weather	3.7	3.5	7.2

Town of Clifton

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	0	0	0	0.0
Drought	1	4	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	2	2.7
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	1	1.0
Tornado	1	1	2	1.3
Wildfire	1	1	1	1.0
Winter weather	4	4	3	3.7

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	0	0	0	0	0	0.0
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	2	1	1	1	1	1.2
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	2	2	1	1	1.6
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	2	1	1.4
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	0	0	0	0	0	0	0	0.0	0.0
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.5
Flood	4	2	1	2	2	2	1	2.0	4.2
High wind/severe storm	2	2	1	2	2	1	1	1.6	3.2
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	1	1	1	2	1	1	1.1	2.5
Tornado	4	2	1	2	2	2	1	2.0	4.2
Wildfire	2	2	1	1	3	1	1	1.6	3.0
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	0.0	0.0	0.0
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.7	2.5	5.2
Flood	1.7	4.2	5.9
High wind/severe storm	2.7	3.2	5.8
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.0	2.5	3.5
Tornado	1.3	4.2	5.5
Wildfire	1.0	3.0	4.0
Winter weather	3.7	3.5	7.2

Town of Herndon

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	1	4	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	2	2.7
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	1	1.0
Tornado	1	1	2	1.3
Wildfire	1	1	1	1.0
Winter weather	4	4	3	3.7

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	4	3	2	1	2.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	2	1	1	1	1	1.2
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	2	2	1	1	1.6
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	2	1	1.4
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	3	1	1	2	2	1	2	1.7	4.5
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.5
Flood	4	2	1	2	2	2	1	2.0	4.2
High wind/severe storm	2	2	1	2	2	1	1	1.6	3.2
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	1	1	1	2	1	1	1.1	2.5
Tornado	4	2	1	2	2	2	1	2.0	4.2
Wildfire	2	2	1	1	3	1	1	1.6	3.0
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.5	5.5
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.7	2.5	5.2
Flood	1.7	4.2	5.9
High wind/severe storm	2.7	3.2	5.8
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.0	2.5	3.5
Tornado	1.3	4.2	5.5
Wildfire	1.0	3.0	4.0
Winter weather	3.7	3.5	7.2

Town of Vienna

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	1	4	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	2	2.7
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	1	1.0
Tornado	1	1	1	1.0
Wildfire	1	1	1	1.0
Winter weather	4	4	3	3.7

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	4	3	2	1	2.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	2	1	1	1	1	1.2
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	2	2	1	1	1.6
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	2	1	1.4
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	3	1	1	2	2	1	2	1.7	4.5
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.5
Flood	4	2	1	2	2	2	1	2.0	4.2
High wind/severe storm	2	2	1	2	2	1	1	1.6	3.2
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	1	1	1	2	1	1	1.1	2.5
Tornado	4	2	1	2	2	2	1	2.0	4.2
Wildfire	2	2	1	1	3	1	1	1.6	3.0
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.5	5.5
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.7	2.5	5.2
Flood	1.7	4.2	5.9
High wind/severe storm	2.7	3.2	5.8
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.0	2.5	3.5
Tornado	1.0	4.2	5.2
Wildfire	1.0	3.0	4.0
Winter weather	3.7	3.5	7.2

Loudoun County

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	2	3	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	1	2.3
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	2	1.3
Tornado	1	2	2	1.7
Wildfire	1	1	1	1.0
Winter weather	3	4	3	3.3

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	4	3	2	1	2.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	3	1	1	1	1	1.4
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	3	2	2	1	2.0
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	1	1	1.2
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	2	1	1	2	2	1	2	1.6	4.4
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.7
Flood	3	2	1	2	2	2	1	1.9	4.1
High wind/severe storm	1	2	1	2	2	1	1	1.4	3.4
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	1	1	1	2	1	1	1.1	2.5
Tornado	3	2	1	2	2	2	1	1.9	4.1
Wildfire	2	2	1	1	3	1	1	1.6	2.8
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.4	5.4
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.3	2.7	5.0
Flood	1.7	4.1	5.7
High wind/severe storm	2.7	3.4	6.1
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.3	2.5	3.9
Tornado	1.7	4.1	5.7
Wildfire	1.0	2.8	3.8
Winter weather	3.3	3.5	6.8

Town of Leesburg

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	2	3	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	1	2.3
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	0	0	0	0.0
Tornado	1	2	2	1.7
Wildfire	1	1	1	1.0
Winter weather	3	4	3	3.3

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	4	3	2	1	2.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	3	1	1	1	1	1.4
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	3	2	2	1	2.0
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	0	0	0	0	0	0.0
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	1	1	1.2
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	2	1	1	2	2	1	2	1.6	4.4
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.7
Flood	3	2	1	2	2	2	1	1.9	4.1
High wind/severe storm	1	2	1	2	2	1	1	1.4	3.4
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	0	0	0	0	0	0	0	0.0	0.0
Tornado	3	2	1	2	2	2	1	1.9	4.1
Wildfire	2	2	1	1	3	1	1	1.6	2.8
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.4	5.4
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.3	2.7	5.0
Flood	1.7	4.1	5.7
High wind/severe storm	2.7	3.4	6.1
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	0.0	0.0	0.0
Tornado	1.7	4.1	5.7
Wildfire	1.0	2.8	3.8
Winter weather	3.3	3.5	6.8

Town of Lovettsville

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	2	3	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	1	2.3
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	2	1.3
Tornado	1	2	2	1.7
Wildfire	1	1	1	1.0
Winter weather	3	4	3	3.3

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	4	3	2	1	2.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	3	1	1	1	1	1.4
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	3	2	2	1	2.0
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	1	1	1.2
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	2	1	1	2	2	1	2	1.6	4.4
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.7
Flood	3	2	1	2	2	2	1	1.9	4.1
High wind/severe storm	1	2	1	2	2	1	1	1.4	3.4
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	1	1	1	2	1	1	1.1	2.5
Tornado	3	2	1	2	2	2	1	1.9	4.1
Wildfire	2	2	1	1	3	1	1	1.6	2.8
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.4	5.4
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.3	2.7	5.0
Flood	1.7	4.1	5.7
High wind/severe storm	2.7	3.4	6.1
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.3	2.5	3.9
Tornado	1.7	4.1	5.7
Wildfire	1.0	2.8	3.8
Winter weather	3.3	3.5	6.8

Town of Middleburg

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	2	3	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	1	2.3
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	2	1.3
Tornado	1	2	2	1.7
Wildfire	1	1	1	1.0
Winter weather	3	4	3	3.3

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	4	3	2	1	2.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	3	1	1	1	1	1.4
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	3	2	2	1	2.0
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	1	1	1.2
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	2	1	1	2	2	1	2	1.6	4.4
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.7
Flood	3	2	1	2	2	2	1	1.9	4.1
High wind/severe storm	1	2	1	2	2	1	1	1.4	3.4
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	1	1	1	2	1	1	1.1	2.5
Tornado	3	2	1	2	2	2	1	1.9	4.1
Wildfire	2	2	1	1	3	1	1	1.6	2.8
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.4	5.4
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.3	2.7	5.0
Flood	1.7	4.1	5.7
High wind/severe storm	2.7	3.4	6.1
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.3	2.5	3.9
Tornado	1.7	4.1	5.7
Wildfire	1.0	2.8	3.8
Winter weather	3.3	3.5	6.8

Town of Purcellville

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	2	3	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	1	2.3
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	2	1.3
Tornado	1	2	2	1.7
Wildfire	1	1	1	1.0
Winter weather	3	4	3	3.3

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	4	3	2	1	2.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	3	1	1	1	1	1.4
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	3	2	2	1	2.0
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	1	1	1.2
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	2	1	1	2	2	1	2	1.6	4.4
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.7
Flood	3	2	1	2	2	2	1	1.9	4.1
High wind/severe storm	1	2	1	2	2	1	1	1.4	3.4
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	1	1	1	2	1	1	1.1	2.5
Tornado	3	2	1	2	2	2	1	1.9	4.1
Wildfire	2	2	1	1	3	1	1	1.6	2.8
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.4	5.4
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.3	2.7	5.0
Flood	1.7	4.1	5.7
High wind/severe storm	2.7	3.4	6.1
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.3	2.5	3.9
Tornado	1.7	4.1	5.7
Wildfire	1.0	2.8	3.8
Winter weather	3.3	3.5	6.8

Town of Round Hill

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	2	3	1	2.0
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	1	2.3
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	2	1.3
Tornado	1	2	2	1.7
Wildfire	1	1	1	1.0
Winter weather	3	4	3	3.3

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	4	3	2	1	2.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	3	1	1	1	1	1.4
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	3	2	2	1	2.0
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	1	1	1.2
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	2	1	1	2	2	1	2	1.6	4.4
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.7
Flood	3	2	1	2	2	2	1	1.9	4.1
High wind/severe storm	1	2	1	2	2	1	1	1.4	3.4
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	1	1	1	2	1	1	1.1	2.5
Tornado	3	2	1	2	2	2	1	1.9	4.1
Wildfire	2	2	1	1	3	1	1	1.6	2.8
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.4	5.4
Drought	2.0	3.2	5.2
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	2.3	2.7	5.0
Flood	1.7	4.1	5.7
High wind/severe storm	2.7	3.4	6.1
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.3	2.5	3.9
Tornado	1.7	4.1	5.7
Wildfire	1.0	2.8	3.8
Winter weather	3.3	3.5	6.8

City of Manassas

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	2	4	1	2.3
Earthquake	2	2	1	2.3
Extreme temperatures (hot/cold)	2	4	3	3.0
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	0	0	0	0.0
Tornado	1	1	2	1.3
Wildfire	0	0	0	0.0
Winter weather	4	4	3	3.7

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	3	3	3	2	1	2.4
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	2	1	1	1	1	1.2
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	2	2	1	1	1.6
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	0	0	0	0	0	0.0
Tornado	3	3	3	1	1	2.2
Wildfire	0	0	0	0	0	0.0
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	3	1	1	2	2	1	2	1.7	4.1
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.5
Flood	4	2	1	2	2	2	1	2.0	4.2
High wind/severe storm	2	2	1	2	2	1	1	1.6	3.2
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	0	0	0	0	0	0	0	0.0	0.0
Tornado	4	2	2	2	2	2	1	2.1	4.3
Wildfire	0	0	0	0	0	0	0	0.0	0.0
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.1	5.1
Drought	2.3	3.2	5.5
Earthquake	2.3	3.2	5.6
Extreme temperatures (hot/cold)	3.0	2.5	5.5
Flood	1.7	4.2	5.9
High wind/severe storm	2.7	3.2	5.8
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	0.0	0.0	0.0
Tornado	1.3	4.3	5.7
Wildfire	0.0	0.0	0.0
Winter weather	3.7	3.5	7.2

City of Manassas Park

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	2	4	1	2.3
Earthquake	2	4	1	2.3
Extreme temperatures (hot/cold)	2	4	3	3.0
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	3	1.7
Landslide	1	1	1	1.0
Tornado	1	1	2	1.3
Wildfire	1	1	1	1.0
Winter weather	4	4	3	3.7

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	2	2	2	2	1	1.8
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	2	1	1	1	1	1.2
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	2	2	1	1	1.6
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	2	1	1.4
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	2	1	1	2	1	1	1	1.3	3.1
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.5
Flood	4	2	1	2	2	2	1	2.0	4.2
High wind/severe storm	2	2	1	2	2	1	1	1.6	3.2
Karst/Sinkhole /Land subsidence	1	1	2	2	1	1	1	1.3	2.7
Landslide	1	2	1	1	2	1	1	1.3	2.7
Tornado	4	2	2	2	2	2	1	2.1	4.3
Wildfire	2	2	1	1	3	1	1	1.6	3.0
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	3.1	4.1
Drought	2.3	3.2	5.5
Earthquake	2.3	3.2	5.6
Extreme temperatures (hot/cold)	3.0	2.5	5.5
Flood	1.7	4.2	5.9
High wind/severe storm	2.7	3.2	5.8
Karst/Sinkhole/Land subsidence	1.7	2.7	4.4
Landslide	1.0	2.7	3.7
Tornado	1.3	4.3	5.7
Wildfire	1.0	3.0	4.0
Winter weather	3.7	3.5	7.2

Prince William County

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	2	1	1.3
Drought	2	4	1	2.3
Earthquake	2	4	1	2.3
Extreme temperatures (hot/cold)	2	4	3	3.0
Flood	1	2	4	2.3
High wind/severe storm	3	3	4	3.3
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	1	1.0
Tornado	1	1	2	1.3
Wildfire	1	1	1	1.0
Winter weather	4	4	3	3.7

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property - Residential (PR)	Property - Commercial (PC)	Environment (E)	Program Operations/Resources (PO)	Impact score (PE+PR+PC+E+PO/5=Impact)
Dam failure	4	3	3	2	1	2.6
Drought	1	1	1	3	1	1.8
Earthquake	2	2	2	1	1	1.6
Extreme temperatures (hot/cold)	2	1	1	1	1	1.2
Flood	3	3	3	2	2	2.6
High wind/severe storm	3	3	3	2	3	2.8
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	2	1	2.4
Wildfire	1	1	2	2	1	1.4
Winter weather	2	3	3	1	3	2.4

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	4	3	1	3	3	2	2	2.6	5.2
Drought	1	1	1	2	3	2	1	1.6	3.4
Earthquake	2	2	2	3	2	3	1	2.1	3.7
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.5
Flood	5	4	2	4	2	2	3	3.1	5.7
High wind/severe storm	4	4	3	2	2	2	1	2.6	5.4
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	2	1	1	2	1	1	1.3	2.7
Tornado	4	3	2	3	2	2	1	2.4	4.8
Wildfire	2	2	1	1	3	1	1	1.6	3.0
Winter weather	3	3	3	3	2	2	1	2.4	4.8

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.3	5.2	6.5
Drought	2.3	3.4	5.7
Earthquake	2.3	3.7	6.0
Extreme temperatures (hot/cold)	3.0	2.5	5.5
Flood	2.3	5.7	8.0
High wind/severe storm	3.3	5.4	8.7
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.0	2.7	3.7
Tornado	1.3	4.8	6.1
Wildfire	1.0	3.0	4.0
Winter weather	3.7	4.8	8.5

Comments
Dam failure scenarios based on high hazard dam failure
Flooding based on moderate flooding impact from tropical storm or hurricane or significant flooding due to widespread flooding event.
High wind/severe storm based on impacts from 3-day windstorm in 2018 as well as potential moderate impacts to tropical storm or hurricane.

Town of Dumfries

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	2	4	1	2.3
Earthquake	2	4	1	2.3
Extreme temperatures (hot/cold)	2	4	3	3.0
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	1	1.0
Tornado	1	1	2	1.3
Wildfire	1	1	1	1.0
Winter weather	4	4	3	3.7

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	3	3	3	2	1	2.4
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	2	1	1	1	1	1.2
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	2	2	1	1	1.6
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	2	1	1.4
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	3	1	1	2	2	1	2	1.7	4.1
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	2.7	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.5
Flood	4	2	1	2	2	2	1	2.0	4.2
High wind/severe storm	2	2	1	2	2	1	1	1.6	3.2
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	2	1	1	2	1	1	1.3	2.7
Tornado	4	2	2	2	2	2	1	2.1	4.3
Wildfire	2	2	1	1	3	1	1	1.6	3.0
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.1	5.1
Drought	2.3	3.2	5.5
Earthquake	2.3	3.2	5.5
Extreme temperatures (hot/cold)	3.0	2.5	5.5
Flood	1.7	4.2	5.9
High wind/severe storm	2.7	3.2	5.8
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.0	2.7	3.7
Tornado	1.3	4.3	5.7
Wildfire	1.0	3.0	4.0
Winter weather	3.7	3.5	7.2

Town of Haymarket

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	1	1	1	1.0
Drought	2	4	1	2.3
Earthquake	2	2	1	1.7
Extreme temperatures (hot/cold)	2	4	3	3.0
Flood	1	2	2	1.7
High wind/severe storm	2	3	3	2.7
Karst/Sinkhole/Land subsidence	1	1	1	1.0
Landslide	1	1	1	1.0
Tornado	1	1	2	1.3
Wildfire	1	1	1	1.0
Winter weather	4	4	3	3.7

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	3	3	3	2	1	2.4
Drought	2	1	1	3	1	1.6
Earthquake	2	3	2	1	1	1.8
Extreme temperatures (hot/cold)	2	1	1	1	1	1.2
Flood	2	3	3	2	1	2.2
High wind/severe storm	2	2	2	1	1	1.6
Karst/Sinkhole/Land subsidence	1	2	2	1	1	1.4
Landslide	1	2	2	1	1	1.4
Tornado	3	3	3	1	1	2.2
Wildfire	1	1	2	2	1	1.4
Winter weather	2	2	2	1	2	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	3	1	1	2	2	1	2	1.7	4.1
Drought	1	1	1	2	3	2	1	1.6	3.2
Earthquake	2	1	2	2	1	1	1	1.4	3.2
Extreme temperatures (hot/cold)	2	2	1	1	1	1	1	1.3	2.5
Flood	4	2	1	2	2	2	1	2.0	4.2
High wind/severe storm	2	2	1	2	2	1	1	1.6	3.2
Karst/Sinkhole /Land subsidence	1	1	1	1	2	1	1	1.1	2.5
Landslide	1	2	1	1	2	1	1	1.3	2.7
Tornado	4	2	2	2	2	2	1	2.1	4.3
Wildfire	2	2	1	1	3	1	1	1.6	3.0
Winter weather	2	2	1	2	2	2	1	1.7	3.5

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	1.0	4.1	5.1
Drought	2.3	3.2	5.5
Earthquake	1.7	3.2	4.9
Extreme temperatures (hot/cold)	3.0	2.5	5.5
Flood	1.7	4.2	5.9
High wind/severe storm	2.7	3.2	5.8
Karst/Sinkhole/Land subsidence	1.0	2.5	3.5
Landslide	1.0	2.7	3.7
Tornado	1.3	4.3	5.7
Wildfire	1.0	3.0	4.0
Winter weather	3.7	3.5	7.2

Town of Occoquan

Total Probability Score (TPS) Calculation

Hazard	Population Vulnerability (PO)	Geographic Extent (G)	Probability (PR)	Probability Score (PO+G+PR/3 = TPS)
Dam failure	4	4	4	4.0
Drought	1	4	1	2.0
Earthquake	1	4	1	2.0
Extreme temperatures (hot/cold)	4	4	4	4.0
Flood	4	4	4	4.0
High wind/severe storm	4	4	4	4.0
Karst/Sinkhole/Land subsidence	1	4	1	2.0
Landslide	1	4	1	2.0
Tornado	4	4	4	4.0
Wildfire	1	4	1	2.0
Winter weather	4	4	4	4.0

Total Consequence Score (TCS) Calculation

Impact Elements

Hazard	People (PE)	Property Residential (PR)	Property Commercial (PC)	Environmental (E)	Program Operations/ Resources (PO)	Impact Score (PE+PR+PC+E+PO/5 =Impact)
Dam failure	4	5	5	3	5	4.4
Drought	1	1	1	1	1	1.0
Earthquake	3	3	3	1	3	2.6
Extreme temperatures (hot/cold)	3	1	1	1	1	1.4
Flood	2	5	5	3	3	3.6
High wind/severe storm	3	4	4	1	3	3.0
Karst/Sinkhole/Land subsidence	1	4	4	1	1	2.2
Landslide	1	1	1	1	1	1.0
Tornado	4	5	5	1	3	3.6
Wildfire	1	1	1	1	1	1.0
Winter weather	3	1	1	1	3	1.8

Consequence Elements

Hazard	Population (POP)	Responders (RES)	Continuity of Operations /Services (COOPs)	Property, Facilities, Infrastructure (PFI)	Environment (E)	Economic Conditions/ Loss (ECL)	Public Confidence in Governance (PCG)	Consequence Score (POP+RES+COOPS+ PFI+ E+ECL+PC/7 =Consequence	TSC (Impact + Consequence)
Dam failure	5	3	3	5	3	5	1	3.5	7.9
Drought	1	1	1	1	1	1	1	1.0	2.0
Earthquake	3	1	3	3	1	3	1	2.1	4.7
Extreme temperatures (hot/cold)	1	1	1	1	1	1	1	1.0	2.4
Flood	5	3	3	5	3	3	1	3.3	6.9
High wind/severe storm	3	3	3	3	1	3	1	2.4	5.4
Karst/Sinkhole /Land subsidence	1	1	1	1	1	1	1	1.0	3.2
Landslide	1	1	1	1	1	1	1	1.0	2
Tornado	3	3	3	3	1	3	1	2.4	6.0
Wildfire	1	1	1	1	1	1	1	1	2
Winter weather	3	3	3	3	1	3	1	2.4	4.2

Overall Risk Score

Hazard	Total Probability Score (TPS)	Total Consequence Score (TCS)	Overall Risk Score (TPS+TCS)
Dam failure	4.0	7.9	11.9
Drought	2.0	2.0	4.0
Earthquake	2.0	4.7	6.7
Extreme temperatures (hot/cold)	4.0	2.4	6.4
Flood	4.0	6.9	10.9
High wind/severe storm	4.0	5.4	9.4
Karst/Sinkhole/Land subsidence	2.0	3.2	5.2
Landslide	2.0	2.0	4.0
Tornado	4.0	6.0	10.0
Wildfire	2.0	2.0	4.0
Winter weather	4.0	4.2	8.2

APPENDIX C: DAM SAFETY DATA

This appendix provides Virginia DCR Dam Safety Data Sheets for each high or significant hazard dams within the NOVA HMP planning area, listed in alphabetical order by dam name.

ARC Redevelopment SWM Pond Dam
Arcola Center
Ashburn Village Lake #1
Ashburn Village Lake #2
Barcroft
Beaverdam Creek
Brambleton Land Bay 3 Pond 6 Dam
Breckinridge Dam
Burke Center Section 11B
Burke Lake
Camp 5 Dam
Carrington Regional Dam
Creighton Hills Dam
Crosspointe Lake Dam
Daddy Long Lake Dam
Daley Dam
Dulles Airport Dam
Dulles Corner Lake
Dulles Corner Lake
East Market Pond
Emergency Sewage Retention Pond No. 1
Emergency Sewage Retention Pond No. 2
F.P Griffith Water Plant Lorton Quarry Dam
F.P. Griffith Water Plant Lorton Quarry
Fair Lakes Dam #1
Fair Lakes Land Bay 2 SWM BMP
Fairview Lake Dam
Goose Creek Dam
Gore Dam
Hampton Forest Section 4
Haynes Dam
Hope Parkway Dam
Horsepen Dam
Innovation at Prince William Pond 3
Innovation at Prince William Pond 3 Dam
Island Creek Dam
J.T. Hirst Dam
Kalnasy Dam
Kings Park West Section 18 Dam
Kingstowne BMP Basin #2
Kingstowne SWM DP #4 Regional
Kingtowne Lake Dam
Lake Accotink Dam
Lake Anne Dam
Lake Audubon Dam
Lake Fairfax Dam
Lake Jackson Dam
Lake Monclair Dam
Lake Newport Dam
Lake Thoreau Dam
Locust Shade Park Dam
Market Center Pond 1 Dam
Morefield Station East SWM Pond Dam
Morefield Station West SWM Pond Dam
New Bristow Village Regional SWM Facility Dam
No 2 Dam of 4 Kingstowne Park Impoundments
North Fork Wetlands Bank Dam
North Twin Lake Dam
NVCC Annadale Campus Dam
NVCC Woodbridge Campus
Occoquan Lower Storage Dam
Occoquan Lower Storage Dam
Oliver Dam
Omisol Dam

Plute McLean SWM Pond Dam
Pohick Creek Dam #1
Pohick Creek Dam #2
Pohick Creek Dam #3
Pohick Creek Dam #4
Pohick Creek Dam #7
Pohick Creek Dam #8
Possum Point Ash Dam #D
Potomac Club Regional Pond Dam
Precision Dynamics Lake Dam
Prince William Parkway Regional SWM
Red Cedar Lake Two Dam
Reston Northern Sector Pond 1 Dam
Reston Town Center Western BMP Dam
Richmond Square Dam
Rocky Branch Regional SWM Dam
Silver Lake Dam
Sleeter Lake Dam
South Twin Lake Dam
Southern Shores Drive Dam
T. Nelson Elliot Dam
The Lakes at Red Rock Dam
Upper Occoquan Dam
Upper Occoquan Dam
Upper Occoquan Sewage Authority Dam
West Ox Road BMP Dam
Winters Branch Dam

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: ARC Redevelopment SWM Pond Dam

Inventory Number: 153055

Hazard Classification: High

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/2030

Dam Owner:
Walter Lynch
(202) 965-2424(Office); (primary)(703) 407-0777(Home)
1058 Thomas Jefferson Street
Washington DC, 20007

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type:

Certificate Expiration:

Days Since Last Inspection:

Inundation Report: Unknown

Type of Dam
Earth (Secondary)

Reservoir Purpose
Flood Control or storm water management (Secondary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 0.00 Acres

Normal Pool Capacity: 28.00 Acre-Feet

Top Capacity: 170.00 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 21.50 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date: 03/10/2021
Expiration Date: 03/10/2027

Dam Location

Dam Address:
5945 Wellington Road
Gainesville VA, 20155

E911 Direction to Dam:
Address for Dam Access Road

EAP Contacts

Dam Operator: Walter Lynch
(202) 965-2424(Office); (primary)(703) 407-0777(Home)
(primary)wlynch@walterlynchaia.com
1058 Thomas Jefferson Street
Washington DC, 20007

Dam Alternate Operator:Jeffrey Hayes
(primary)(202) 965-2424(Office)
(primary)jhayes@walterlynchaia.com
1058 Thomas Jefferson St., NW
Washington DC, 20007

Rain Gauge Observer: Geoffrey L. Cowan
(primary)(703) 468-2243(Office); (703) 615-0011(Mobile)
(primary)jcowan@dewberry.com
13575 Heathcote Blvd.
Suite 130
Gainesville VA, 20155

Alternate Rain Gauge Observer:Richard Farella
(primary)(610) 905-5558(Mobile)
(primary)rfarella@dewberry.com
13575 Heathcote Blvd
Suite 130
Gainesville VA, 20155

24-Hour Dispatch Center: Prince William County UFRO
(703) 792-6500(Office); (primary)(703) 792-6813(Office)
(primary)pwcem@pwcgov.org
1 County Complex Court
Prince William VA, 22192

Local Government Emergency Services:Brian Misner
(primary)(703) 792-5627(Office)
(primary)bmisner@pwcgov.org
1 County Complex Court
Prince William VA, 22192

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Steve Shannon
(primary)(703) 259-2357(Office)
(primary)STEVEN.SHANNON@VDOT.VIRGINIA.GOV
na
Na VA, 12345

National Weather Service:Jason Elliott
(primary)(703) 996-2234(Office)
(primary)jason.elliott@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 674 - 0.073 miles downstream
- 3500 - 0.162 miles downstream
- 619 - 1.899 miles downstream

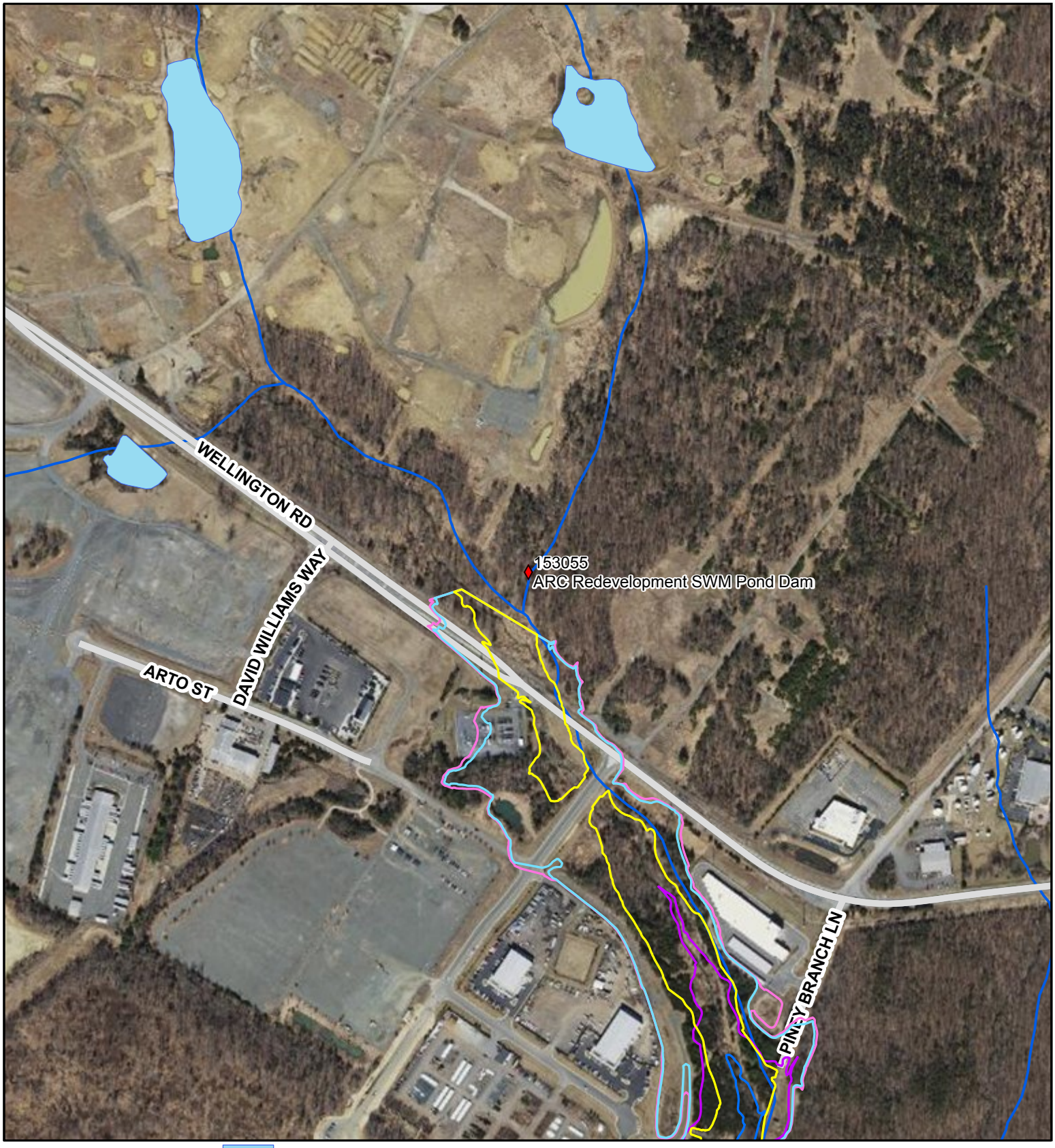
Dams Downstream:

- n/a

Potential Impact Structures (count):

- 27 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 2 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **153055**
Dam Name: **ARC Redevelopment SWM Pond Dam**
VAHU6: PL34
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 13
HUC 12: 020700100504
VA House: 50
Watershed Name: Broad Run-Rocky Branch
Congressional: 5101
USGS Topo: GAINESVILLE



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Arcola Center Dam

Inventory Number: 107130

Hazard Classification: Significant

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/2010

Dam Owner:
Mark McFarland
(primary)(703) 391-1100(Office)
44715 Brimfield Drive, Suite 210
Ashburn VA, 20147

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 09/30/2020

Days Since Last Inspection:

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: Acres

Top Surface Area: Acres

Normal Pool Capacity: Acre-Feet

Top Capacity: Acre-Feet

Normal Pool Elevation: Feet

Top Elevation: Feet

Normal Pool Height: Feet

Top Height: Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **107130**
Dam Name: **Arcola Center Dam**
VAHU6: PL17
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080901
VA House: 87
Watershed Name: Broad Run-Lenah Run
Congressional: 5110
USGS Topo: ARCOLA

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Ashburn Village Lake #1

Inventory Number: 107027

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1989

Dam Owner:
Marck Rossy
(primary)(703) 723-7910(Office)
44025 Courtland Drive
Ashburn VA, 20147

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 11/30/2024

Days Since Last Inspection: 3460

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: TR-Russel Branch

Technical Basics

Normal Pool Area: 18.00 Acres

Top Surface Area: 25.00 Acres

Normal Pool Capacity: 155.00 Acre-Feet

Top Capacity: 221.00 Acre-Feet

Normal Pool Elevation: 263.00 Feet

Top Elevation: 268.00 Feet

Normal Pool Height: 26.00 Feet

Top Height: 32.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.31 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMF

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
7/16/2013	Owner	
1/30/2012	Engineer	
1/15/2008	Engineer	

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Steven Pandish, P.E.
(primary)(703) 889-2305(Office)
(primary)spandish@gordon.us.com
4501 Daly Drive
Suite 200
Chantilly VA, 20165

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

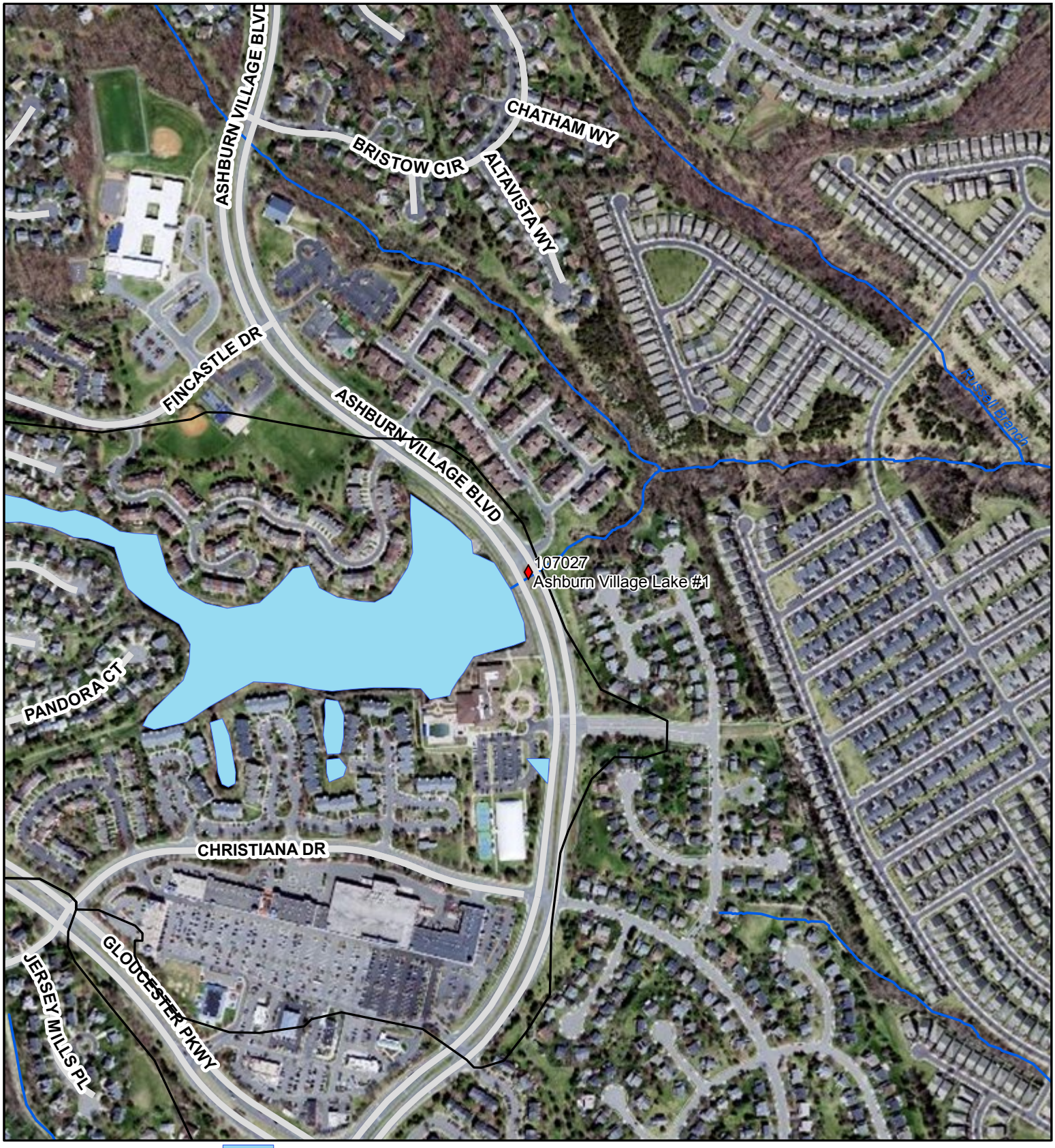
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **107027**
Dam Name: **Ashburn Village Lake #1**
VAHU6: PL19
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080903
VA House: 32
Watershed Name: Broad Run-Beaverdam Run
Congressional: 5110
USGS Topo: STERLING



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Ashburn Village Lake #2

Inventory Number: 107034

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1990

Dam Owner:
Marck Rossy
(primary)(703) 723-7910(Office)
44025 Courtland Drive
Ashburn VA, 20147

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 11/30/2024

Days Since Last Inspection: 3460

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream: TR-Russel Branch

Technical Basics

Normal Pool Area: 27.20 Acres

Top Surface Area: 68.00 Acres

Normal Pool Capacity: 149.00 Acre-Feet

Top Capacity: 794.00 Acre-Feet

Normal Pool Elevation: 230.00 Feet

Top Elevation: 247.00 Feet

Normal Pool Height: 12.00 Feet

Top Height: 28.90 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 10.60 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMF

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
7/16/2013	Owner	Fair
1/30/2012	Engineer	Fair
7/20/2009	Owner	Satisfactory

EAP Quick Reference

Approval Date: 05/27/2008
Expiration Date: 05/27/2014

Dam Location

Dam Address:
44078 Cheltenham Circle
Ashburn VA, 20147

E911 Direction to Dam:
Ashburn Village Boulevard is a roadway crossing the The Ashburn Village Dam. The embankment is located between Saxony Terrace and Bruceton Mills Circle.

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

- VA-772 - 1 miles downstream
- VA-607 - 2 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **107034**
Dam Name: **Ashburn Village Lake #2**
VAHU6: PL19
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080903
VA House: 32
Watershed Name: Broad Run-Beaverdam Run
Congressional: 5110
USGS Topo: STERLING

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Barcroft Dam

Inventory Number: 059001

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1915

Dam Owner:
Davis Grant
(703) 209-2080(Mobile); (primary)(703) 820-1300(Office)
3650 Boat Dock Drive
Falls Church VA, 22041

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 11/30/2023

Days Since Last Inspection: 255

Inundation Report: Unknown

Type of Dam
Gravity (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 1.00 Miles

River or Stream: Holmes Run

Technical Basics

Normal Pool Area: 154.00 Acres

Top Surface Area: 175.00 Acres

Normal Pool Capacity: 2500.00 Acre-Feet

Top Capacity: 3020.00 Acre-Feet

Normal Pool Elevation: 208.00 Feet

Top Elevation: 212.00 Feet

Normal Pool Height: 66.00 Feet

Top Height: 69.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 14.50 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF **Required Spillway Design Flow**: 1.00 PMF

Inspections (Last 3 Max)

Date	Type	Condition
4/26/2022	Owner	Satisfactory
4/26/2021	Engineer	Satisfactory
12/1/2020	Owner	Unsatisfactory

EAP Quick Reference

Approval Date: 01/04/2021
Expiration Date: 01/04/2027

Dam Location

Dam Address:
3650 Boat Dock Drive
Falls Church VA, 22041

E911 Direction to Dam:
Boat Dock Drive is a cul-de-sac. At the end of the cul-de-sac is a small gravel access road that will lead to the Lake Barcroft Dam. The gravel road has gates that are locked when LBWID staff are not on site at the dam.

EAP Contacts

Dam Operator: Sam Ellis
(703) 209-3541(Mobile); (primary)(703) 820-1300(Office); (703) 941-6170(Home)
(primary)lbwid@vacoxmail.com
3650 Boat Dock Drive
Falls Church VA, 22041

Dam Alternate Operator:Davis Grant
(703) 209-2080(Mobile); (primary)(703) 820-1300(Office)
(primary)dgrantlbwid@vacoxmail.com
3650 Boat Dock Drive
Falls Church VA, 22041

Rain Gauge Observer: Sam Ellis
(703) 209-3541(Mobile); (primary)(703) 820-1300(Office); (703) 941-6170(Home)
(primary)lbwid@vacoxmail.com
3650 Boat Dock Drive
Falls Church VA, 22041

Alternate Rain Gauge Observer:Davis Grant
(703) 209-2080(Mobile); (primary)(703) 820-1300(Office)
(primary)dgrantlbwid@vacoxmail.com
3650 Boat Dock Drive
Falls Church VA, 22041

24-Hour Dispatch Center: Fairfax County
(primary)(703) 691-2131(Office)
(primary)NA@NA.com
N/A
N/A VA, 22041

Local Government Emergency Services:Seamus Mooney
(primary)(571) 350-1000(Office)
(primary)NaNa@Na.com
4890 Alliance Drive #2200
Fairfax VA, 22030

Owner's Engineer: William P. Wagner
(primary)(443) 224-1543(Office)
(primary)wwagner@wrallp.com
801 Caroline St.
Baltimore VA, 21231

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:VDOT District Office (NOVA)
(primary)(800) 367-7623(Office)
(primary)NaNa@Na.com
4975 Alliance Dr
Fairfax VA, 22030

National Weather Service:National Weather Service
(primary)(703) 996-2200(Office)
(primary)na@na.com
43858 Weather Service Road
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 244 - 0.1 miles downstream
- 393 - 2.2 miles downstream
- 401 - 2.3 miles downstream
- 495 - 5.3 miles downstream
- 611 - 5.6 miles downstream
- 1 - 6.9 miles downstream

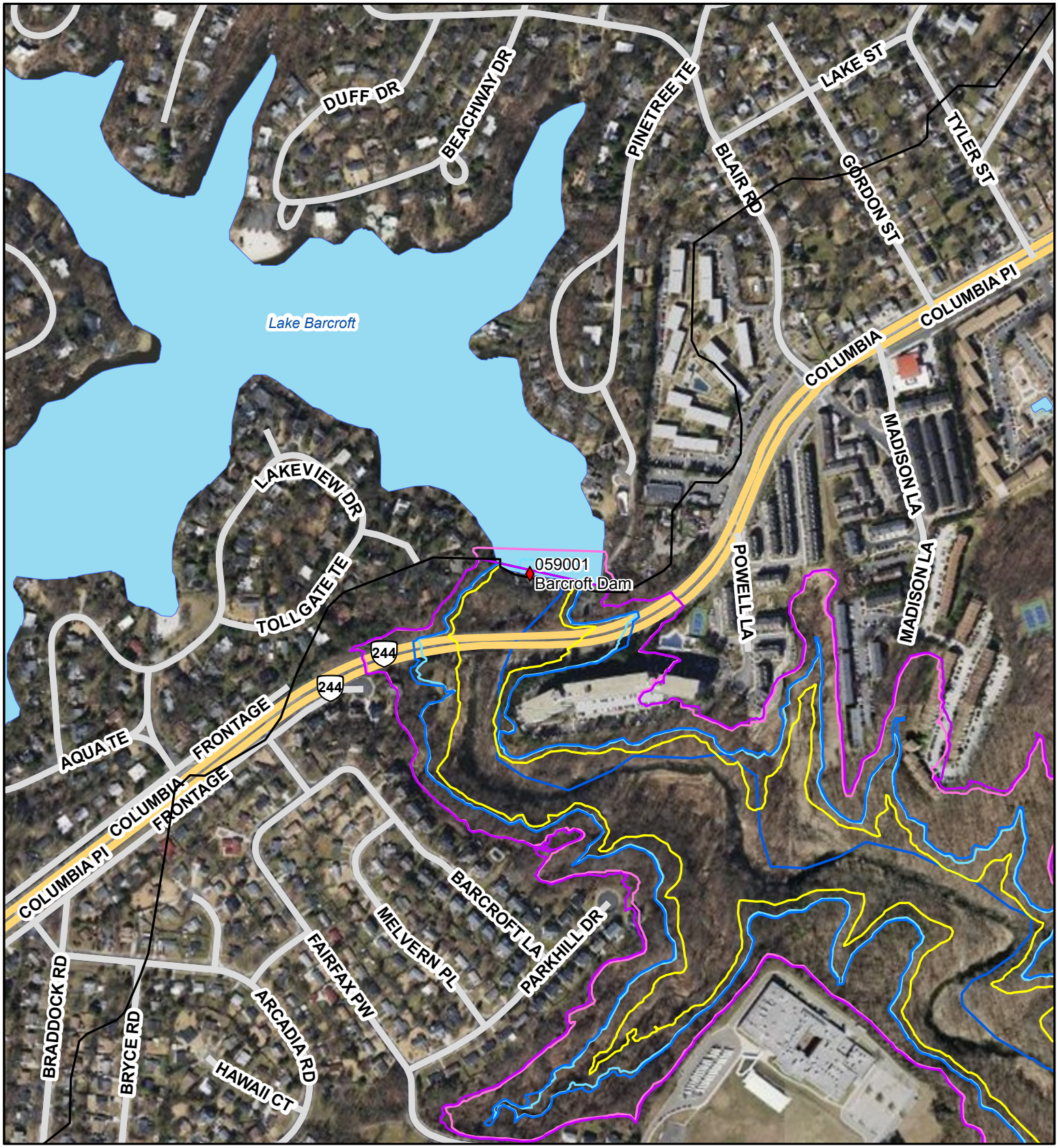
Dams Downstream:

- N/A

Potential Impact Structures (count):

- 5477 Homes
- 52 Businesses
- 1 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 2 Railroads
- 1 Utilities
- 1 Parks
- 1 Golf Courses

Dam Number: **059001**
Dam Name: **Barcroft Dam**
VAHU6: PL26
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 35,37
HUC 12: 020700100302
VA House: 38
Watershed Name: Cameron Run
Congressional: 5108,5111
USGS Topo: ANNANDALE



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Beaverdam Creek Dam

Inventory Number: 107001

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1972

Dam Owner:
Dale C. Hammes, General Manager
(primary)(571) 291-7980(Office)
44865 Loudoun Water Way
Ashburn VA, 20147

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 11/30/2026

Days Since Last Inspection: 498

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Water Supply (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 29.00 Miles

River or Stream: Beaverdam Creek

Technical Basics

Normal Pool Area: 275.00 Acres

Top Surface Area: 398.00 Acres

Normal Pool Capacity: 4082.00 Acre-Feet

Top Capacity: 6764.00 Acre-Feet

Normal Pool Elevation: 290.00 Feet

Top Elevation: 298.00 Feet

Normal Pool Height: 47.00 Feet

Top Height: 55.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 5.50 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .74 PMF **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
8/25/2021	Engineer	Satisfactory
9/22/2020	Engineer	Satisfactory
9/3/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 06/18/2018
Expiration Date: 06/18/2024

Dam Location

Dam Address:
21319 Fairhunt Drive
Ashburn VA, 20148

E911 Direction to Dam:
The impoundment structure can be accessed by taking Reservoir Rd (Rte 861) east toward Beaverdam Reservoir and then turning left onto a dirt road, heading north about three quarters of a mile to the structure.

EAP Contacts

Dam Operator: Carl Burleson
(540) 454-0902(Mobile); (primary)(571) 291-7940(Office)
(primary)na
44865 Loudoun Water Way
Ashburn VA, 20146

Dam Alternate Operator:Roddy Mowe
(primary)(571) 291-7701(Office); (703) 508-3307(Mobile)
(primary)na
44865 Loudoun Water Way
Ashburn VA, 20146

Rain Gauge Observer: Ray Braithwaite
(571) 291-1986(Mobile); (primary)(571) 291-7849(Office)
(primary)na
44961 Loudoun Water Way
Ashburn VA, 20147

Alternate Rain Gauge Observer:John Bartyczak
(primary)(703) 728-1686(Office)
(primary)na
NA
Na VA, 99999

24-Hour Dispatch Center: NA NA
(primary)(703) 777-2243(Office); (911) 911-9119(Office)
(primary)na
16600 Courage Court
Leesburg VA, 22075

Local Government Emergency Services:Kevin Johnson
(703) 737-8831(Mobile); (primary)(703) 777-2243(Office)
(primary)oem@loudoun.gov
801 Sycolin Road
Suite 100
Leesburg VA, 20175

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:James Betz
(primary)(703) 259-0245(Office); (800) 367-7623(Office)
(primary)james.betz@vdot.virginia.gov

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov

41 Lawson Road S.E.
Leesburg VA, 20175

43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 643 - 99999 miles downstream
- 7 - 99999 miles downstream
- 773 - 99999 miles downstream

Dams Downstream:

- 107030
- 107003

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **107001**

Dam Name: **Beaverdam Creek Dam**

VAHU6: PL14

Municipalities: Loudoun County

Region: 1

SWCD: LOUDOUN

VA Senate: 13

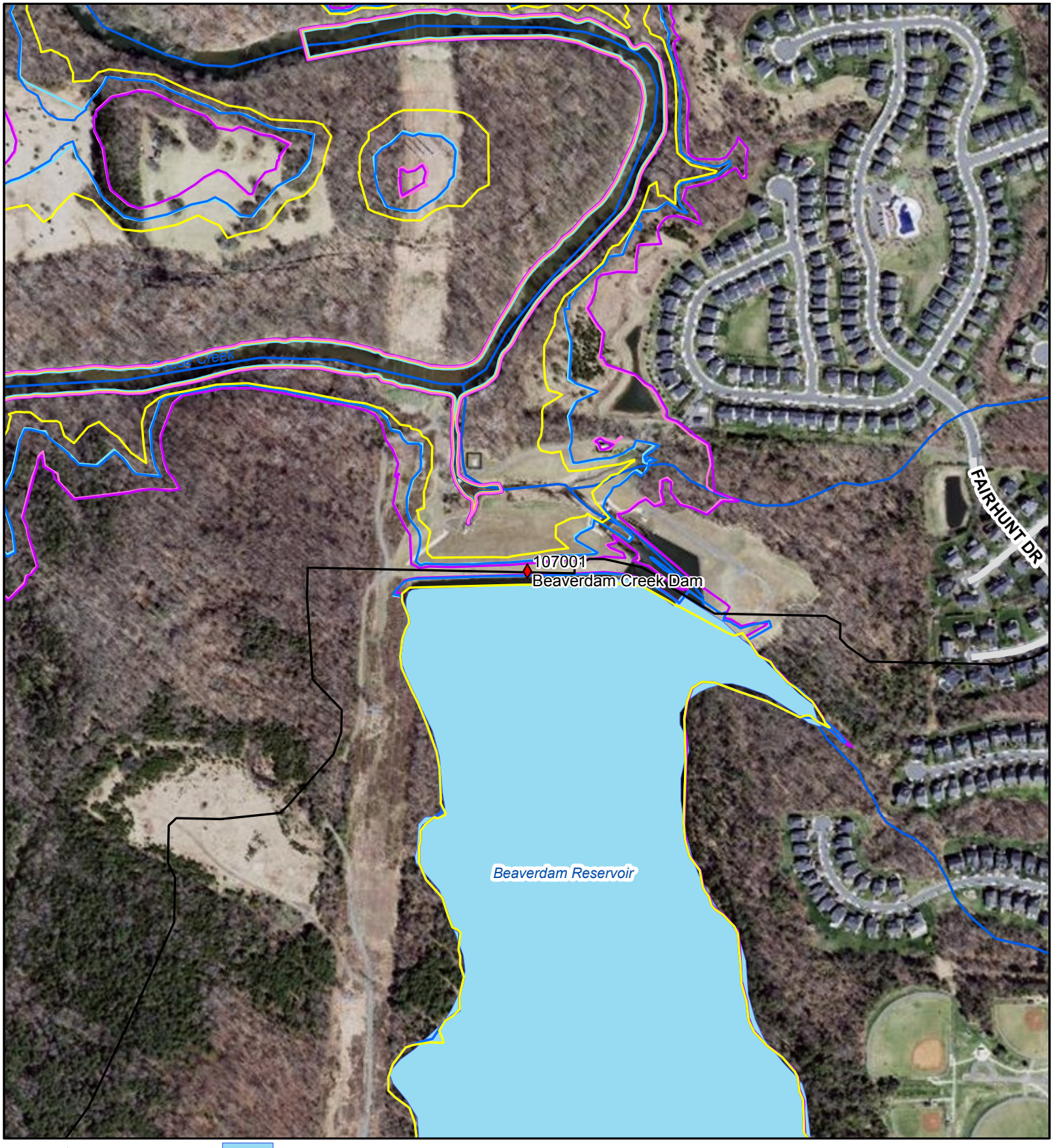
HUC 12: 020700080702

VA House: 10

Watershed Name: Goose Creek-Big Branch

Congressional: 5110

USGS Topo: LEESBURG



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Brambleton Land Bay 3 Pond 6 Dam

Inventory Number: 107039

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 03/01/2005

Dam Owner:
Kim Adams
(primary)(703) 722-2684(Office)
42395 Ryan Road, Suite 301
Brambleton VA, 20148

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 1 Year Certificate

Certificate Expiration: 03/31/2023

Days Since Last Inspection: 720

Inundation Report: 08/16/2017

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: TR-Broad Run

Technical Basics

Normal Pool Area: 6.20 Acres

Top Surface Area: 13.90 Acres

Normal Pool Capacity: 21.60 Acre-Feet

Top Capacity: 79.20 Acre-Feet

Normal Pool Elevation: 274.00 Feet

Top Elevation: 282.00 Feet

Normal Pool Height: 8.70 Feet

Top Height: 14.20 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.86 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: 100.00 YR

Required Spillway Design Flow: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
1/15/2021	Engineer	Satisfactory
1/2/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 05/09/2004
Expiration Date: 05/09/2010

Dam Location

Dam Address:
42853 Cumulus Terrace
Brambleton VA, 20148

E911 Direction to Dam:
Dam is visible from E911 address.

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Brice R. Kutch, P.E.
(primary)(703) 870-7000(Office)
(primary)bkutch@gky.com
4229 Lafayette Center Drive
Suite 1850
Chantilly VA, 20151

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

- VA-653 - 0.11 miles downstream

Dams Downstream:

- 000000

Potential Impact Structures (count):

- 0 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **107039**

Dam Name: **Brambleton Land Bay 3 Pond 6 Dam**

VAHU6: PL17

Municipalities: Loudoun County

Region: 1

SWCD: LOUDOUN

VA Senate: 33

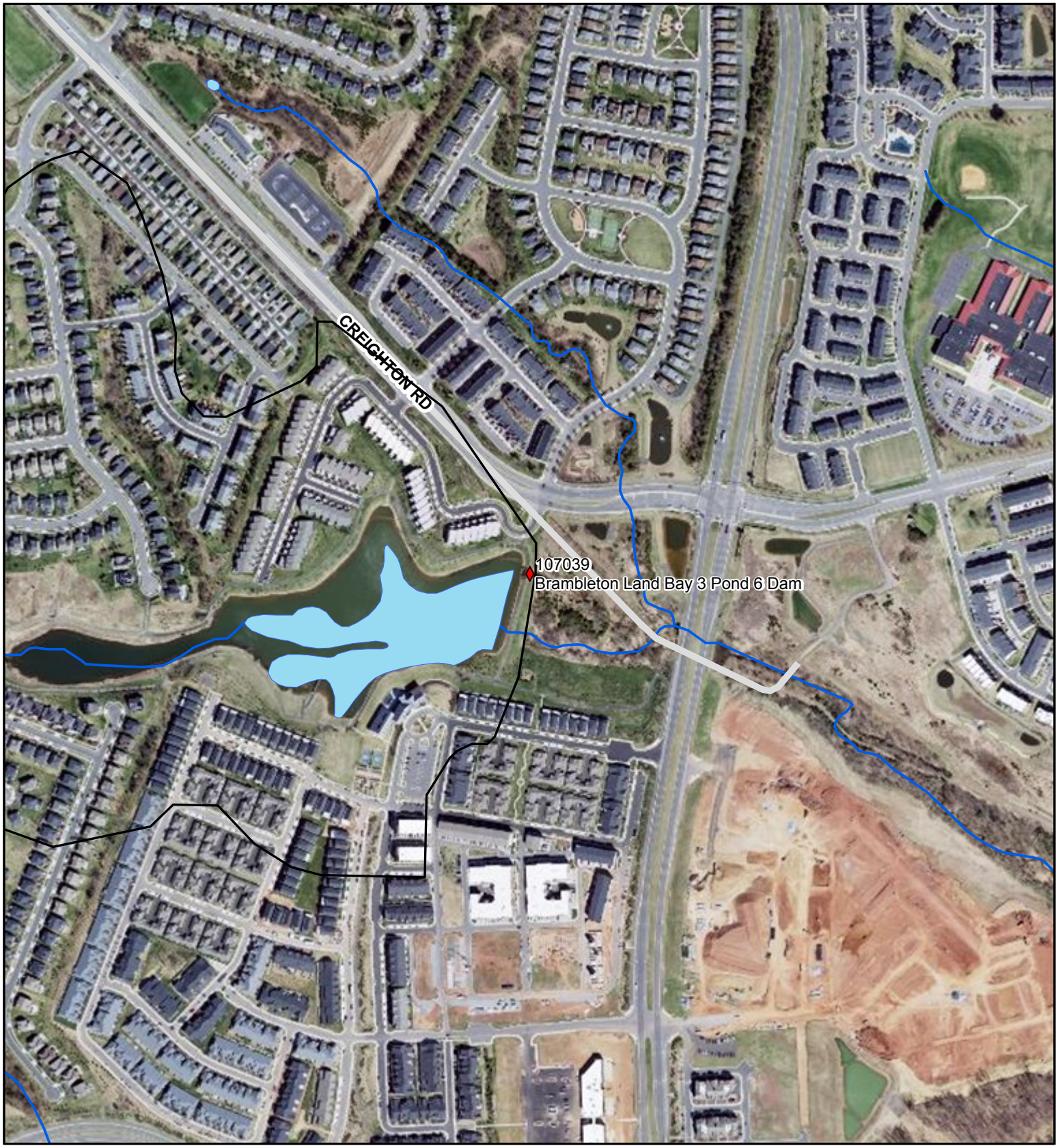
HUC 12: 020700080901

VA House: 87

Watershed Name: Broad Run-Lenah Run

Congressional: 5110

USGS Topo: ARCOLA



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Breckinridge Dam

Inventory Number: 179003

Hazard Classification: High

City/County: Prince William County, Stafford County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1940

Dam Owner:
Donald R. Cory
(primary)(703) 221-9000(Office)

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type:

Certificate Expiration:

Days Since Last Inspection:

Inundation Report: Unknown

Type of Dam
Gravity (Primary)

Reservoir Purpose
Water Supply (Primary)
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: Chopawamsic Creek

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 0.00 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 2670.00 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 58.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **179003**

Dam Name: **Breckinridge Dam**

VAHU6: PL53

Municipalities: Prince William County,Stafford County

Region: 1

SWCD: PRINCE WILLIAM,TRI-COUNTY/CITY

VA Senate: 36

HUC 12: 020700110105

VA House: 2,31

Watershed Name: Chopawamsic Creek

Congressional: 5101

USGS Topo: JOPLIN

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Burke Centre Section 11B Dam

Inventory Number: 059040

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2024

Days Since Last Inspection: 38

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 0.00 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 84.82 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 374.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 34.90 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.11 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF

Required Spillway Design Flow: 1.00 PMF

Inspections (Last 3 Max)

Date	Type	Condition
11/29/2022	Owner	Satisfactory
11/16/2021	Engineer	Satisfactory
11/2/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 05/06/2021
Expiration Date: 05/06/2027

Dam Location

Dam Address:
6000 Burke Centre Parkway
Burke VA, 22015

E911 Direction to Dam:
On an unnamed tributary to Sideburn Branch near Burke Centre Parkway

EAP Contacts

Dam Operator: Chad Crawford
(primary)(703) 324-5500(Office)
(primary)Chad.Crawford@fairfaxcounty.gov
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Dam Alternate Operator:Craig Carinci
(primary)(703) 324-5500(Office)
(primary)Craig.Carinci@fairfaxcounty.gov
12055 Government Center Parkway, Suite 449
Fairfax VA, 22035

Rain Gauge Observer: Bat Phone Holder Bat Phone
(primary)(571) 722-8622(Mobile)
(primary)dipmani.kumar@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

Alternate Rain Gauge Observer:Bat Phone Holder Bat Phone Holder
(primary)(571) 722-8622(Mobile)
(primary)dipmani.kumar@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

24-Hour Dispatch Center: 911 Emergency Center
(primary)(703) 691-2131(Office)
(primary)DPSCBridge@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Local Government Emergency Services:Emergency Operation Center (EOC)
Emergency Operation Center (EOC)
(primary)(571) 350-1000(Office)
(primary)oem@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Owner's Engineer: Brice Kutch
(primary)(703) 870-7000(Office)
(primary)bkutch@gky.com
None
4229 Lafayette Center Drive, Suite 1850
Chantilly VA, 20151

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Transportation Operations Center TOC
(primary)(703) 877-3401(Office)
(primary)Joseph.Warner@vdot.virginia.gov
4975 Alliance Drive
Fairfax VA, 22033

National Weather Service:Forecaster of the Day
Forecaster of the Day
(primary)(571) 888-3500(Office)
(primary)Steven.Zubrick@noaa.gov
43858 Weather Service Road
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- None - 0 miles downstream

Dams Downstream:

- 000000

Potential Impact Structures (count):

- 2 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **059040**
Dam Name: **Burke Centre Section 11B Dam**
VAHU6: PL29
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 37
HUC 12: 020700100401
VA House: 41
Watershed Name: Pohick Creek
Congressional: 5111
USGS Topo: FAIRFAX

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Burke Lake Dam

Inventory Number: 059002

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1960

Dam Owner:
John Kirk
(primary)(804) 367-2087(Office)
7870 Villa Park Dr. Suite 400
PO Box 90778
Henrico VA, 23228

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 03/31/2022

Days Since Last Inspection: 270

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 5.00 Miles

River or Stream: South Run

Technical Basics

Normal Pool Area: 223.00 Acres

Top Surface Area: 280.00 Acres

Normal Pool Capacity: 1983.00 Acre-Feet

Top Capacity: 4589.40 Acre-Feet

Normal Pool Elevation: 314.50 Feet

Top Elevation: 323.50 Feet

Normal Pool Height: 40.50 Feet

Top Height: 49.50 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 3.14 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
4/11/2022	Engineer	Fair
3/18/2020	Engineer	Satisfactory
3/27/2018	Engineer	Fair

EAP Quick Reference

Approval Date: 12/08/2011
Expiration Date: 07/17/2026

Dam Location

Dam Address:
7523 Ox Rd.
7309 Laketree Drive
Fairfax Station VA, 22309

E911 Direction to Dam:
DWR Boat Ramp Access (7523 Ox Rd.): access dam by foot following trail to the southeast towards the dam. |

Auxiliary Spillway Access (7309 Laketree Drive): Park adjacent to residential homes along roads widened gravel shoulde. Access route to auxiliary spillway is located on the right side of Laketree drive opposite 7309 Laketree drive.

EAP Contacts

Dam Operator: Ron Hughes
(primary)(540) 248-9360(Office); (540) 295-5698(Mobile)
(primary)ron.hughes@dwr.virginia.gov
na
Na VA, 12345

Dam Alternate Operator:John Odenkirk
(primary)(540) 899-4169(Mobile); (804) 844-9661(Mobile)
(primary)john.odenkirk@dwr.virginia.gov
na
Na VA, 12345

Rain Gauge Observer: Keith O'Conner
(primary)(703) 323-6600(Office); (703) 731-4564(Mobile)
(primary)keith.oconnor@fairfaxcounty.gov
7315 Ox Rd
Fairfax Station VA, 22039

Alternate Rain Gauge Observer:Rich Landers
(primary)(540) 295-3528(Mobile); (804) 367-5415(Office)
(primary)RICH.LANDERS@DWR.VIRGINIA.GOV
7870 Villa Park Dr.
Suite 400
Henrioc VA, 23229

24-Hour Dispatch Center: DWR 24Hr-Dispatch
(primary)(804) 367-5415(Office)
(primary)DISPATCH@DWR.VIRGINIA.GOV
7870 Villa Park Dr.
Henrico VA, 23228

Local Government Emergency Services:Seamus Mooney
(primary)(571) 439-4901(Office)
(primary)Seamus.Mooney@fairfaxcounty.gov
4890 Alliance Drive
Suite 2200
Fairfax VA, 22030

Owner's Engineer: Michael D. Wilson, P.E.
(434) 546-6156(Mobile); (primary)(434) 847-7796(Office)
mdw@handp.com; (primary)mwilson@handp.com
2524 Langhorne Road
Lynchburg VA, 24501

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Steve Shannon
(primary)(703) 259-2357(Office)
(primary)STEVEN.SHANNON@VDOT.VIRGINIA.GOV
na
Na VA, 12345

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 636 - Hooes Rd - 3.2 miles downstream
- 6070 - South Run Rd - 5.5 miles downstream
- I-95 - Interstate Hwy - 7.6 miles downstream
- Railroad - Pohick Creek - 7.7 miles downstream
- 642 - Lorton Rd - 8.6 miles downstream
- Rt. 1 - Richmond Hwy - 8.7 miles downstream
- 611 - Old Colchester Rd - 9.6 miles downstream

Potential Impact Structures (count):

- 459 Homes
- 16 Businesses
- 1 Schools
- 0 Hospitals
- 1 Critical Infrastructure
- 1 Railroads
- 1 Utilities
- 4 Parks
- 0 Golf Courses

Dams Downstream:

- Lake Mercer Dam

Dam Number: **059002**
Dam Name: **Burke Lake Dam**
VAHU6: PL29
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 39
HUC 12: 020700100401
VA House: 42
Watershed Name: Pohick Creek
Congressional: 5110
USGS Topo: FAIRFAX

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Camp 5 Dam

Inventory Number: 153008

Hazard Classification: High

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1937

Dam Owner:

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type:

Certificate Expiration:

Days Since Last Inspection:

Inundation Report: Unknown

Type of Dam
Gravity (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 6.00 Miles

River or Stream: South Br.Quantico Creek

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 0.00 Acres

Normal Pool Capacity: 70.00 Acre-Feet

Top Capacity: 92.00 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 24.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

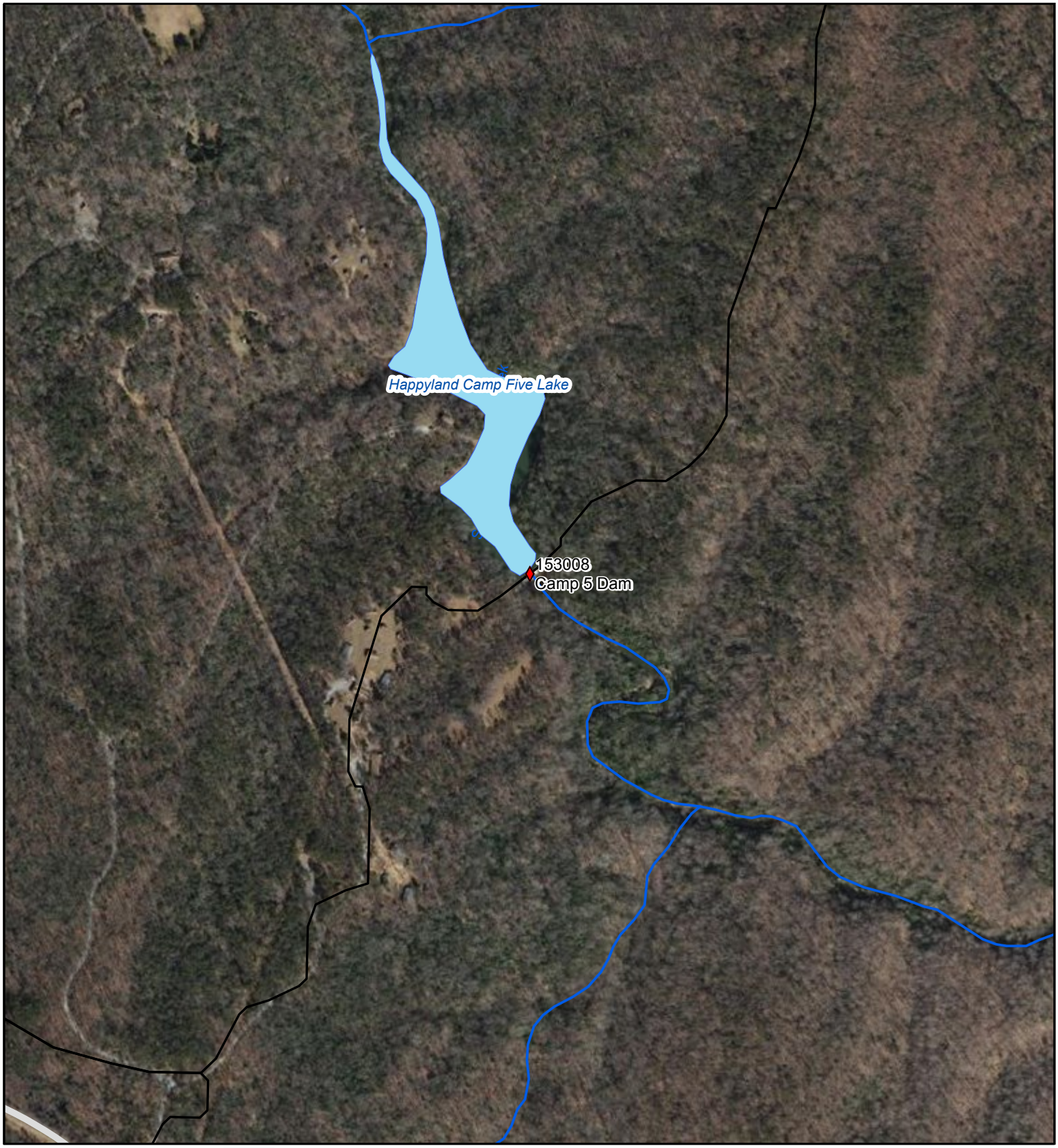
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **153008**
Dam Name: **Camp 5 Dam**
VAHU6: PL52
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 36
HUC 12: 020700110104
VA House: 31
Watershed Name: Quantico Creek
Congressional: 5101
USGS Topo: JOPLIN



Dam Locations
Waterbodies (NHD)
Interstate
State Primary Highway
Streams (NHD)
US Primary Highway
Secondary
N

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Carrington Regional Dam

Inventory Number: 059049

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2023

Days Since Last Inspection: 52

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream:

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 6.50 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 55.00 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 346.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 25.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 1.00 Sq. Mi.

6 Hour PMP: 28.40

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .90 PMP

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
11/15/2022	Engineer	Satisfactory
11/16/2021	Engineer	Satisfactory
11/2/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 11/30/2016
Expiration Date: 11/30/2022

Dam Location

Dam Address:

,

E911 Direction to Dam:
TBD

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Ewald Schwarzenegger
(primary)(703) 385-7555(Office)
(primary)ewald@cpja.com
3959 Pender Dr. Suite 201
Fairfax VA, 22030

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

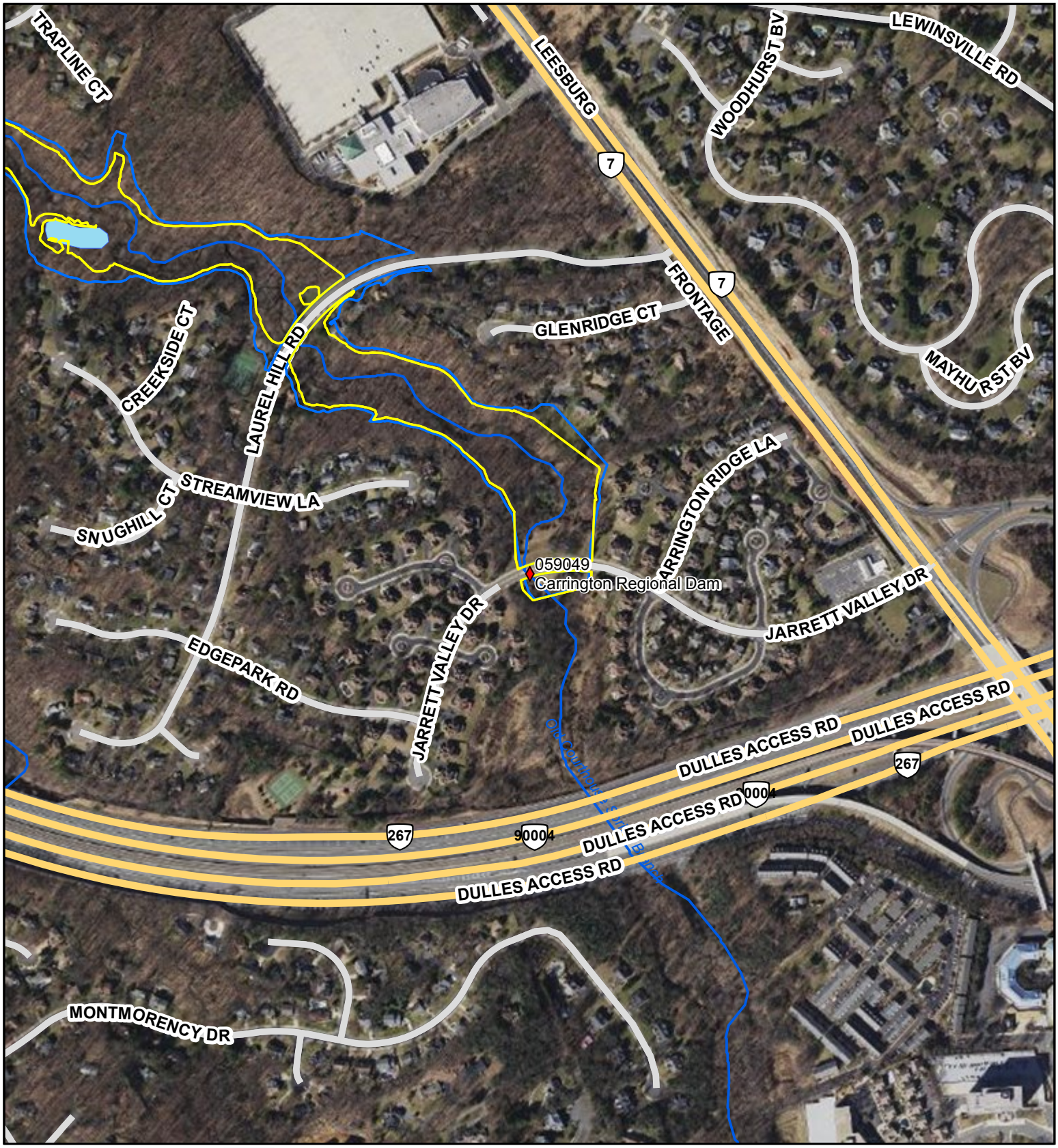
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- 6 Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059049**
Dam Name: **Carrington Regional Dam**
VAHU6: PL22
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 31,32
HUC 12: 020700081004
VA House: 34
Watershed Name: Difficult Run
Congressional: 5110,5111
USGS Topo: FALLS CHURCH,VIENNA



Dam Locations | Waterbodies (NHD) | Interstate | State Primary Highway
Streams (NHD) | US Primary Highway | Secondary

N

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Creighton Hills Dam

Inventory Number: 107131

Hazard Classification: Significant

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 06/01/2000

Dam Owner:
James D. Brown
(primary)(571) 237-0905(Home); (703) 675-0867(Office)
41194 Grenata Preserve Place
Leesburg VA, 20175

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 11/30/2024

Days Since Last Inspection: 97

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)
Flood Control or storm water management (Secondary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 0.00 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 89.54 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 57.90 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition
9/30/2022	Owner	Fair
11/3/2021	Engineer	Poor
7/18/2018	Engineer	Poor

EAP Quick Reference

Approval Date: 11/30/2021
Expiration Date: 11/30/2027

Dam Location

Dam Address:
39486 Lime Kiln Road
Leesburg VA, 20175

E911 Direction to Dam:
Located at the driveway entrance. Take a left at the 1st fork in the road and a left at the 2nd fork in the road. Proceed straight to the dam.

EAP Contacts

Dam Operator: Tim Brown
(primary)(703) 675-0867(Home); (703) 675-0882(Mobile)
(primary)tbrown@creightonenterprises.com
41194 Grenata Preserve Place
Leesburg VA, 20175

Dam Alternate Operator:James Brown
(primary)(571) 237-0905(Office)
(primary)jbrown@creightonenterprises.com
41194 Grenata Preserve PLace
Leesburg VA, 20175

Rain Gauge Observer: Tim Brown
(primary)(703) 675-0867(Home); (703) 675-0882(Mobile)
(primary)tbrown@creightonenterprises.com
41194 Grenata Preserve Place
Leesburg VA, 20175

Alternate Rain Gauge Observer:James Brown
(primary)(571) 237-0905(Office)
(primary)jbrown@creightonenterprises.com
41194 Grenata Preserve PLace
Leesburg VA, 20175

24-Hour Dispatch Center: Loudoun County Emergency Communications Center
(primary)(703) 777-0637(Office)
(primary)na@na.gov
801 Sycolin Road SE
Leesburg VA, 20175

Local Government Emergency Services:Kevin Johnson
(571) 436-1055(Mobile); (primary)(703) 777-0333(Office)
(primary)Kevin.johnson@loudoun.gov.gov
801 Sycolin Road SE
Suite 100
Leesburg VA, 20175

Owner's Engineer: Steven Pandish, P.E.
(primary)(703) 889-2305(Office)
(primary)spandish@gordon.us.com
4501 Daly Drive
Suite 200
Chantilly VA, 20165

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Rodney Frye
(primary)(703) 877-3401(Office)
(primary)rodney.frye@vdot.virginia.gov
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:National Weather Service
(571) 888-3501(Office); (primary)(800) 253-7091(Mobile)
(primary)na@na.com
43858 Weather Service Rd

Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 703 - 0.35 miles downstream

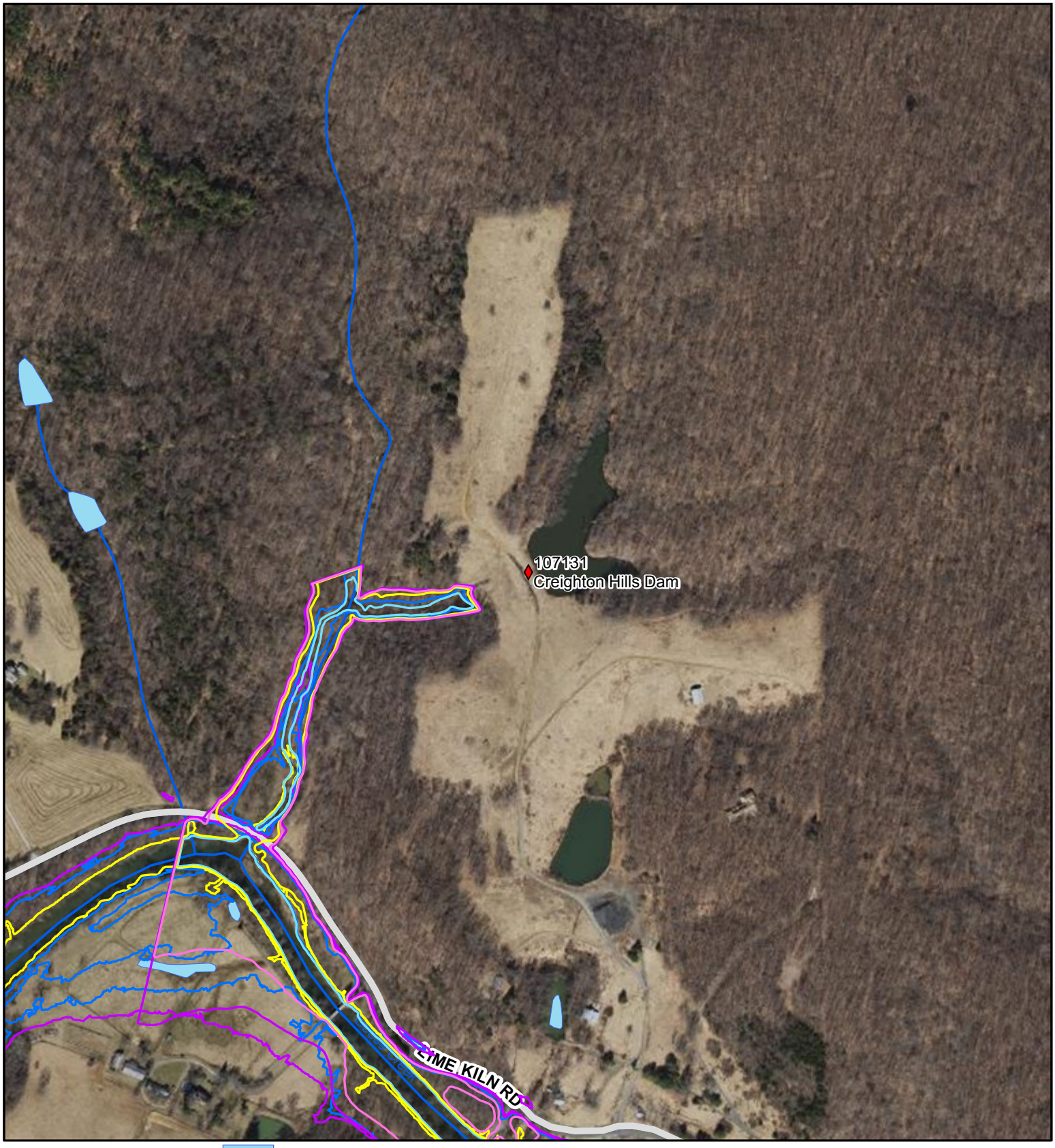
Dams Downstream:

- N/A

Potential Impact Structures (count):

- 0 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **107131**
Dam Name: **Creighton Hills Dam**
VAHU6: PL14
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080702
VA House: 33
Watershed Name: Goose Creek-Big Branch
Congressional: 5110
USGS Topo: LINCOLN



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Crosspointe Lake Dam

Inventory Number: 059014

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1900

Dam Owner:
Heather L. McDevitt, Community Manager
(primary)(703) 690-2321(Office)
8275 Glen Eagles Lane
Fairfax Station VA, 22039

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 12/31/2024

Days Since Last Inspection: 58

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)
Fish & wildlife or small farm pond (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Giles Run

Technical Basics

Normal Pool Area: 8.40 Acres

Top Surface Area: 12.50 Acres

Normal Pool Capacity: 35.00 Acre-Feet

Top Capacity: 88.00 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 12.00 Feet

Top Height: 20.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition
11/9/2022	Engineer	Fair
1/29/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: David A. Krisnitski, P.E.
(primary)(540) 344-7939(Office)
(primary)DKrisnitski@fandr.com
1734 Seibel Drive, NE
Roanoke VA, 24012

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

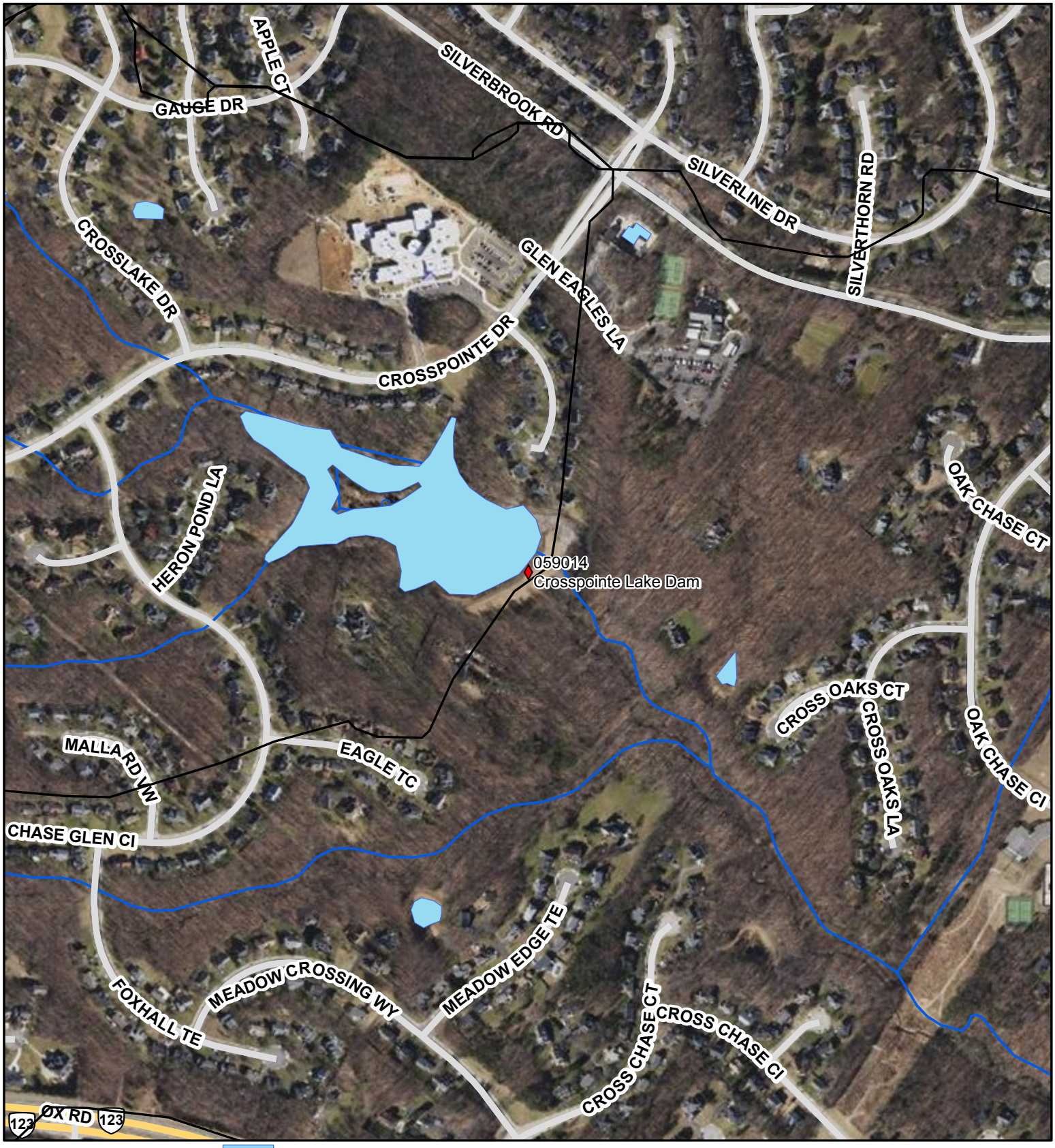
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059014**
Dam Name: **Crosspointe Lake Dam**
VAHU6: PL48
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 39
HUC 12: 020700100803
VA House: 42
Watershed Name: Occoquan River-Belmont Bay
Congressional: 5110
USGS Topo: OCCOQUAN



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Daddy Long Lake Dam

Inventory Number: 059110

Hazard Classification: Significant

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Richard L. Beizer
(primary)(703) 759-3064(Office)
98 Interpromontory Road
Great Falls VA, 22066

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type:

Certificate Expiration:

Days Since Last Inspection:

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Fish & wildlife or small farm pond (Primary)
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Nichols Run

Technical Basics

Normal Pool Area: 5.85 Acres

Top Surface Area: 10.10 Acres

Normal Pool Capacity: 26.61 Acre-Feet

Top Capacity: 53.03 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 13.00 Feet

Top Height: 15.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059110**
Dam Name: **Daddy Long Lake Dam**
VAHU6: PL23
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 31
HUC 12: 020700081005
VA House: 34
Watershed Name: Potomac River-Nichols Run-Scott Run
Congressional: 5110
USGS Topo: SENECA

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Daley Dam

Inventory Number: 107009

Hazard Classification: Significant

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1974

Dam Owner:
Timothy M. Biddle
(primary)(540) 668-9030(Office)
14481 Purcellville Road
Purcellville VA, 20132-3605

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 05/31/2024

Days Since Last Inspection: 452

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 1.00 Miles

River or Stream: TR-Catoctin Creek

Technical Basics

Normal Pool Area: 18.00 Acres

Top Surface Area: 52.00 Acres

Normal Pool Capacity: 193.00 Acre-Feet

Top Capacity: 465.00 Acre-Feet

Normal Pool Elevation: 138.00 Feet

Top Elevation: 148.00 Feet

Normal Pool Height: 19.00 Feet

Top Height: 29.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 1.40 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition
10/10/2021	Owner	Satisfactory
9/1/2019	Owner	Satisfactory
9/12/2018	Owner	Satisfactory

EAP Quick Reference

Approval Date: 06/17/2007
Expiration Date: 06/17/2013

Dam Location

Dam Address:
14481 Purcellville Road
Purcellville VA, 20132

E911 Direction to Dam:
Dam is visible from E911 address.

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Daniel R. Hamric, P.E.
(primary)(540) 678-1216(Office)
(primary)dan.hamric@ruckmanengineering.com
22-B Ricketts Drive
Winchester VA, 22601

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

- VA-611 - 0.06 miles downstream
- VA-693 - 1.2 miles downstream

Dams Downstream:

- 000000

Potential Impact Structures (count):

- 30 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **107009**
Dam Name: **Daley Dam**
VAHU6: PL03
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080302
VA House: 33
Watershed Name: Catoctin Creek
Congressional: 5110
USGS Topo: PURCELLVILLE

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Dulles Airport Dam

Inventory Number: 107008

Hazard Classification: Significant

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1962

Dam Owner:
Darrell Hollowell
(primary)(703) 572-2808(Office)
PO Box 17045
Washington DC, 20041

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 03/31/2019

Days Since Last Inspection: 3502

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Water Supply (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 2.00 Miles

River or Stream: TR-Horsepen Run

Technical Basics

Normal Pool Area: 28.00 Acres

Top Surface Area: 32.40 Acres

Normal Pool Capacity: 102.00 Acre-Feet

Top Capacity: 259.00 Acre-Feet

Normal Pool Elevation: 265.10 Feet

Top Elevation: 270.40 Feet

Normal Pool Height: 10.00 Feet

Top Height: 11.40 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 1.42 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: 100.00 YR **Required Spillway Design Flow**: .50 PMP

Inspections (Last 3 Max)

Date	Type	Condition
6/4/2013	Engineer	Fair
12/11/2009	Owner	Fair
12/18/2008	Owner	Fair

EAP Quick Reference

Approval Date: 07/11/2002
Expiration Date: 07/11/2008

Dam Location

Dam Address:
44950 Rudder Road
Sterling VA, 20166

E911 Direction to Dam:
Dam is located across from Sunoco Gas Station.

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Brian A. Leuck, P.E.
(primary)(703) 572-2800(Office)
(primary)na@na.com
1 Saarinen Circle
P.O. Box 17045
Dulles VA, 20166

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

- VA-267 - 0.11 miles downstream

Dams Downstream:

- 000000

Potential Impact Structures (count):

- 0 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **107008**
Dam Name: **Dulles Airport Dam**
VAHU6: PL18
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 33
HUC 12: 020700080902
VA House: 87
Watershed Name: Horsepen Run
Congressional: 5110
USGS Topo: HERNDON

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Dulles Corner Lake Dam

Inventory Number: 059048

Hazard Classification: Significant

City/County: Fairfax County, Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1990

Dam Owner:
Robert O'Brien
(571) 220-5045(Mobile); (primary)(703) 713-0878(Office)
2411 Dulles Corner park, Suite 100
Herndon VA, 20171

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 11/30/2023

Days Since Last Inspection: 1982

Inundation Report: Unknown

Type of Dam
Earth (Primary)
Concrete (Primary)

Reservoir Purpose
Other (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: 3.43 Acres

Top Surface Area: 14.00 Acres

Normal Pool Capacity: 16.00 Acre-Feet

Top Capacity: 116.00 Acre-Feet

Normal Pool Elevation: 281.00 Feet

Top Elevation: 294.80 Feet

Normal Pool Height: 0.00 Feet

Top Height: 20.40 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 1.33 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration: 0.54

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .42 PMF

Required Spillway Design Flow: .42 PMF

Inspections (Last 3 Max)

Date	Type	Condition
8/2/2017	Engineer	Satisfactory
6/18/2011	Owner	
6/18/2011	Engineer	

EAP Quick Reference

Approval Date: 10/14/2017
Expiration Date: 10/14/2023

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Edward Umbrell
(primary)(703) 468-2258(Office)
(primary)eumbrell@dewberry.com
13575 Heathcote Boulevard
Suite 130
Gainesville VA, 20155

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059048**

Dam Name: **Dulles Corner Lake Dam**

VAHU6: PL18

Municipalities: Fairfax County,Loudoun County

Region: 1

SWCD: LOUDOUN,NORTHERN VIRGINIA

VA Senate: 33

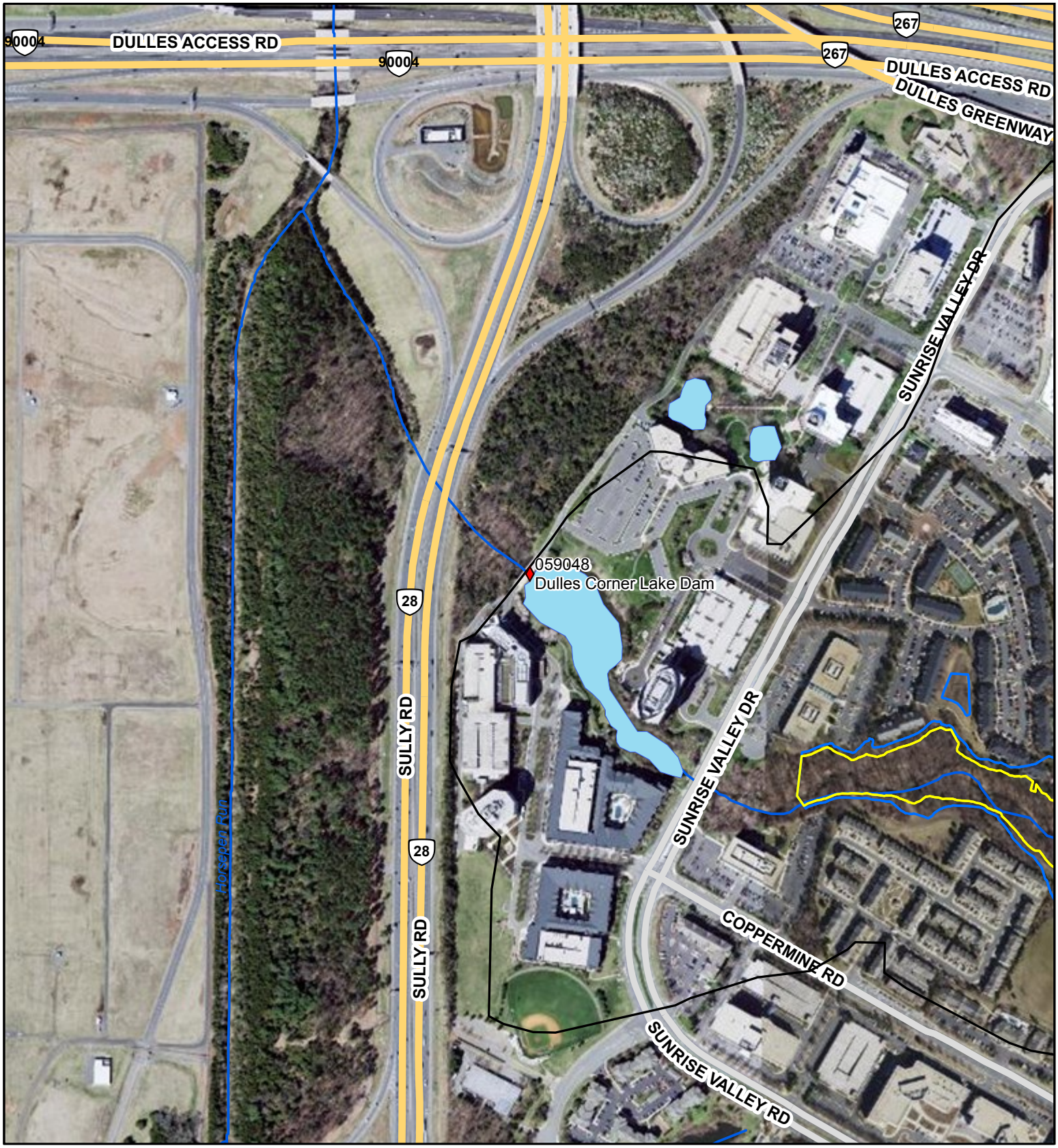
HUC 12: 020700080902

VA House: 86,87

Watershed Name: Horsepen Run

Congressional: 5110,5111

USGS Topo: HERNDON



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: East Market Pond Dam

Inventory Number: 059059

Hazard Classification: Significant

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
C/O Mr. Niyi Fajana, The Peterson Company
12500 Fair Lakes Circle, Suite 400
Fairfax VA, 22033

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type:

Certificate Expiration:

Days Since Last Inspection:

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Tributary to Big Rocky Run

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 11.01 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 53.99 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 12.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

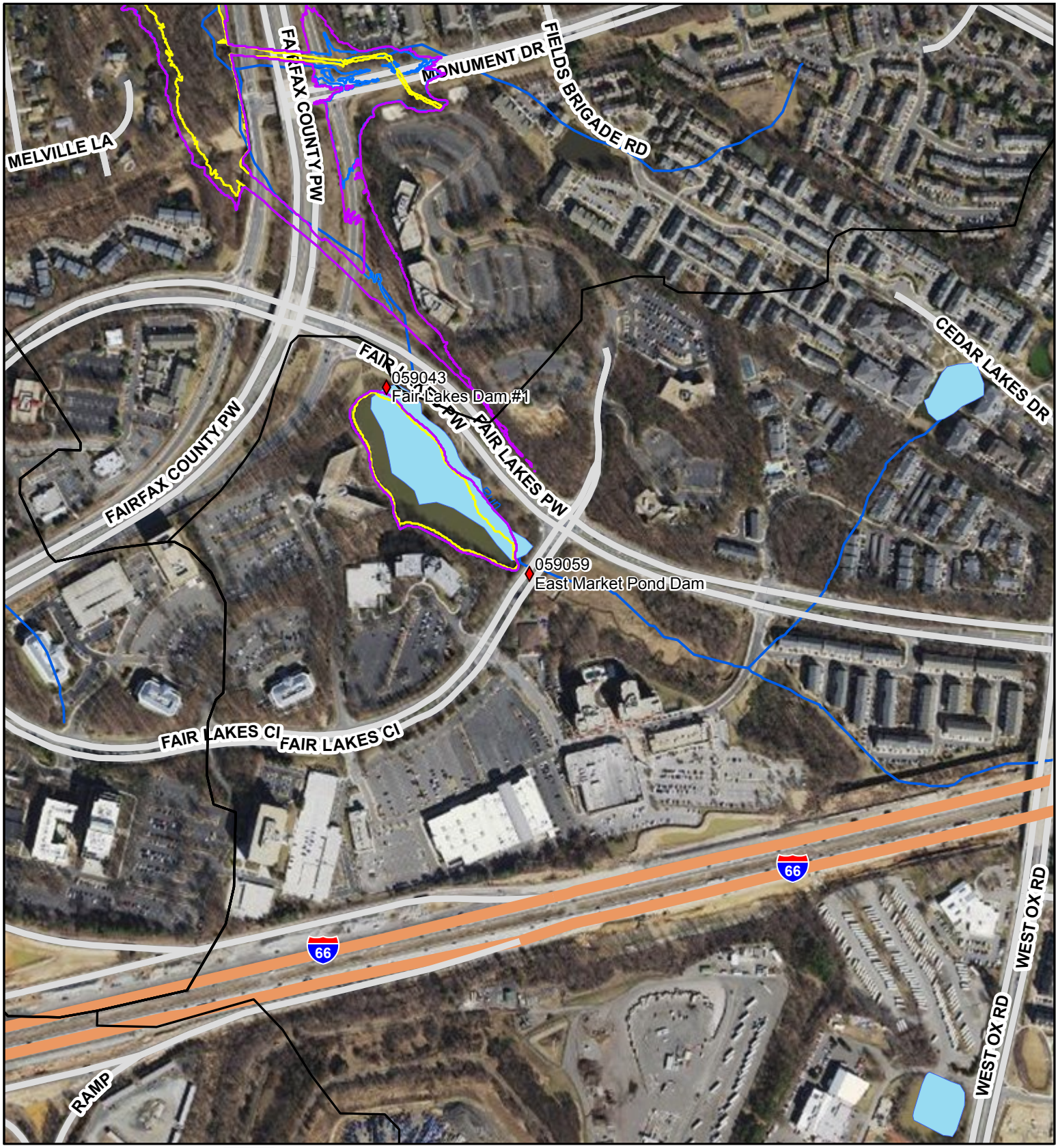
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059059**
Dam Name: **East Market Pond Dam**
VAHU6: PL45
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 37
HUC 12: 020700100704
VA House: 35
Watershed Name: Cub Run
Congressional: 5111
USGS Topo: FAIRFAX,MANASSAS



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Emergency Sewage Retention Pond No.1 Structure

Inventory Number: 059055

Hazard Classification: Significant

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Richard C. Zaepfel, Project Manager
(primary)(703) 830-2200(Office)
14631 Compton Rd.
Centreville VA, 20121

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type:

Certificate Expiration:

Days Since Last Inspection:

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Other (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Tributary of Bull Run

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 13.20 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 140.00 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 20.50 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059055**

Dam Name: **Emergency Sewage Retention Pond No.1 Structure**

VAHU6: PL45,PL46

Municipalities: Fairfax County

Region: 1

SWCD: NORTHERN VIRGINIA

VA Senate: 37

HUC 12: 020700100704,020700100705

VA House: 40

Watershed Name: Cub Run,Lower Bull Run

Congressional: 5110

USGS Topo: MANASSAS

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Emergency Sewage Retention Pond No.2 Structure

Inventory Number: 059056

Hazard Classification: Significant

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Richard C. Zaepfel, Project Manager
(primary)(703) 830-2200(Office)
14631 Compton Rd.
Centreville VA, 20121

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type:

Certificate Expiration:

Days Since Last Inspection:

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Other (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Tributary to Bull Run

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 12.24 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 140.00 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 25.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059056**

Dam Name: **Emergency Sewage Retention Pond No.2 Structure**

VAHU6: PL45,PL46

Municipalities: Fairfax County

Region: 1

SWCD: NORTHERN VIRGINIA

VA Senate: 37

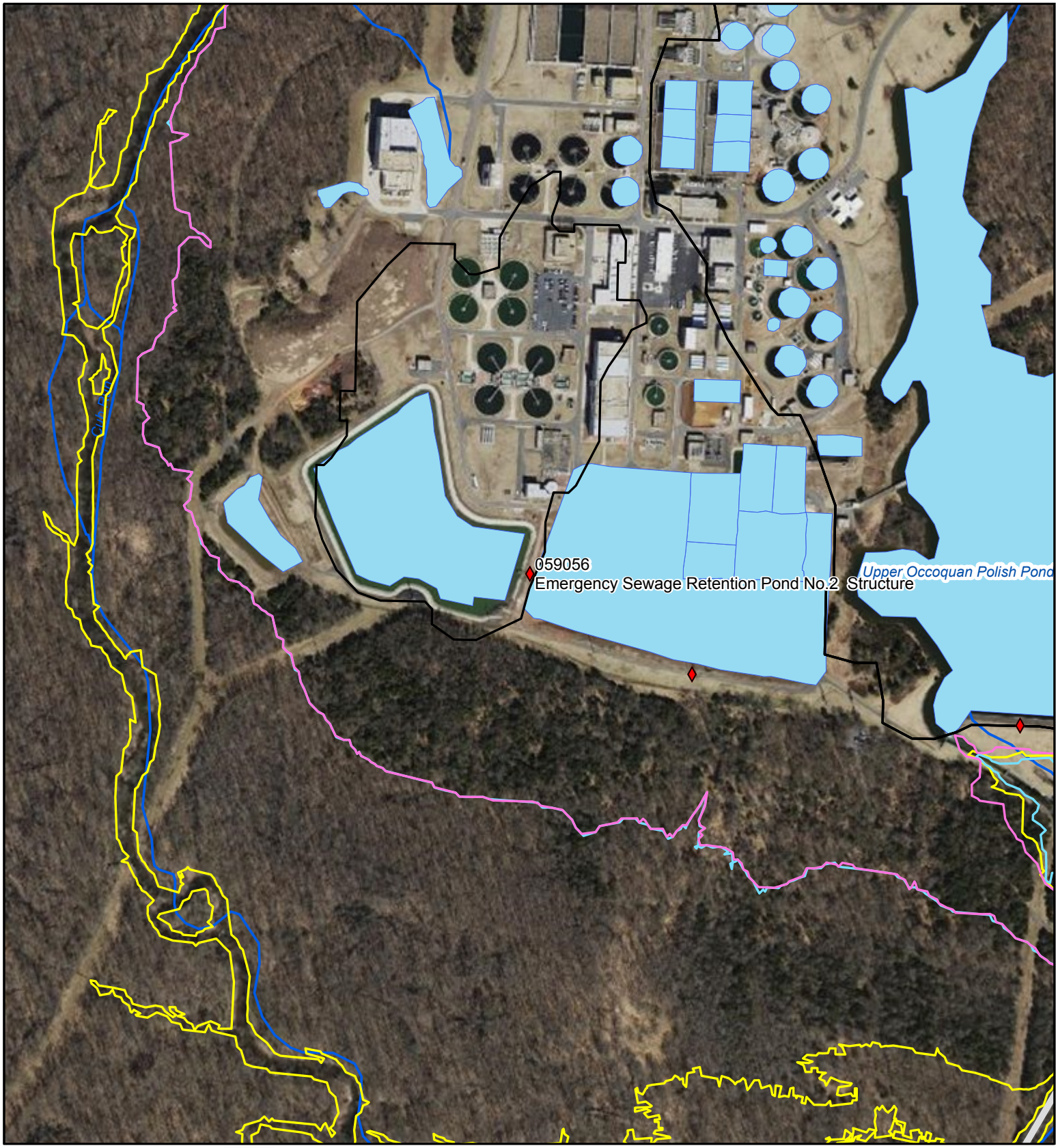
HUC 12: 020700100704,020700100705

VA House: 40

Watershed Name: Cub Run,Lower Bull Run

Congressional: 5110

USGS Topo: MANASSAS



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: F.P. Griffith Water Plant Lorton Quarry

Inventory Number: 059109

Hazard Classification: Significant

City/County: Fairfax County, Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Jamie Bain Hedges
(571) 722-3018(Mobile); (primary)(703) 289-6012(Office)
8570 Executive Park Avenue
P.O. Box 1500
Merrifield VA, 22116

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type:

Certificate Expiration:

Days Since Last Inspection:

Inundation Report: Unknown

Type of Dam
Other (Primary)

Reservoir Purpose
Other (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Little Occoquan Run.

Technical Basics

Normal Pool Area: 12.00 Acres

Top Surface Area: 12.67 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 253.00 Acre-Feet

Normal Pool Elevation: 28.10 Feet

Top Elevation: 50.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 20.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059109**

Dam Name: **F.P. Griffith Water Plant Lorton Quarry**

VAHU6: PL48

Municipalities: Fairfax County,Prince William County

Region: 1

SWCD: NORTHERN VIRGINIA,PRINCE WILLIAM

VA Senate: 36,39

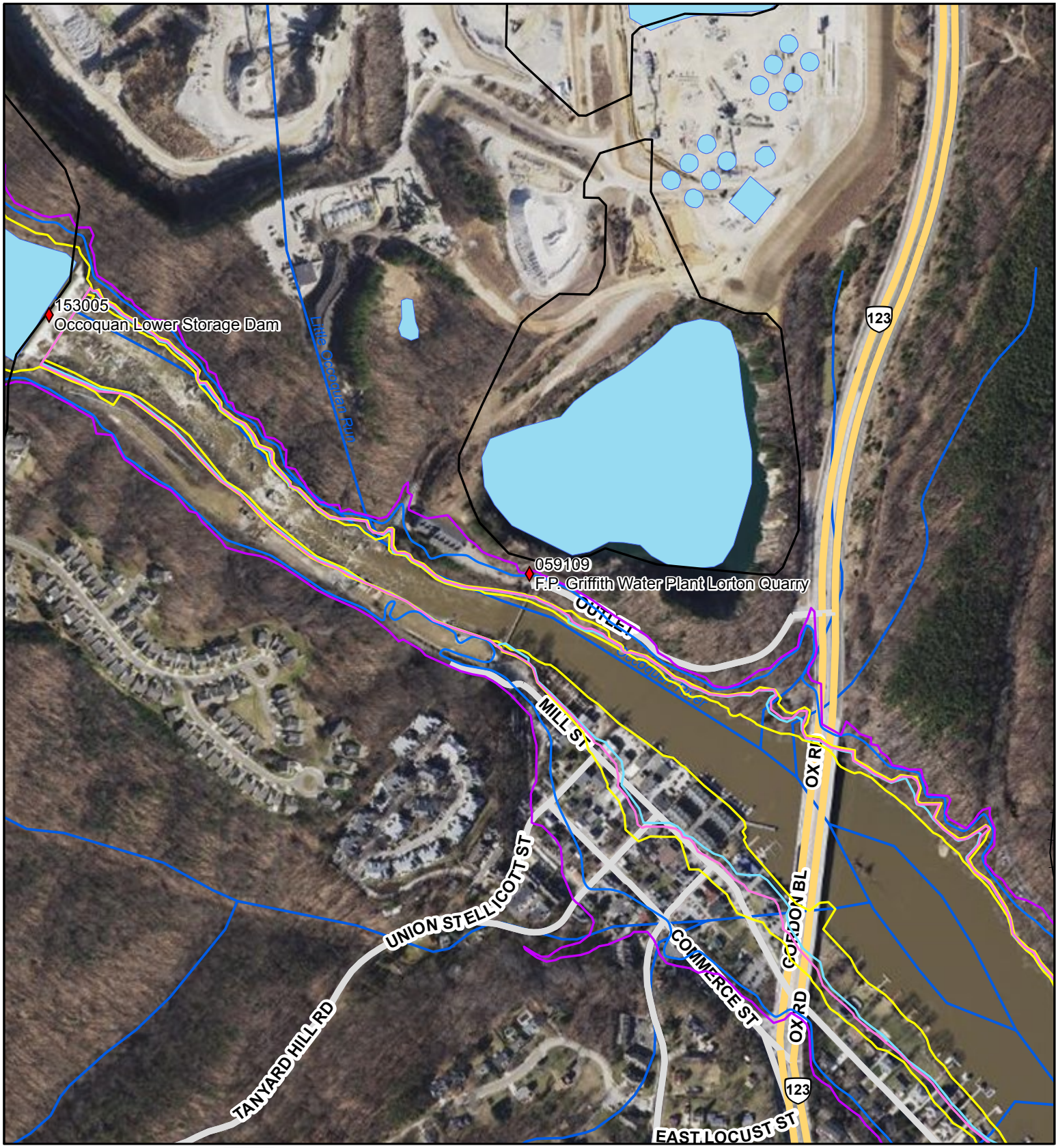
HUC 12: 020700100803

VA House: 42,51,52

Watershed Name: Occoquan River-Belmont Bay

Congressional: 5111

USGS Topo: OCCOQUAN



Dam Locations | Waterbodies (NHD) | Interstate | State Primary Highway

Streams (NHD) | US Primary Highway | Secondary

N

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Fair Lakes Dam #1

Inventory Number: 059043

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Betty J. Rose
(primary)(703) 227-0884(Office)
12500 Fair Lakes Circle, Suite 400
Fairfax VA, 22033

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 03/31/2024

Days Since Last Inspection: 277

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Big Rocky Run tributary

Technical Basics

Normal Pool Area: 3.81 Acres

Top Surface Area: 11.36 Acres

Normal Pool Capacity: 9.48 Acre-Feet

Top Capacity: 99.43 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 7.10 Feet

Top Height: 25.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.78 Sq. Mi.

6 Hour PMP: 28.10

Time of Concentration:

12 Hour PMP: 32.20

Weighted Curve Number:

24 Hour PMP: 32.20

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMP **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
4/4/2022	Engineer	Satisfactory
10/5/2021	Owner	Satisfactory
2/4/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 08/01/2019
Expiration Date: 08/01/2025

Dam Location

Dam Address:
12500 Fair Lakes Circle
Fairfax VA, 22033

E911 Direction to Dam:
Office building next to Fair Lakes Dam #1

EAP Contacts

Dam Operator: Betty Rose
(primary)(540) 326-5226(Mobile)
(primary)brose@petersoncos.com
12500 Fair Lakes Circle
Suite 400
Fairfax VA, 22033

Dam Alternate Operator:Betty Rose
(primary)(540) 326-5226(Mobile)
(primary)brose@petersoncos.com
12500 Fair Lakes Circle
Suite 400
Fairfax VA, 22033

Rain Gauge Observer: Betty Rose
(primary)(540) 326-5226(Mobile)
(primary)brose@petersoncos.com
12500 Fair Lakes Circle
Suite 400
Fairfax VA, 22033

Alternate Rain Gauge Observer:Elizabeth French
(primary)(703) 227-0896(Office)
(primary)EFrench@PetersonCos.com
12500 Fair Lakes Circle
Suite 400
Fairfax WV, 22033

24-Hour Dispatch Center: 911 Emergency Center
(primary)(703) 691-2131(Office)
(primary)DPSCBridge@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Local Government Emergency Services:Seamus Mooney
(primary)(571) 439-4901(Office)
(primary)Seamus.Mooney@fairfaxcounty.gov
4890 Alliance Drive
Suite 2200
Fairfax VA, 22030

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Michael Wood
(571) 237-5320(Mobile); (primary)(571) 350-2021(Office)
(primary)Michael.Wood@VDOT.Virginia.gov
4197 Alliance Drive
Fairfax VA, 22030

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

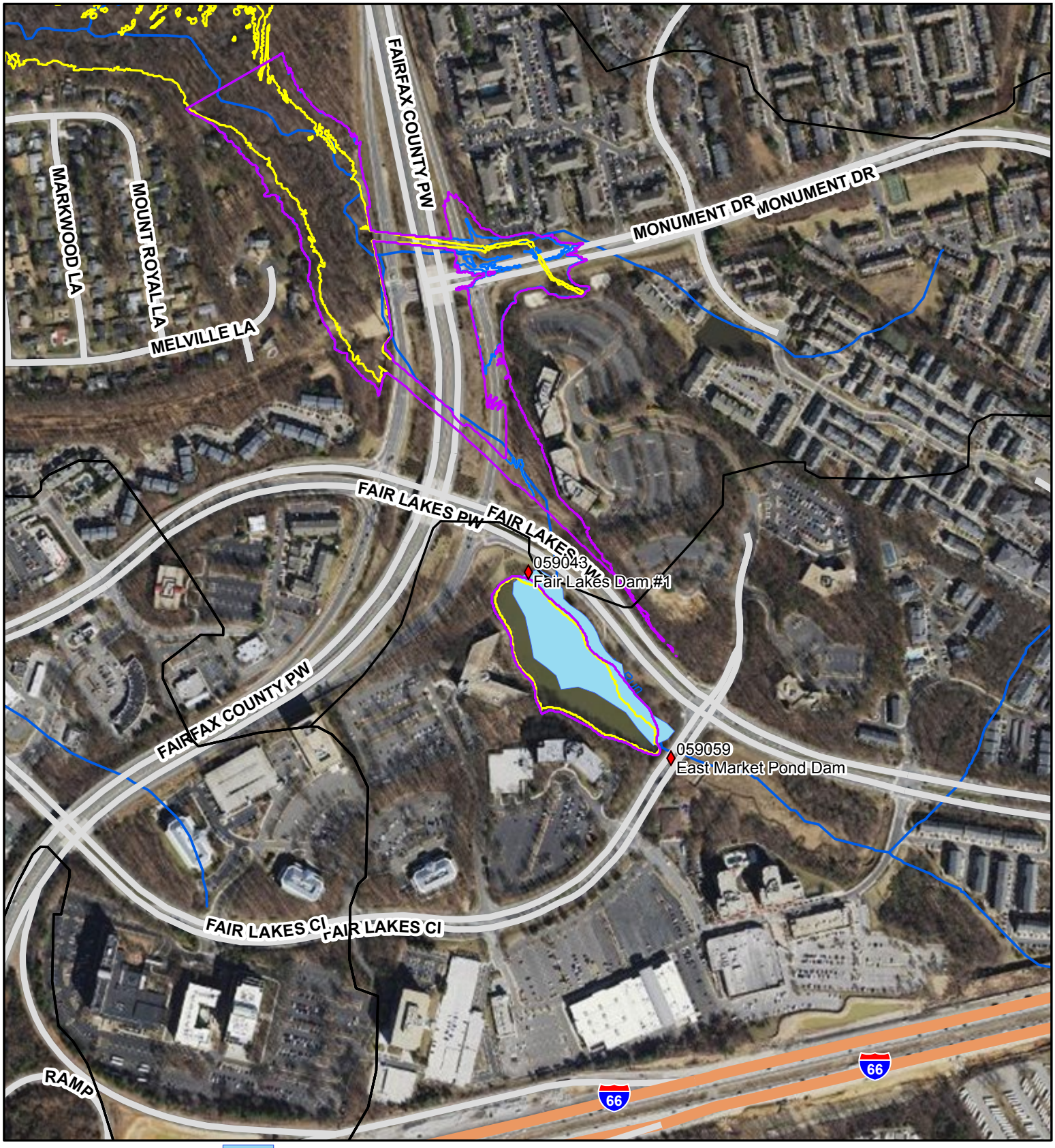
- 7700 - 0 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 0 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 1 Parks
- 0 Golf Courses

Dam Number: **059043**
Dam Name: **Fair Lakes Dam #1**
VAHU6: PL45
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 34,37
HUC 12: 020700100704
VA House: 35,67
Watershed Name: Cub Run
Congressional: 5111
USGS Topo: MANASSAS



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Fair Lakes Land Bay 2 SWM BMP Pond Dam

Inventory Number: 059068

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Martin Robison
(primary)(571) 321-5991(Office)
12500 Fair Lakes Circle
Suite 335
Fairfax VA, 22033

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 11/30/2023

Days Since Last Inspection: 323

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Big Rocky Run tributary

Technical Basics

Normal Pool Area: 5.77 Acres

Top Surface Area: 7.63 Acres

Normal Pool Capacity: 20.19 Acre-Feet

Top Capacity: 56.10 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 10.00 Feet

Top Height: 21.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition
2/17/2022	Engineer	Satisfactory
1/29/2021	Engineer	Satisfactory
6/5/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 02/28/2018
Expiration Date: 02/28/2024

Dam Location

Dam Address:
13002 RED ADMIRAL PL
Fairfax VA, 22033

E911 Direction to Dam:
Dam along trail beyond apartment complex.
Alternative E911 address: 4548 FAIR VALLEY DR, or 4501 MIDDLE RIDGE DR

EAP Contacts

Dam Operator: Annette Moses
(703) 928-3543(Mobile); (primary)(703) 968-1454(Office)
(primary)na
na
Fairfax VA, 12345

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:Seamus Mooney
(571) 350-1000(Office); (primary)(571) 439-4901(Office)
(primary)OEMDutyOfficer@fairfaxcounty.gov
4890 Alliance Drive
Suite 2200
Fairfax VA, 22030

Owner's Engineer: Geoffrey L. Cowan
(primary)(703) 468-2243(Office); (703) 615-0011(Mobile)
(primary)jcowan@dewberry.com
13575 Heathcote Blvd.
Suite 130
Gainesville VA, 20155

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Gaby Hakim, PE
(primary)(703) 259-0243(Office); (800) 367-7623(Office)
(primary)na
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- 6 Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059068**
Dam Name: **Fair Lakes Land Bay 2 SWM BMP Pond Dam**
VAHU6: PL45
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 37
HUC 12: 020700100704
VA House: 67
Watershed Name: Cub Run
Congressional: 5111
USGS Topo: MANASSAS

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Fairview Lake Dam

Inventory Number: 059031

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1986

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2025

Days Since Last Inspection: 248

Inundation Report: Unknown

Type of Dam
Gravity (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: Holmes Run

Technical Basics

Normal Pool Area: 18.70 Acres

Top Surface Area: 86.00 Acres

Normal Pool Capacity: 179.90 Acre-Feet

Top Capacity: 785.00 Acre-Feet

Normal Pool Elevation: 310.00 Feet

Top Elevation: 324.00 Feet

Normal Pool Height: 12.00 Feet

Top Height: 26.50 Feet

Technical Hydrology/Hydraulics

Controlling PMP: 12-HR PMP

Drainage Area: 2.48 Sq. Mi.

6 Hour PMP: 28.20

Time of Concentration:

12 Hour PMP: 33.40

Weighted Curve Number:

24 Hour PMP: 33.40

IDA Spillway Reduction:

Available Spillway Design Flow: .90 PMP

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
5/3/2022	Engineer	Satisfactory
5/11/2021	Owner	Satisfactory
5/13/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 03/14/2019
Expiration Date: 03/14/2025

Dam Location

Dam Address:
7745 Inversham Drive
Falls Chruch VA, 22042

E911 Direction to Dam:
Paved access road to dam through 7745 Inversham Drive, Falls Church, VA 22042

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Elfaith Salim
(primary)(703) 324-5667(Office)
(primary)elfaith.salim@fairfaxcounty.gov
NA
Na VA, 99999

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

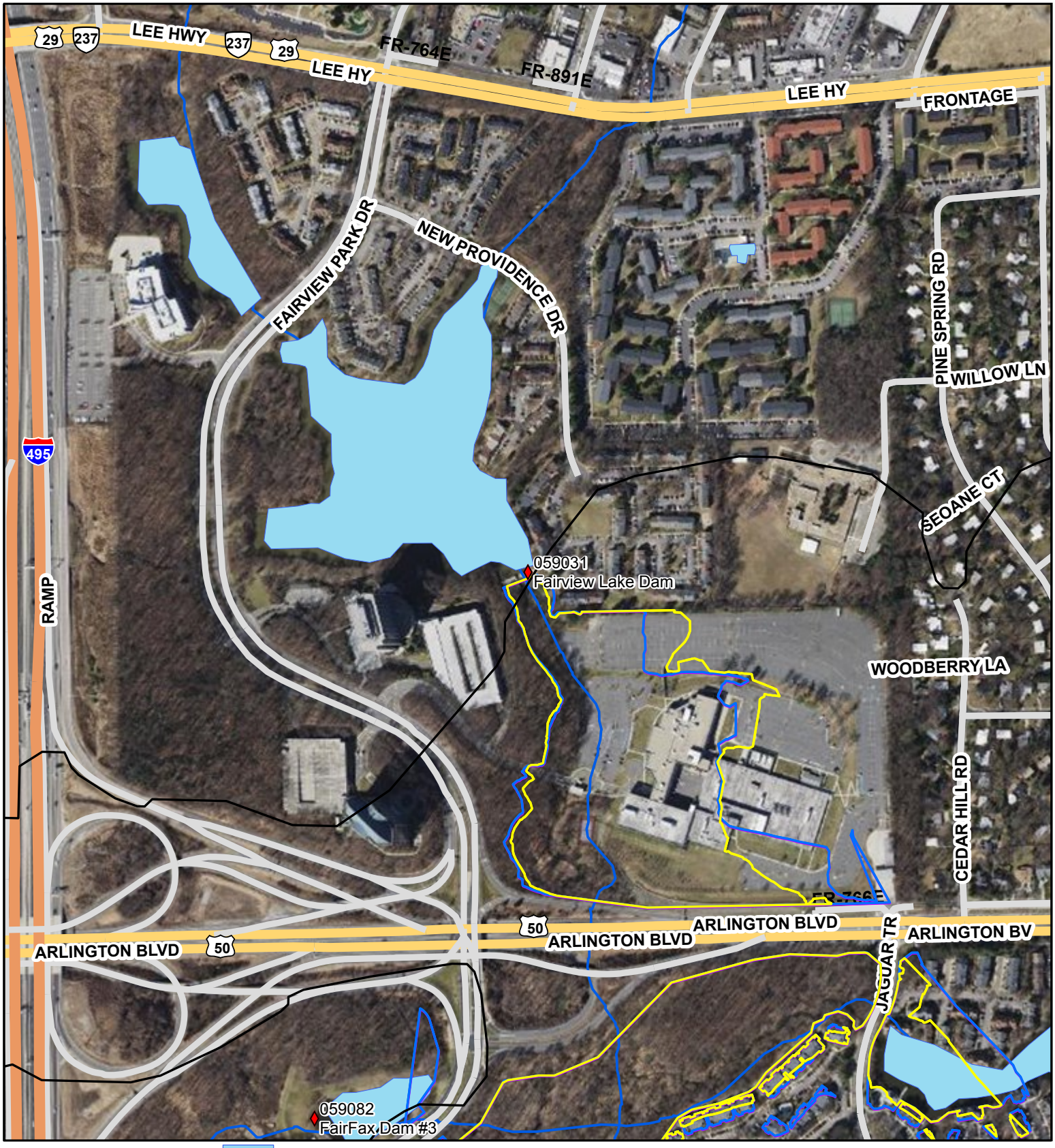
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- 223 Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059031**
Dam Name: **Fairview Lake Dam**
VAHU6: PL26
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 35
HUC 12: 020700100302
VA House: 53
Watershed Name: Cameron Run
Congressional: 5108
USGS Topo: ANNANDALE



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Goose Creek Dam

Inventory Number: 107003

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1960

Dam Owner:
Dale C. Hammes, General Manager
(primary)(571) 291-7980(Office)
44865 Loudoun Water Way
Ashburn VA, 20147

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 11/30/2023

Days Since Last Inspection: 498

Inundation Report: Unknown

Type of Dam
Gravity (Primary)

Reservoir Purpose
Water Supply (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 27.00 Miles

River or Stream: Goose Creek

Technical Basics

Normal Pool Area: 120.00 Acres

Top Surface Area: 410.00 Acres

Normal Pool Capacity: 613.00 Acre-Feet

Top Capacity: 4373.00 Acre-Feet

Normal Pool Elevation: 240.00 Feet

Top Elevation: 255.00 Feet

Normal Pool Height: 24.00 Feet

Top Height: 39.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 347.00 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMF **Required Spillway Design Flow**: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
8/25/2021	Engineer	Satisfactory
9/22/2020	Engineer	Satisfactory
9/3/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 06/18/2018
Expiration Date: 06/18/2024

Dam Location

Dam Address:
20521 Belmont Ridge Rd
Ashburn VA, 20147

E911 Direction to Dam:
The impoundment structure can be accessed by travelling west on Hearford Ln, then turning right onto a dirt road and heading north for about 1/3 of a mile to the structure.

EAP Contacts

Dam Operator: Carl Burleson
(540) 454-0902(Mobile); (primary)(571) 291-7940(Office)
(primary)na
44865 Loudoun Water Way
Ashburn VA, 20146

Dam Alternate Operator:Roddy Mowe
(primary)(571) 291-7701(Office); (703) 508-3307(Mobile)
(primary)na
44865 Loudoun Water Way
Ashburn VA, 20146

Rain Gauge Observer: Ray Braithwaite
(571) 291-1986(Mobile); (primary)(571) 291-7849(Office)
(primary)na
44961 Loudoun Water Way
Ashburn VA, 20147

Alternate Rain Gauge Observer:John Bartyczak
(primary)(703) 728-1686(Office)
(primary)na
NA
Na VA, 99999

24-Hour Dispatch Center: NA NA
(primary)(703) 777-2243(Office); (911) 911-9119(Office)
(primary)na
16600 Courage Court
Leesburg VA, 22075

Local Government Emergency Services:Kevin Johnson
(703) 737-8831(Mobile); (primary)(703) 777-2243(Office)
(primary)oem@loudoun.gov
801 Sycolin Road
Suite 100
Leesburg VA, 20175

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:James Betz
(primary)(703) 259-0245(Office); (800) 367-7623(Office)
(primary)james.betz@vdot.virginia.gov
41 Lawson Road S.E.

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.

Leesburg VA, 20175

Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 7 - 99999 miles downstream
- 773 - 99999 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **107003**

Dam Name: **Goose Creek Dam**

VAHU6: PL14

Municipalities: Loudoun County

Region: 1

SWCD: LOUDOUN

VA Senate: 13

HUC 12: 020700080702

VA House: 10,32

Watershed Name: Goose Creek-Big Branch

Congressional: 5110

USGS Topo: LEESBURG

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Gore Dam

Inventory Number: 107014

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1950

Dam Owner:
Jo Ann D. Athey
(primary)(703) 777-1717(Office)
13087 James Monroe Hwy.
Leesburg VA, 20176

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 05/31/2027

Days Since Last Inspection: 757

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: TR-Potomac River

Technical Basics

Normal Pool Area: 8.00 Acres

Top Surface Area: 11.00 Acres

Normal Pool Capacity: 86.00 Acre-Feet

Top Capacity: 162.00 Acre-Feet

Normal Pool Elevation: 315.77 Feet

Top Elevation: 320.50 Feet

Normal Pool Height: 27.00 Feet

Top Height: 40.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.27 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration: 0.70

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
12/9/2020	Engineer	Satisfactory
12/7/2018	Engineer	Satisfactory
2/22/2012	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 02/25/2021
Expiration Date: 02/25/2027

Dam Location

Dam Address:
13087 James Monroe Highway
Leesburg VA, 20176

E911 Direction to Dam:
Dam is located just SW of intersection of U.S. Route 15 James Monroe Highway and Rt. 664 Wilt Store Road

EAP Contacts

Dam Operator: Jo Ann Athey
(primary)(703) 777-1717(Home)
(primary)joannathey@gmail.com
13087 James Monroe Highway
Leesburg VA, 20176

Dam Alternate Operator:Mark Athey
(primary)(703) 505-7221(Mobile)
(primary)joannathey@gmail.com
13087 James Monroe Highway
Leesburg VA, 20176

Rain Gauge Observer: Jo Ann Athey
(primary)(703) 777-1717(Home)
(primary)joannathey@gmail.com
13087 James Monroe Highway
Leesburg VA, 20176

Alternate Rain Gauge Observer:Mark Athey
(primary)(703) 505-7221(Mobile)
(primary)joannathey@gmail.com
13087 James Monroe Highway
Leesburg VA, 20176

24-Hour Dispatch Center: na na
(primary)(703) 737-8200(Office); (703) 777-2243(Office)
(primary)EOCOps@loudoun.gov
801 Scolin Road SE
Ste 100
Leesburg VA, 20175

Local Government Emergency Services:Loudoun County Emergency Communications Center
(primary)(703) 777-0637(Office)
(primary)na@na.gov
801 Sycolin Road SE
Leesburg VA, 20175

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:James Betz
(primary)(703) 259-0245(Office); (800) 367-7623(Office)
(primary)james.betz@vdot.virginia.gov
41 Lawson Road S.E.
Leesburg VA, 20175

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- U.S. 15 - 0.05 miles downstream

Dams Downstream:

- 107014

Potential Impact Structures (count):

- 0 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **107014**
Dam Name: **Gore Dam**
VAHU6: PL04
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080401
VA House: 33
Watershed Name: Potomac River-Tuscarora Creek
Congressional: 5110
USGS Topo: POINT OF ROCKS

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Hampton Forest Section 4 SWM Dam

Inventory Number: 059047

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2023

Days Since Last Inspection: 38

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 12.60 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 72.50 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 378.60 Feet

Normal Pool Height: 0.00 Feet

Top Height: 16.40 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.47 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMP

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
11/29/2022	Owner	Satisfactory
11/16/2021	Engineer	Satisfactory
11/2/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 12/12/2016
Expiration Date: 12/12/2022

Dam Location

Dam Address:
5349 ASHLEIGH RD
Fairfax VA, 22030

E911 Direction to Dam:
Dam on south side of Ashleigh Rd 0.04 miles east of E911 address

EAP Contacts

Dam Operator: na na
(primary)(703) 877-2800(Office)
(primary)na
10635 West Drive
Fairfax VA, 22030

Dam Alternate Operator:

Rain Gauge Observer: NA NA
(571) 439-4901(Office); (primary)(703) 324-5500(Office)
(primary)na
10635 West Drive
Fairfax VA, 22030

Alternate Rain Gauge Observer:

24-Hour Dispatch Center: na na
(primary)(703) 322-4500(Office)
(primary)na
4621 Legato Road
Fairax VA, 22030

Local Government Emergency Services:Wallace Twigg
(primary)(804) 897-6500(Office)
(primary)wallace.twigg@vdem.virginia.gov
null
Null VA, 12345

Owner's Engineer: Brice Kutch
(primary)(703) 870-7000(Office)
(primary)bkutch@gky.com
None
4229 Lafayette Center Drive, Suite 1850
Chantilly VA, 20151

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Gaby Hakim, PE
(primary)(703) 259-0243(Office); (800) 367-7623(Office)
(primary)na
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:

Potential Impacts

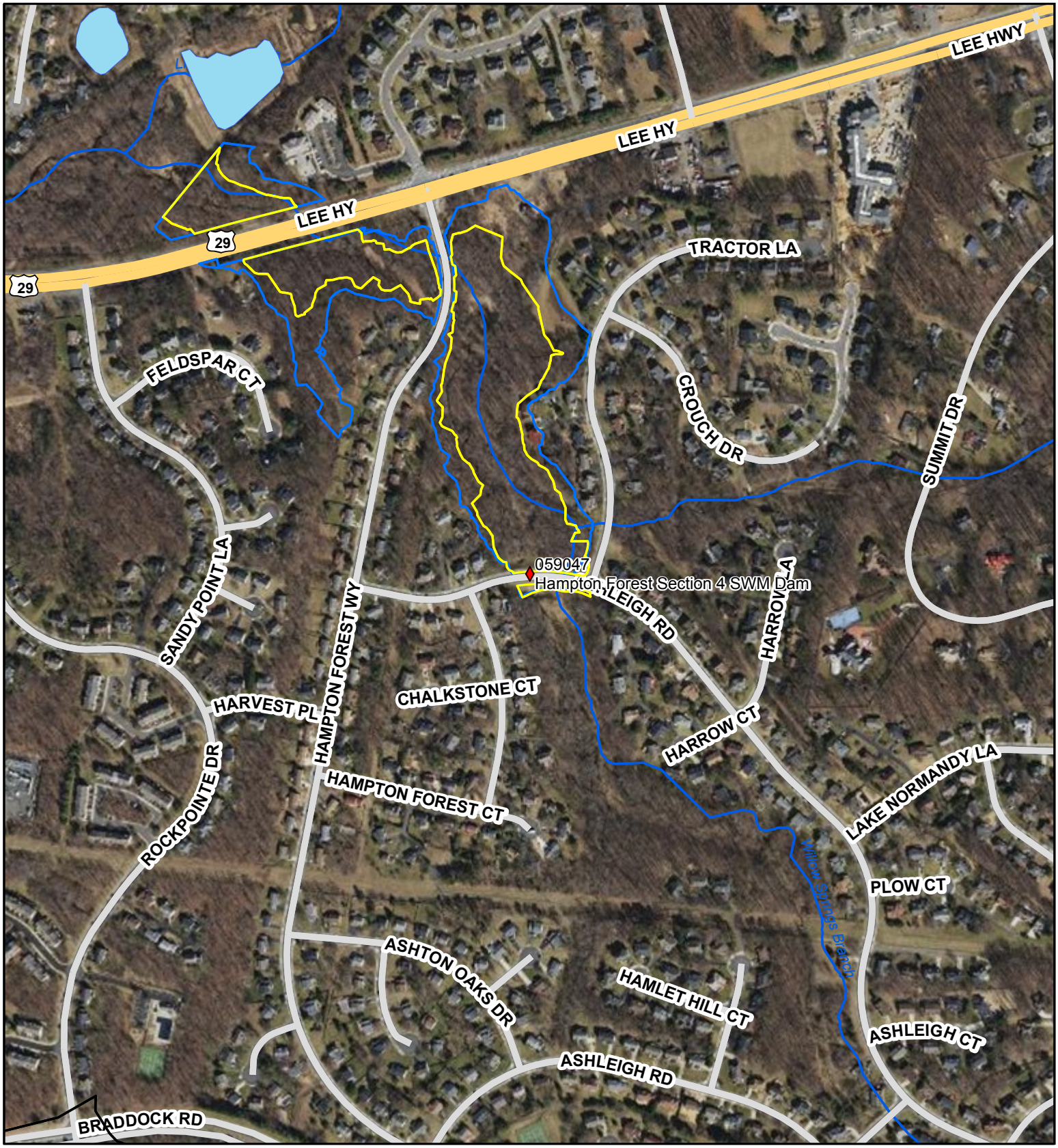
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- 6 Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059047**
Dam Name: **Hampton Forest Section 4 SWM Dam**
VAHU6: PL46
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 37
HUC 12: 020700100705
VA House: 40
Watershed Name: Lower Bull Run
Congressional: 5111
USGS Topo: MANASSAS



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Haynes Dam

Inventory Number: 107028

Hazard Classification: Significant

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1980

Dam Owner:
Mejia & Company DeBlois
(primary)(310) 273-7769(Office)
9171 Wilshire Boulevard, Suite 300
Beverly Hills CA, 90210

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 11/30/2021

Days Since Last Inspection: 1237

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: TR-North Fork Goose Creek

Technical Basics

Normal Pool Area: 15.00 Acres

Top Surface Area: 20.00 Acres

Normal Pool Capacity: 190.00 Acre-Feet

Top Capacity: 312.00 Acre-Feet

Normal Pool Elevation: 390.00 Feet

Top Elevation: 397.00 Feet

Normal Pool Height: 34.00 Feet

Top Height: 41.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.63 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMF **Required Spillway Design Flow**: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
8/17/2019	Engineer	Fair
8/9/2017	Engineer	Satisfactory
8/16/2016	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 09/03/2015
Expiration Date: 09/03/2021

Dam Location

Dam Address:
19290 Telegraph Springs Road
Purcellville VA, 20132

E911 Direction to Dam:
Dam is visible from E911 address.

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Daniel R. Hamric, P.E.
(primary)(540) 678-1216(Office)
(primary)dan.hamric@ruckmanengineering.com
22-B Ricketts Drive
Winchester VA, 22601

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

- VA-622 - 0.13 miles downstream

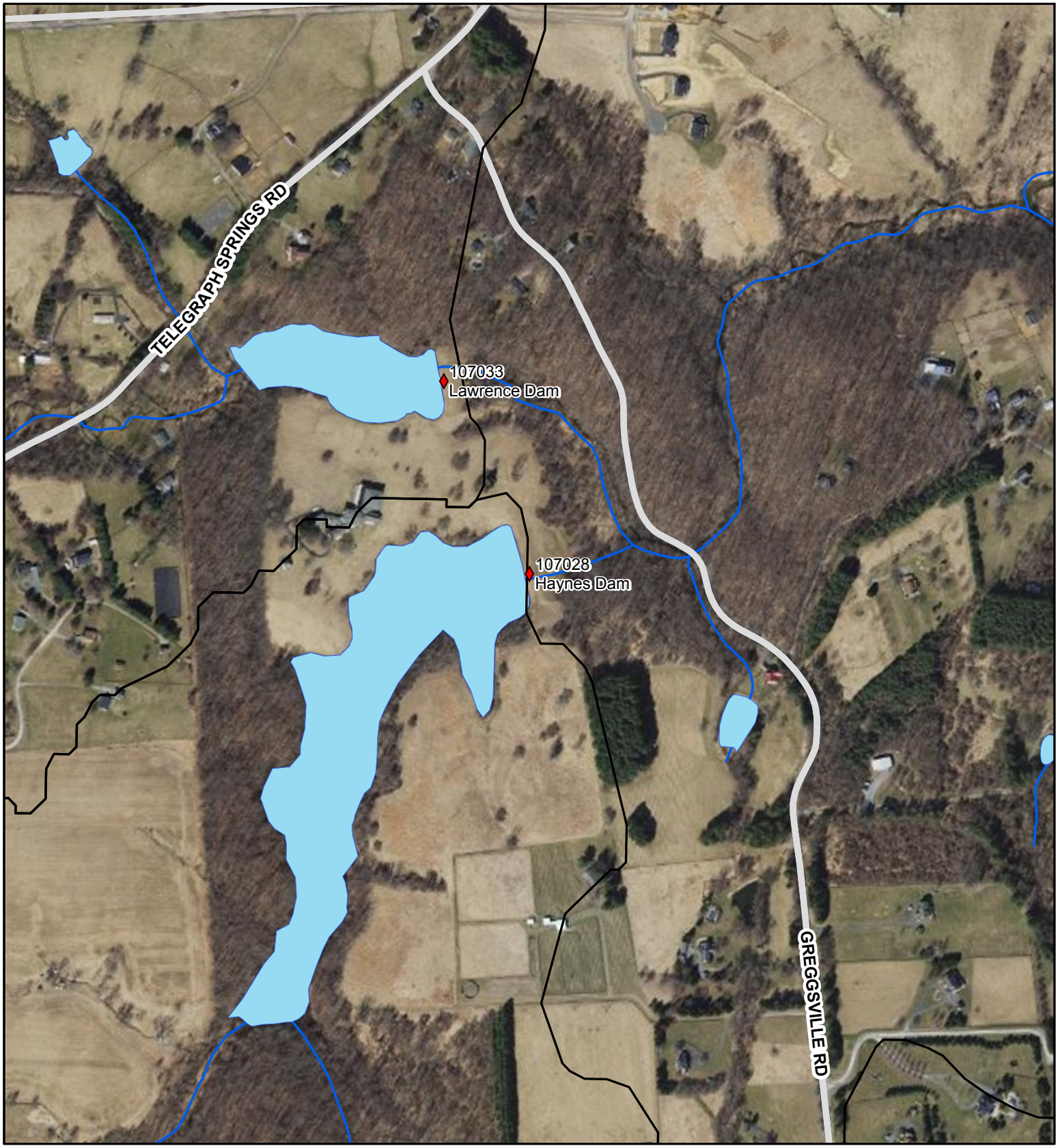
Dams Downstream:

- 000000

Potential Impact Structures (count):

- 6 Homes
- 1 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **107028**
Dam Name: **Haynes Dam**
VAHU6: PL12
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080602
VA House: 33
Watershed Name: North Fork Goose Creek
Congressional: 5110
USGS Topo: LINCOLN



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Hope Parkway Dam

Inventory Number: 107036

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Shannon Cook
(primary)(703) 803-9641(Office)
13998 Park East Circle
Chantilly VA, 20151

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 09/30/2027

Days Since Last Inspection: 546

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: TR-Tuscarora Creek

Technical Basics

Normal Pool Area: 5.60 Acres

Top Surface Area: 14.00 Acres

Normal Pool Capacity: 35.50 Acre-Feet

Top Capacity: 128.60 Acre-Feet

Normal Pool Elevation: 330.00 Feet

Top Elevation: 340.00 Feet

Normal Pool Height: 20.00 Feet

Top Height: 30.30 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.44 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
7/8/2021	Engineer	Satisfactory
4/20/2020	Engineer	Satisfactory
3/26/2019	Owner	Satisfactory

EAP Quick Reference

Approval Date: 08/28/2020
Expiration Date: 08/28/2026

Dam Location

Dam Address:
801 Sycolin Road Suite 200
Leesburg VA, 20175

E911 Direction to Dam:
Loudoun County Emergency Communications and Support Services

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Edward Umbrell
(primary)(703) 468-2258(Office)
(primary)eumbrell@dewberry.com
13575 Heathcote Boulevard
Suite 130
Gainesville VA, 20155

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

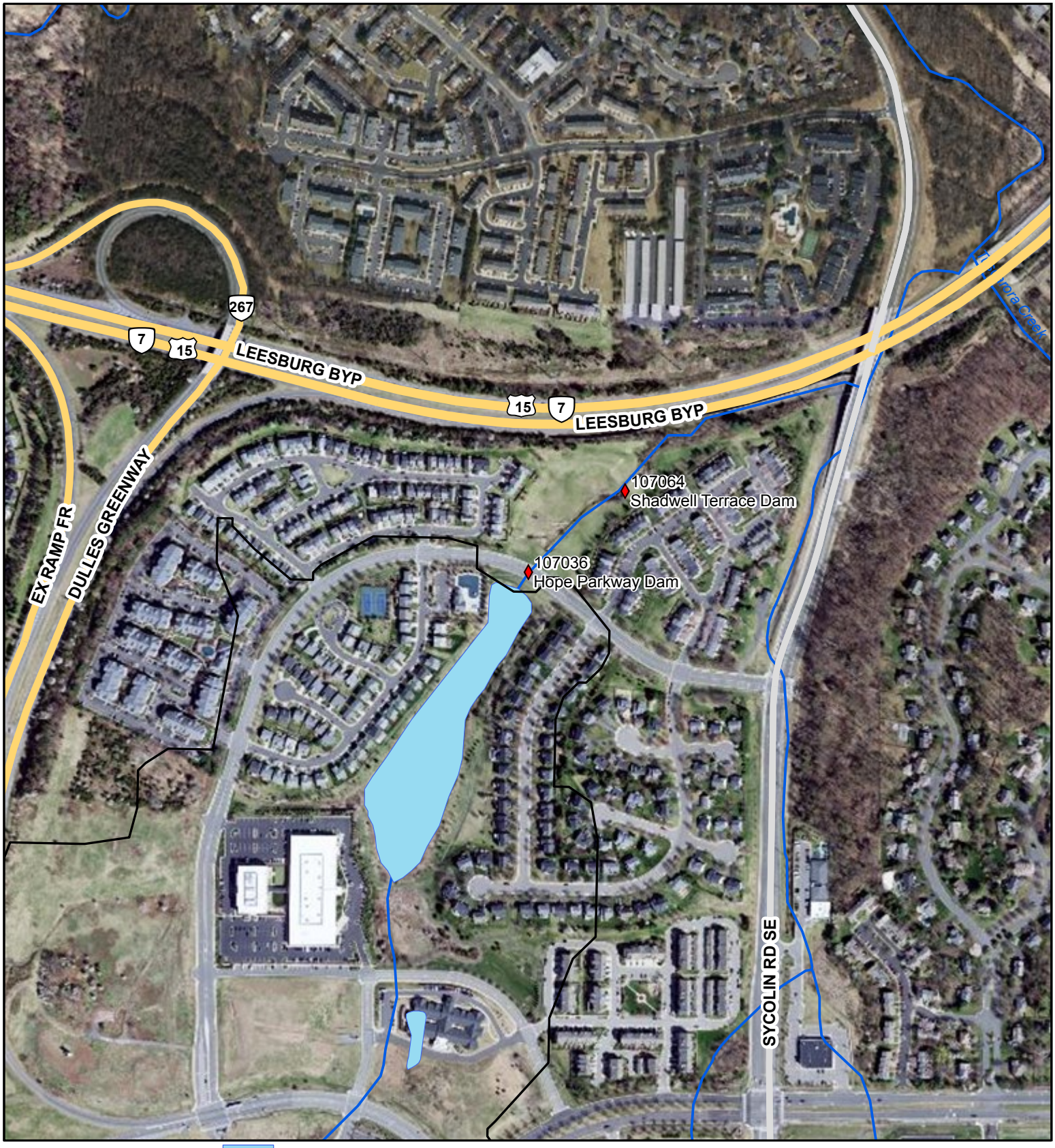
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **107036**
Dam Name: **Hope Parkway Dam**
VAHU6: PL16
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13,33
HUC 12: 020700080704
VA House: 10
Watershed Name: Goose Creek-Cattail Branch
Congressional: 5110
USGS Topo: LEESBURG



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Horsepen Dam

Inventory Number: 107007

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1961

Dam Owner:
Darrell Hollowell
(primary)(703) 572-2808(Office)
PO Box 17045
Washington DC, 20041

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 09/30/2027

Days Since Last Inspection: 534

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Water Supply (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: Horsepen Run

Technical Basics

Normal Pool Area: 18.00 Acres

Top Surface Area: 1584.00 Acres

Normal Pool Capacity: 129.00 Acre-Feet

Top Capacity: 15200.00 Acre-Feet

Normal Pool Elevation: 247.00 Feet

Top Elevation: 270.00 Feet

Normal Pool Height: 27.00 Feet

Top Height: 50.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: 24-HR PMP

Drainage Area: 22.80 Sq. Mi.

6 Hour PMP: 26.04

Time of Concentration: 210.00

12 Hour PMP: 30.36

Weighted Curve Number:

24 Hour PMP: 33.65

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMP **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
7/20/2021	Engineer	Satisfactory
3/13/2019	Engineer	Satisfactory
12/11/2009	Owner	Fair

EAP Quick Reference

Approval Date: 09/15/2021
Expiration Date: 09/15/2027

Dam Location

Dam Address:

,

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

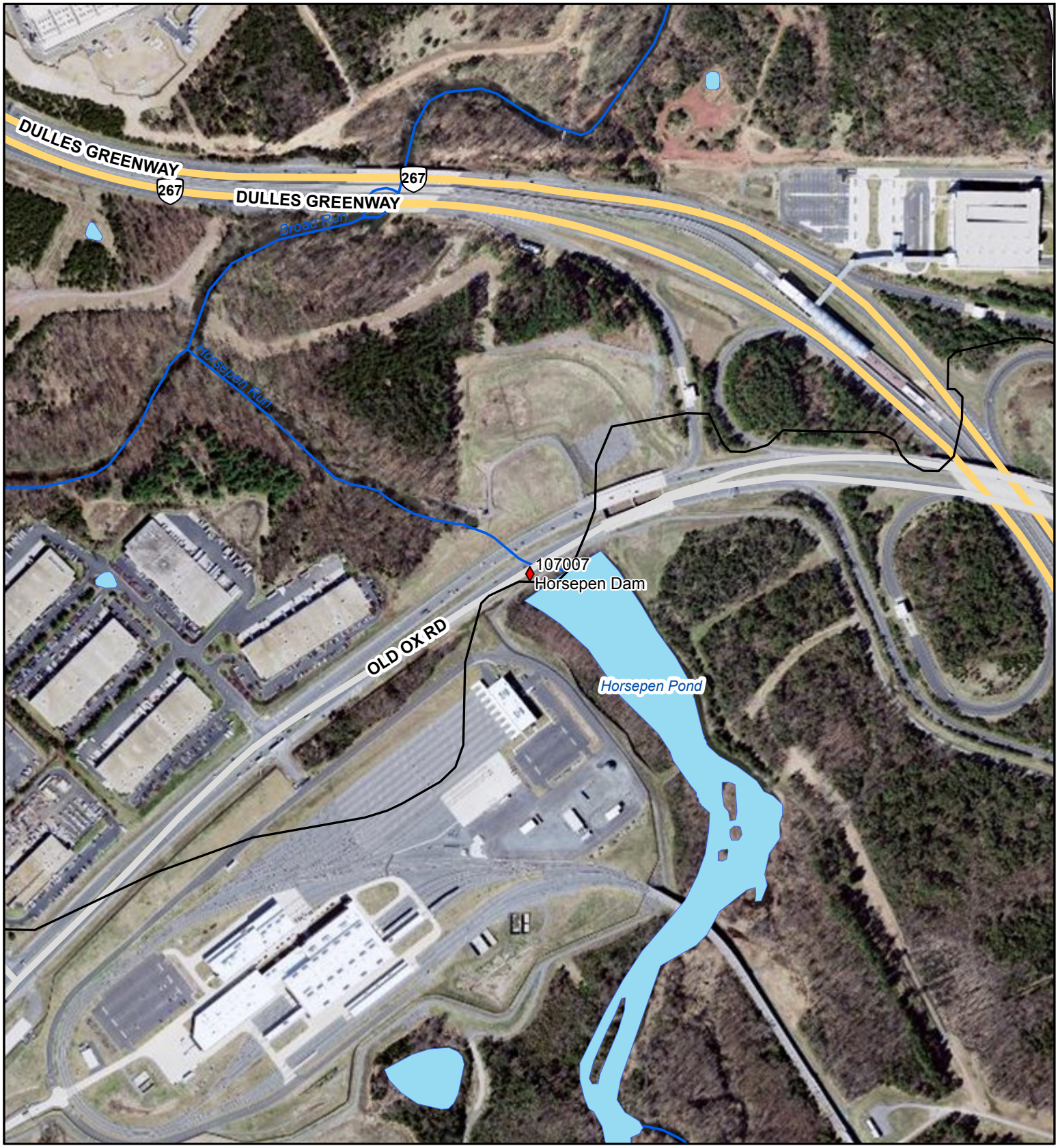
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **107007**
Dam Name: **Horsepen Dam**
VAHU6: PL17,PL18,PL19
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 33
HUC 12: 020700080901,020700080902,020700080903
VA House: 87
Watershed Name: Broad Run-Beaverdam Run,Broad Run-Lenah Run,Hors
Congressional: 5110
USGS Topo: HERNDON



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Innovation at Prince William - Pond 3

Inventory Number: 153032

Hazard Classification: High

City/County: City of Manassas, Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Thomas Smith
(primary)(703) 792-6252(Office)
5 County Complex Ct., Suite 250
Prince William VA, 22912

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 1 Year Certificate

Certificate Expiration: 03/31/2023

Days Since Last Inspection: 295

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream: TR-Cannon Branch

Technical Basics

Normal Pool Area: 5.60 Acres

Top Surface Area: 13.00 Acres

Normal Pool Capacity: 17.50 Acre-Feet

Top Capacity: 109.00 Acre-Feet

Normal Pool Elevation: 205.00 Feet

Top Elevation: 214.00 Feet

Normal Pool Height: 6.00 Feet

Top Height: 16.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.52 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
3/16/2022	Engineer	Satisfactory
8/26/2020	Engineer	Satisfactory
6/20/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 02/10/2016
Expiration Date: 02/10/2022

Dam Location

Dam Address:
9901 Discovery Blvd
Manassas VA, 20109

E911 Direction to Dam:
At intersection of Nokesville Rd (VA 28) and Prince William Pkwy (VA 234)

EAP Contacts

Dam Operator: Phil Darden
(primary)(703) 792-7122(Office)
(primary)na
5 County Complex Court
Va VA, 22192

Dam Alternate Operator:George Cropp
(primary)(703) 792-7112(Office)
(primary)na
na
Na VA, 12345

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center: Prince William County Public Safety Communications Center
(primary)(703) 792-6500(Office)
(primary)na@na.com
9320 Lee Avenue
Manassas VA, 20110

Local Government Emergency Services:Patrick Collins
(primary)(703) 792-5828(Office)
(primary)pcollins@pwcgov.org
3 County complex Court
Prince William VA, 22192

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:David Brown
(primary)(703) 366-1929(Office)
(primary)david.brown@vdot.virginia.gov
na
Na VA, 12345

National Weather Service:

Potential Impacts

Roadways Impacted:

- Nokesville Rd (VA 28) - 0.08 miles downstream

Potential Impact Structures (count):

- Homes
- 3 Businesses
- Schools
- Hospitals

Dams Downstream:

- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **153032**

Dam Name: **Innovation at Prince William - Pond 3**

VAHU6: PL34

Municipalities: City of Manassas,Prince William County

Region: 1

SWCD: ,PRINCE WILLIAM

VA Senate: 29

HUC 12: 020700100504

VA House: 50

Watershed Name: Broad Run-Rocky Branch

Congressional: 5101,5110

USGS Topo: NOKESVILLE

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Innovation at Prince William - Pond 3

Inventory Number: 153032

Hazard Classification: High

City/County: City of Manassas, Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Thomas Smith
(primary)(703) 792-6252(Office)
5 County Complex Ct., Suite 250
Prince William VA, 22912

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 1 Year Certificate

Certificate Expiration: 03/31/2023

Days Since Last Inspection: 295

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream: TR-Cannon Branch

Technical Basics

Normal Pool Area: 5.60 Acres

Top Surface Area: 13.00 Acres

Normal Pool Capacity: 17.50 Acre-Feet

Top Capacity: 109.00 Acre-Feet

Normal Pool Elevation: 205.00 Feet

Top Elevation: 214.00 Feet

Normal Pool Height: 6.00 Feet

Top Height: 16.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.52 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
3/16/2022	Engineer	Satisfactory
8/26/2020	Engineer	Satisfactory
6/20/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 02/10/2016
Expiration Date: 02/10/2022

Dam Location

Dam Address:
9901 Discovery Blvd
Manassas VA, 20109

E911 Direction to Dam:
At intersection of Nokesville Rd (VA 28) and Prince William Pkwy (VA 234)

EAP Contacts

Dam Operator: Phil Darden
(primary)(703) 792-7122(Office)
(primary)na
5 County Complex Court
Va VA, 22192

Dam Alternate Operator:George Cropp
(primary)(703) 792-7112(Office)
(primary)na
na
Na VA, 12345

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center: Prince William County Public Safety Communications Center
(primary)(703) 792-6500(Office)
(primary)na@na.com
9320 Lee Avenue
Manassas VA, 20110

Local Government Emergency Services:Patrick Collins
(primary)(703) 792-5828(Office)
(primary)pcollins@pwcgov.org
3 County complex Court
Prince William VA, 22192

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:David Brown
(primary)(703) 366-1929(Office)
(primary)david.brown@vdot.virginia.gov
na
Na VA, 12345

National Weather Service:

Potential Impacts

Roadways Impacted:

- Nokesville Rd (VA 28) - 0.08 miles downstream

Potential Impact Structures (count):

- Homes
- 3 Businesses
- Schools
- Hospitals

Dams Downstream:

- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **153032**

Dam Name: **Innovation at Prince William - Pond 3**

VAHU6: PL34

Municipalities: City of Manassas,Prince William County

Region: 1

SWCD: ,PRINCE WILLIAM

VA Senate: 29

HUC 12: 020700100504

VA House: 50

Watershed Name: Broad Run-Rocky Branch

Congressional: 5101,5110

USGS Topo: NOKESVILLE

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Island Creek Dam

Inventory Number: 059112

Hazard Classification: Significant

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Carr Properties Inc.
(primary)(703) 339-6987(Office)
7535 Little River Turnpike, #301
Annandale VA, 22003

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type:

Certificate Expiration:

Days Since Last Inspection:

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)
Fish & wildlife or small farm pond (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.50 Miles

River or Stream: Long Branch tributary

Technical Basics

Normal Pool Area: 2.15 Acres

Top Surface Area: 5.06 Acres

Normal Pool Capacity: 22.28 Acre-Feet

Top Capacity: 70.07 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 29.50 Feet

Top Height: 39.50 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

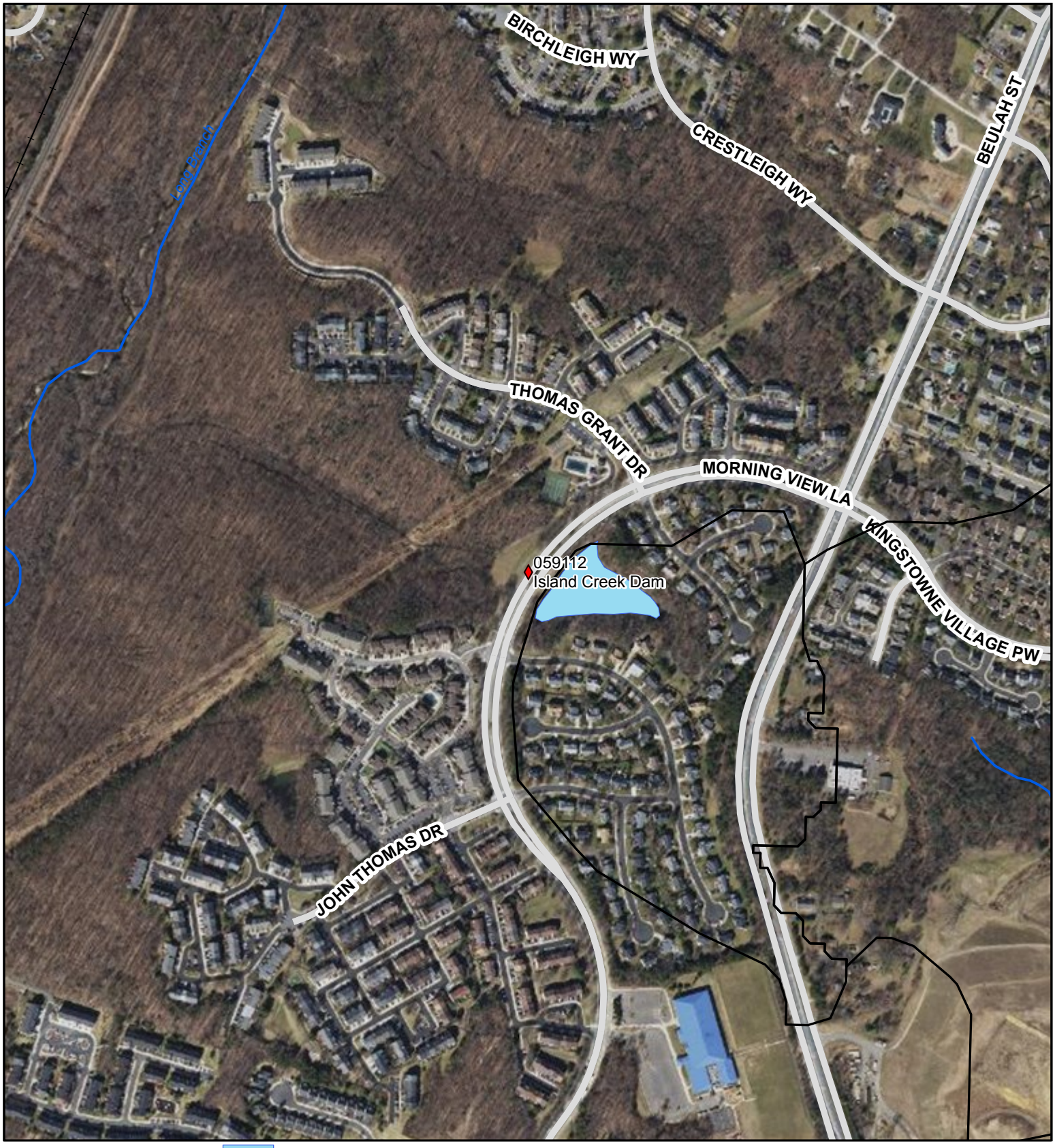
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059112**
Dam Name: **Island Creek Dam**
VAHU6: PL27,PL30
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 36,39
HUC 12: 020700100306,020700100402
VA House: 43
Watershed Name: Accotink Creek,Dogue Creek
Congressional: 5108
USGS Topo: ANNANDALE,FORT BELVOIR



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: J.T. Hirst Dam

Inventory Number: 107019

Hazard Classification: Significant

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1962

Dam Owner:
c/o Dale Lehnig
(primary)(540) 338-5024(Office)
221 S. Nursery Avenue
Purcellville VA, 20132

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 03/31/2024

Days Since Last Inspection: 356

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Water Supply (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: N Fork Catoctin Creek

Technical Basics

Normal Pool Area: 8.60 Acres

Top Surface Area: 9.00 Acres

Normal Pool Capacity: 128.00 Acre-Feet

Top Capacity: 155.00 Acre-Feet

Normal Pool Elevation: 741.00 Feet

Top Elevation: 744.00 Feet

Normal Pool Height: 31.00 Feet

Top Height: 34.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 1.03 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 100.00 YR **Required Spillway Design Flow**: 100.00 YR

Inspections (Last 3 Max)

Date	Type	Condition
1/14/2022	Engineer	Fair
4/15/2021	Owner	Fair
1/28/2020	Engineer	Fair

EAP Quick Reference

Approval Date: 07/26/2021
Expiration Date: 07/31/2027

Dam Location

Dam Address:
801 Sycolin Road
Leesburg VA, 20175

E911 Direction to Dam:
Loudoun County Sheriff's Office ECC

EAP Contacts

Dam Operator: Bernie Snyder
(primary)(540) 338-2513(Office)
(primary)bsnyder@purcellvilleva.gov
16153 Short Hill Road
Purcellville VA, 20132

Dam Alternate Operator:Dale Lehnig
(primary)(540) 751-2327(Office)
(primary)dlehnig@purcellvilleva.gov
221 S. Nursery Ave
Purcellville VA, 20132

Rain Gauge Observer: Jason Didawick
(primary)(540) 338-7440(Office)
(primary)jdidawick@purcellvilleva.gov
21 S. Nursery Ave
Purcellville VA, 20132

Alternate Rain Gauge Observer:Stacie Alter
(primary)(571) 255-0294(Mobile)
(primary)salter@purcellvilleva.gov
16153 Short Hill Road
Purcellville VA, 20132

24-Hour Dispatch Center: Purcellville Police Department
(primary)(540) 338-7422(Office)
(primary)none@none.com
125 Hirst Road, Unit 7-A
Purcellville VA, 20132

Local Government Emergency Services:Dale Lehnig
(primary)(540) 751-2327(Office)
(primary)dlehnig@purcellvilleva.gov
221 S. Nursery Ave
Purcellville VA, 20132

Owner's Engineer: Michael Claud
(primary)(804) 200-6413(Office)
(primary)mike.claud@timmons.com
1001 Boulders Parkway, Ste300
Richmond VA, 23225

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Rodney Frye
(primary)(703) 877-3401(Office)
(primary)rodney.frye@vdot.virginia.gov
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Jason Elliot
(primary)(703) 996-2234(Office)
(primary)jason.elliot@noaa.gov
43858 Weather Service Road
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Shannondale Road (Route 714) - 0.9 miles downstream

Potential Impact Structures (count):

- 0 Homes
- 0 Businesses

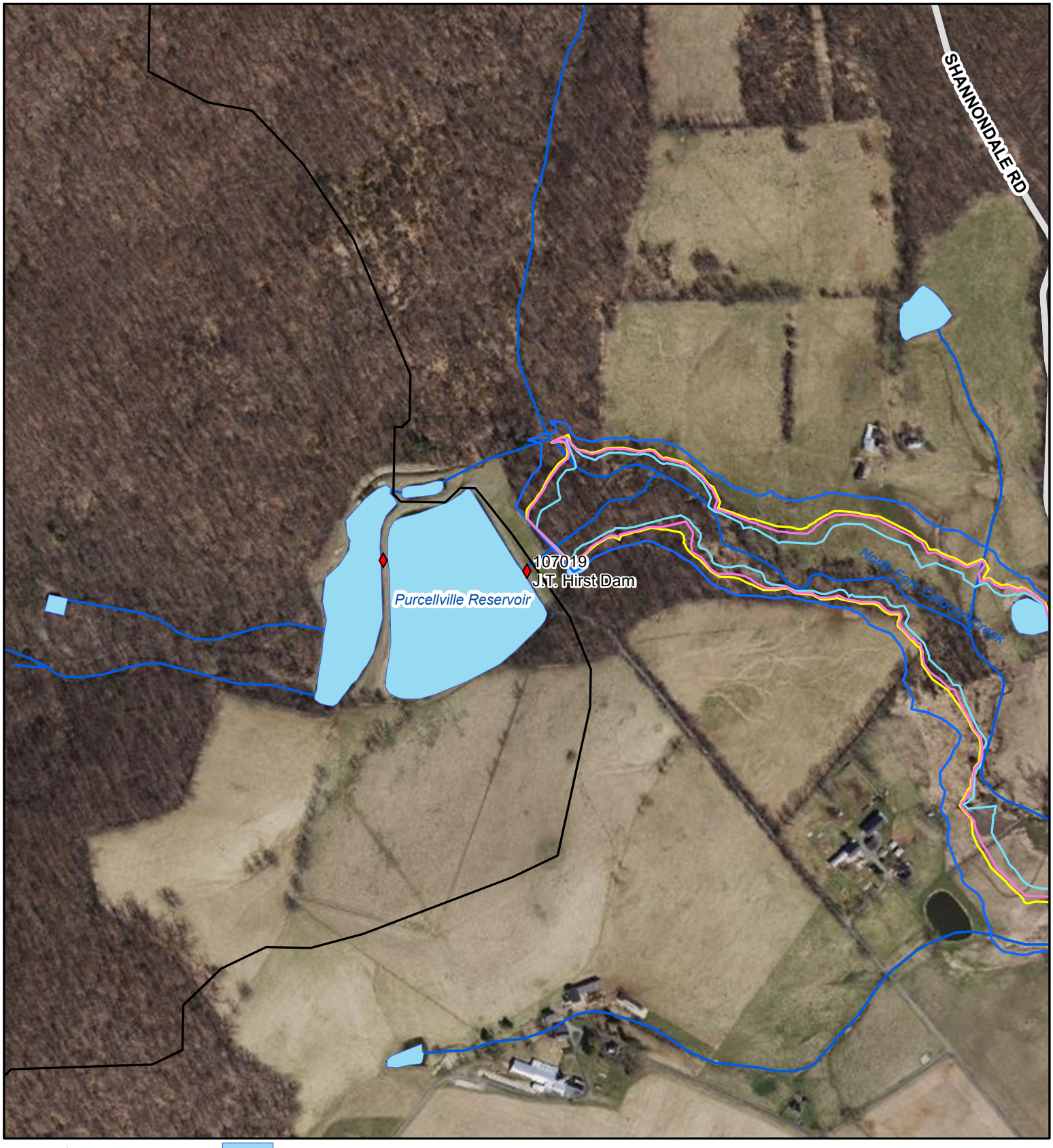
- Edgegrove Road (Route 716) - 1.3 miles downstream
- Woodgrove Road (Route 719) - 1.7 miles downstream
- Stony Point Road (Route 719) - 1.8 miles downstream

Dams Downstream:

- none

- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **107019**
Dam Name: **J.T. Hirst Dam**
VAHU6: PL02
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080301
VA House: 33
Watershed Name: South Fork Catoctin Creek
Congressional: 5110
USGS Topo: ROUND HILL



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Kalnasy Dam

Inventory Number: 107013

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1964

Dam Owner:

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')
Certificate Type: Regular Operation and Maintenance Certificate
Certificate Expiration: 03/31/2025

Days Since Last Inspection: 1794

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)
Irrigation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: South Fork Catoctin Creek tributary

Technical Basics

Normal Pool Area: 7.36 Acres

Top Surface Area: 15.40 Acres

Normal Pool Capacity: 35.30 Acre-Feet

Top Capacity: 116.10 Acre-Feet

Normal Pool Elevation: 417.00 Feet

Top Elevation: 424.50 Feet

Normal Pool Height: 18.00 Feet

Top Height: 26.10 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 1.76 Sq. Mi.

6 Hour PMP: 27.30

Time of Concentration:

12 Hour PMP: 31.10

Weighted Curve Number:

24 Hour PMP: 31.10

IDA Spillway Reduction:

Available Spillway Design Flow: 100.00 YR

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
2/6/2018	Engineer	Fair
2/23/2017	Engineer	
4/15/2014	Engineer	

EAP Quick Reference

Approval Date: 08/20/2014
Expiration Date: 08/20/2020

Dam Location

Dam Address:
39949 Charles Town Pike
Hamilton VA, 20158

E911 Direction to Dam:
The impoundment structure can be accessed via a dirt road located across from the intersection of Hamilton Station Rd and Still Meadow Ln.

EAP Contacts

Dam Operator: Marc Weiner
(primary)(703) 629-6645(Office)
(primary)MSW@bskb.com
39949 Charles Town Pike
Hamilton VA, 20158

Dam Alternate Operator:Heather Rowe
(primary)(515) 398-2506(Office)
(primary)heather.r.rowe@WellsFargo.com
8480 Stagecoach Dir Bldg A
Floor 3
Frederick MD, 21701

Rain Gauge Observer: Marc Weiner
(primary)(703) 629-6645(Office)
(primary)MSW@bskb.com
39949 Charles Town Pike
Hamilton VA, 20158

Alternate Rain Gauge Observer:Heather Rowe
(primary)(515) 398-2506(Office)
(primary)heather.r.rowe@WellsFargo.com
8480 Stagecoach Dir Bldg A
Floor 3
Frederick MD, 21701

24-Hour Dispatch Center: Kevin Johnson
(703) 737-8831(Mobile); (primary)(703) 777-2243(Office)
(primary)oem@loudoun.gov
801 Sycolin Road
Suite 100
Leesburg VA, 20175

Local Government Emergency Services:Kevin Johnson
(703) 737-8831(Mobile); (primary)(703) 777-2243(Office)
(primary)oem@loudoun.gov
801 Sycolin Road
Suite 100
Leesburg VA, 20175

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:James Betz
(primary)(703) 259-0245(Office); (800) 367-7623(Office)
(primary)james.betz@vdot.virginia.gov
41 Lawson Road S.E.
Leesburg VA, 20175

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

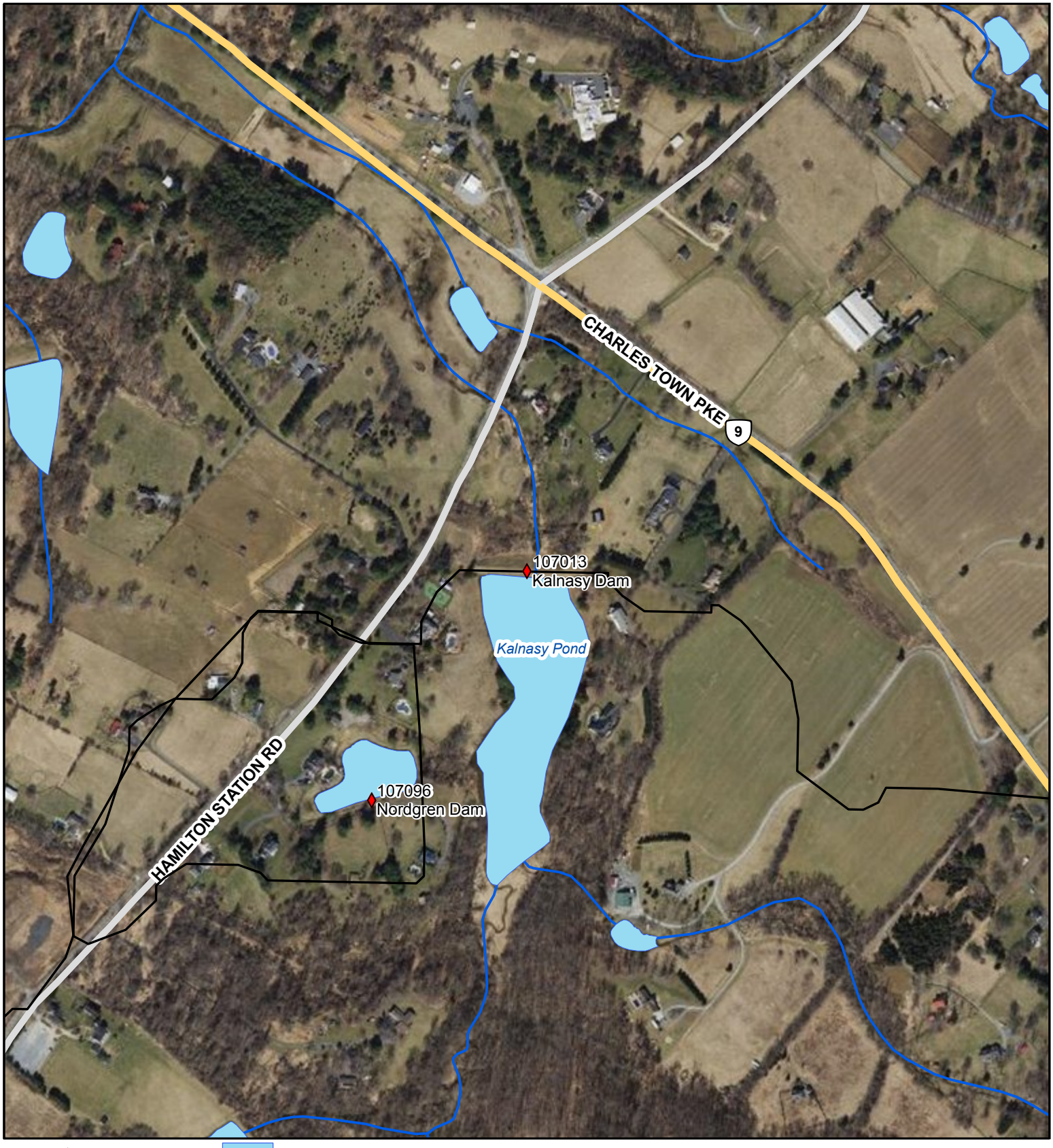
- 704 - 0.12 miles downstream
- 9 - 0.59 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 17 Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **107013**
Dam Name: **Kalnasy Dam**
VAHU6: PL02
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080301
VA House: 33
Watershed Name: South Fork Catoctin Creek
Congressional: 5110
USGS Topo: PURCELLVILLE



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Kings Park West Section 18 Dam

Inventory Number: 059039

Hazard Classification: Significant

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 03/10/1976

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2024

Days Since Last Inspection: 479

Inundation Report: 01/05/2018

Type of Dam
Earth (Secondary)

Reservoir Purpose
Flood Control or storm water management (Secondary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 0.00 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 70.90 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 354.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 25.60 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.32 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMF

Required Spillway Design Flow: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
9/14/2021	Engineer	Satisfactory
8/31/2020	Engineer	Satisfactory
9/10/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 06/01/2007
Expiration Date: 06/01/2013

Dam Location

Dam Address:

,

E911 Direction to Dam:
TBD

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Elfatih Salim
(primary)(703) 324-5667(Office)
(primary)elfatih.salim@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22033

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059039**
Dam Name: **Kings Park West Section 18 Dam**
VAHU6: PL29
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 34
HUC 12: 020700100401
VA House: 41
Watershed Name: Pohick Creek
Congressional: 5111
USGS Topo: FAIRFAX

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Kingstowne BMP Basin #2

Inventory Number: 059099

Hazard Classification: Significant

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Rhoda Desplinter
(primary)(703) 922-9477(Office)
6090 Kingstowne Village Parkway
Kingstowne VA, 22315-4624

Size Classification: Under Size Threshold

Certificate Type:

Certificate Expiration:

Days Since Last Inspection:

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Dogue Creek

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 6.30 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 44.80 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 16.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

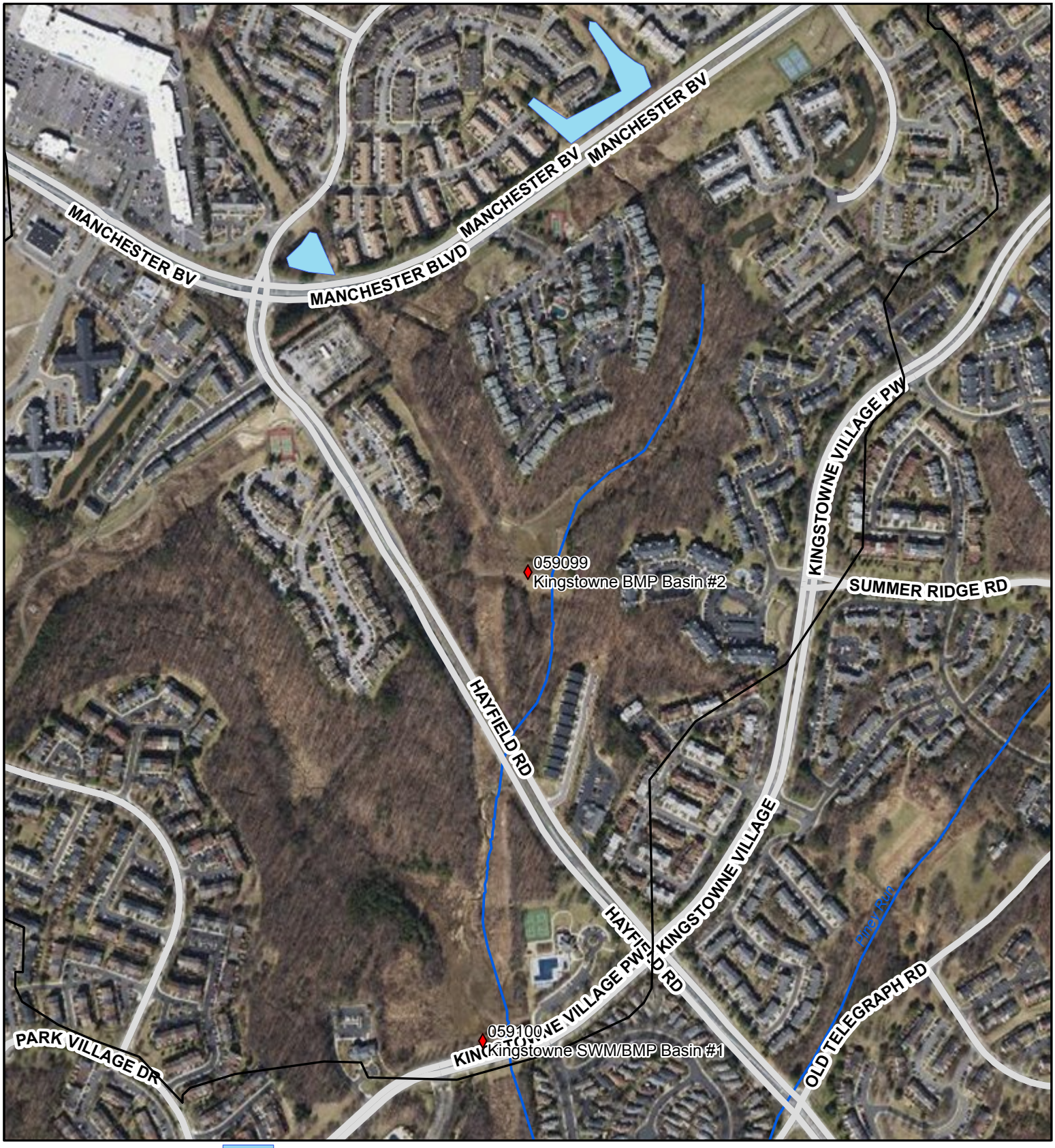
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059099**
Dam Name: **Kingstowne BMP Basin #2**
VAHU6: PL27
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 36,39
HUC 12: 020700100306
VA House: 43
Watershed Name: Dogue Creek
Congressional: 5108
USGS Topo: ANNANDALE



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Kingstowne Lake Dam

Inventory Number: 059032

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1988

Dam Owner:
Rich Rounds
(primary)(301) 495-1520(Office)
2900 Linden Lane, Suite 300
Silver Spring MD, 20910

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 09/30/2023

Days Since Last Inspection: 471

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: Dogue Creek

Technical Basics

Normal Pool Area: 13.50 Acres

Top Surface Area: 18.30 Acres

Normal Pool Capacity: 160.00 Acre-Feet

Top Capacity: 320.00 Acre-Feet

Normal Pool Elevation: 172.00 Feet

Top Elevation: 182.00 Feet

Normal Pool Height: 55.00 Feet

Top Height: 64.20 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.42 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMF **Required Spillway Design Flow**: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
9/22/2021	Other	
7/12/2017	Engineer	Satisfactory
7/14/2015	Engineer	

EAP Quick Reference

Approval Date: 08/25/2003
Expiration Date: 08/25/2009

Dam Location

Dam Address:
6601 S Van Dorn St
Alexandria VA, 22315

E911 Direction to Dam:
The impoundment structure is located at the intersection of S Van Dorn St and Kingstowne Village Pkwy.

EAP Contacts

Dam Operator: NA NA
(primary)(301) 495-1520(Office)
(primary)na
2900 Linden Lane, Suite 300
Silver Spring MD, 20910

Dam Alternate Operator:

Rain Gauge Observer: Vic Scalia
(primary)(301) 495-1520(Office)
(primary)na
2900 Linden Lane, Suite 300
Silver Spring MD, 20910

Alternate Rain Gauge Observer:Adam Adamson
(primary)(301) 370-6289(Office)
(primary)na
2900 Linden Lane, Suite 300
Silver Spring MD, 20910

24-Hour Dispatch Center: NA NA
(primary)(703) 691-2131(Office)
(primary)na
3911 Woodburn Rd
Annandale VA, 22003

Local Government Emergency Services:Ronald Phillips
(primary)(703) 280-0584(Office)
(primary)na
3911 Woodburn Rd
Annandale VA, 22003

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Gaby Hakim, PE
(primary)(703) 259-0243(Office); (800) 367-7623(Office)
(primary)na
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 613 - 0 miles downstream
- 633 - 1 miles downstream
- 611 - 1 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 73 Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059032**
Dam Name: **Kingstowne Lake Dam**
VAHU6: PL27
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 30,36
HUC 12: 020700100306
VA House: 43
Watershed Name: Dogue Creek
Congressional: 5108
USGS Topo: ANNANDALE

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Kingstowne SWM DP #4 Regional

Inventory Number: 059050

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 09/30/2026

Days Since Last Inspection: 113

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Dogue Creek tributary

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 10.00 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 140.00 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 168.90 Feet

Normal Pool Height: 0.00 Feet

Top Height: 42.90 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.17 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
9/15/2022	Engineer	Satisfactory
9/14/2021	Engineer	Satisfactory
9/2/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 07/31/2020
Expiration Date: 07/31/2026

Dam Location

Dam Address:
Paved access road to dam located on the right just past the intersection of Kingstowne Village Parkway and Wigmore Lane
Alexandria VA, 22315

E911 Direction to Dam:
Paved access road to dam located on the right just past the intersection of Kingstowne Village Parkway and Wigmore Lane, Alexandria, VA 22315.

EAP Contacts

Dam Operator: Chad Crawford
(primary)(703) 324-5500(Office)
(primary)Chad.Crawford@fairfaxcounty.gov
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Dam Alternate Operator:Aaron George
(primary)(703) 870-7000(Office)
(primary)ageorge@gky.com
4229 Lafayette Center Drive
Suite 1850
Chantilly VA, 20151

Rain Gauge Observer: Alex Shahvari
(primary)(703) 877-2800(Office)
(primary)Alireza.Shahvari@fairfaxcounty.gov
10635 West Drive
Fairfax VA, 22030

Alternate Rain Gauge Observer:Ganesh Thapa
(primary)(703) 877-2800(Office)
(primary)Ganesh.Thapa@fairfaxcounty.gov
10635 West Drive
Fairfax VA, 22030

24-Hour Dispatch Center: Ganesh Thapa
(primary)(703) 877-2800(Office)
(primary)Ganesh.Thapa@fairfaxcounty.gov
10635 West Drive
Fairfax VA, 22030

Local Government Emergency Services:Greg Zebrowski
(primary)(571) 350-2100(Office)
(primary)Gregory.Zebrowski@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Gaby Hakim, PE
(primary)(703) 259-0243(Office); (800) 367-7623(Office)
(primary)na
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Eric Seymour
(757) 899-2415(Office); (primary)(757) 899-4200(Office); (800) 737-8624(Office)
(primary)eric.seymour@noaa.gov
1009 General Mahone Highway
Wakefield VA, 23888

Potential Impacts

Roadways Impacted:

- Kingstowne Village Parkway (Route 8690) - 0 miles downstream

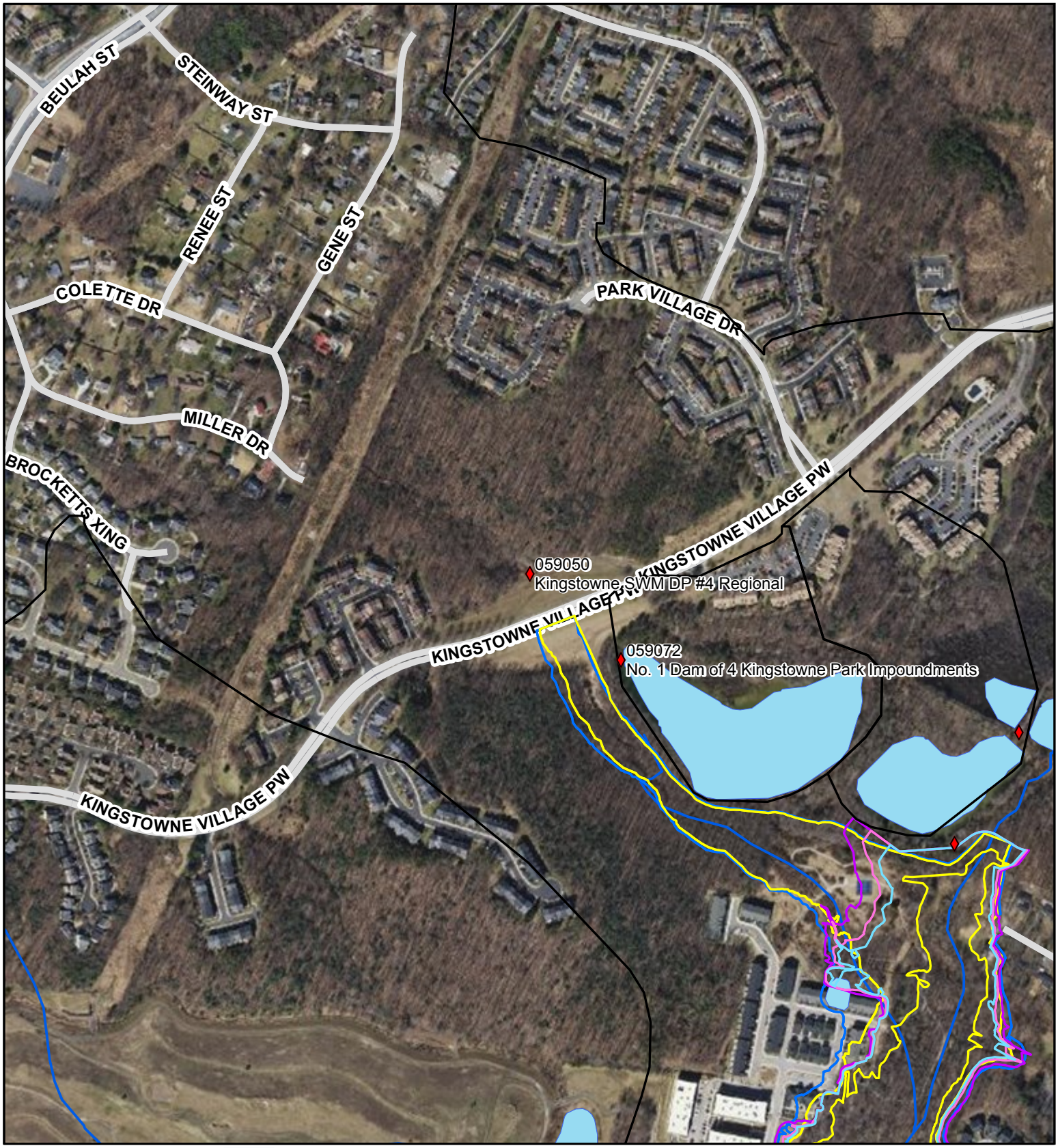
Dams Downstream:

- none

Potential Impact Structures (count):

- 31 Homes
- 1 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **059050**
Dam Name: **Kingstowne SWM DP #4 Regional**
VAHU6: PL27
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 36,39
HUC 12: 020700100306
VA House: 43
Watershed Name: Dogue Creek
Congressional: 5108
USGS Topo: ANNANDALE,FORT BELVOIR



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Lake Accotink Dam

Inventory Number: 059006

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1920

Dam Owner:
Cynthia Walsh
(primary)(703) 324-8537(Office)
12055 Government Center Parkway
Fairfax VA, 22035

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 11/30/2024

Days Since Last Inspection: 136

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 1.00 Miles

River or Stream: Accotink Creek

Technical Basics

Normal Pool Area: 88.00 Acres

Top Surface Area: 302.00 Acres

Normal Pool Capacity: 679.00 Acre-Feet

Top Capacity: 2963.00 Acre-Feet

Normal Pool Elevation: 187.00 Feet

Top Elevation: 198.00 Feet

Normal Pool Height: 17.00 Feet

Top Height: 28.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 31.00 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
8/23/2022	Engineer	Fair
10/21/2021	Owner	Fair
10/28/2020	Engineer	Fair

EAP Quick Reference

Approval Date: 06/27/2017
Expiration Date: 06/27/2023

Dam Location

Dam Address:
7500 Accotink Park Rd
Springfield VA, 22150

E911 Direction to Dam:
Alternative address if Accotink Park Rd. is impacted due to flooding is 5650 Heming Ave, Springfield, VA 22151

EAP Contacts

Dam Operator: Julie Tahan
(primary)(703) 569-0285(Office); (703) 609-1583(Mobile); (703) 644-6516(Home)
(primary)julie.tahan@fairfaxcounty.gov
7500 Accotink Park Road
Springfield VA, 22150

Dam Alternate Operator:Ken Fulling
(primary)(703) 569-0285(Office); (703) 609-1583(Mobile); (703) 644-6516(Home)
(primary)ken.fulling@fairfaxcounty.gov
7500 Accotink Park Road
Springfield VA, 22150

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center: na na
(primary)(571) 350-2100(Office)
(primary)na
4890 Alliance Drive
Suite 2300
Fiarfax VA, 22030

Local Government Emergency Services:Seamus Mooney
(primary)(571) 439-4901(Office)
(primary)Seamus.Mooney@fairfaxcounty.gov
4890 Alliance Drive
Suite 2200
Fairfax VA, 22030

Owner's Engineer: Adrienne K Shaner
(757) 346-4173(Office); (757) 483-3838(Office);
(primary)(757) 493-2319(Mobile)
(primary)ashaner@gfnet.com
5029 Corporate Woods Drive
Suite 301
Virginia Beach VA, 23462

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 644 - 1.78 miles downstream
- 289 - 2.71 miles downstream
- 286 - 4.18 miles downstream
- 95 - 6 miles downstream
- 611 - 6.76 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 220 Homes
- 5 Businesses
- 1 Schools
- Hospitals
- Critical Infrastructure
- 2 Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059006**
Dam Name: **Lake Accotink Dam**
VAHU6: PL30
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 35
HUC 12: 020700100402
VA House: 39,42
Watershed Name: Accotink Creek
Congressional: 5108,5111
USGS Topo: ANNANDALE

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Lake Anne Dam

Inventory Number: 059009

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1962

Dam Owner:
William Peterson
(571) 233-9943(Mobile); (primary)(703) 435-6535(Office)
12001 Sunrise Valley Drive
Reson VA, 20191

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 03/31/2022

Days Since Last Inspection: 696

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: TR-Colvin Run

Technical Basics

Normal Pool Area: 24.80 Acres

Top Surface Area: 50.00 Acres

Normal Pool Capacity: 363.00 Acre-Feet

Top Capacity: 745.00 Acre-Feet

Normal Pool Elevation: 325.00 Feet

Top Elevation: 336.00 Feet

Normal Pool Height: 36.00 Feet

Top Height: 47.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.91 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .42 PMF

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
2/9/2021	Engineer	Satisfactory
2/5/2020	Owner	Satisfactory
2/6/2019	Engineer	Fair

EAP Quick Reference

Approval Date: 02/28/2018
Expiration Date: 02/28/2024

Dam Location

Dam Address:
1510 Inlet Ct
Reston VA, 20190

E911 Direction to Dam:
The impoundment structure is located directly west and adjacent to Rte 828, Wiehle Ave, between Inlet Ct and Fairway Dr.

EAP Contacts

Dam Operator: Larry T. Butler
(primary)(703) 435-6501(Office)
(primary)Larry@reston.org
12001 Sunrise Valley Drive
Reston VA, 20191-3404

Dam Alternate Operator:William Peterson
(571) 233-9943(Mobile); (primary)(703) 435-6535(Office)
(primary)wpeterson@reston.org
12001 Sunrise Valley Drive
Reson VA, 20191

Rain Gauge Observer: William Peterson
(571) 233-9943(Mobile); (primary)(703) 435-6535(Office)
(primary)wpeterson@reston.org
12001 Sunrise Valley Drive
Reson VA, 20191

Alternate Rain Gauge Observer:Larry T. Butler
(primary)(703) 435-6501(Office)
(primary)Larry@reston.org
12001 Sunrise Valley Drive
Reston VA, 20191-3404

24-Hour Dispatch Center: NA NA
(primary)(703) 478-0904(Office)
(primary)na
1801 Cameron Glen Dr
Reston VA, 20190

Local Government Emergency Services:NA NA
(primary)(571) 350-2100(Office)
(primary)na
4890 Alliance Dr
Fairfax VA, 22030

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Gaby Hakim, PE
(primary)(703) 259-0243(Office); (800) 367-7623(Office)
(primary)na
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Wiehle Ave - 0 miles downstream
- Lake Fairfax Dr - 99999 miles downstream
- Hunter Mill Rd - 99999 miles downstream
- Carpers Farm Way - 99999 miles downstream
- Leesburg Pike - 99999 miles downstream
- Leigh Mill Rd - 99999 miles downstream
- Georgetown Pike - 99999 miles downstream

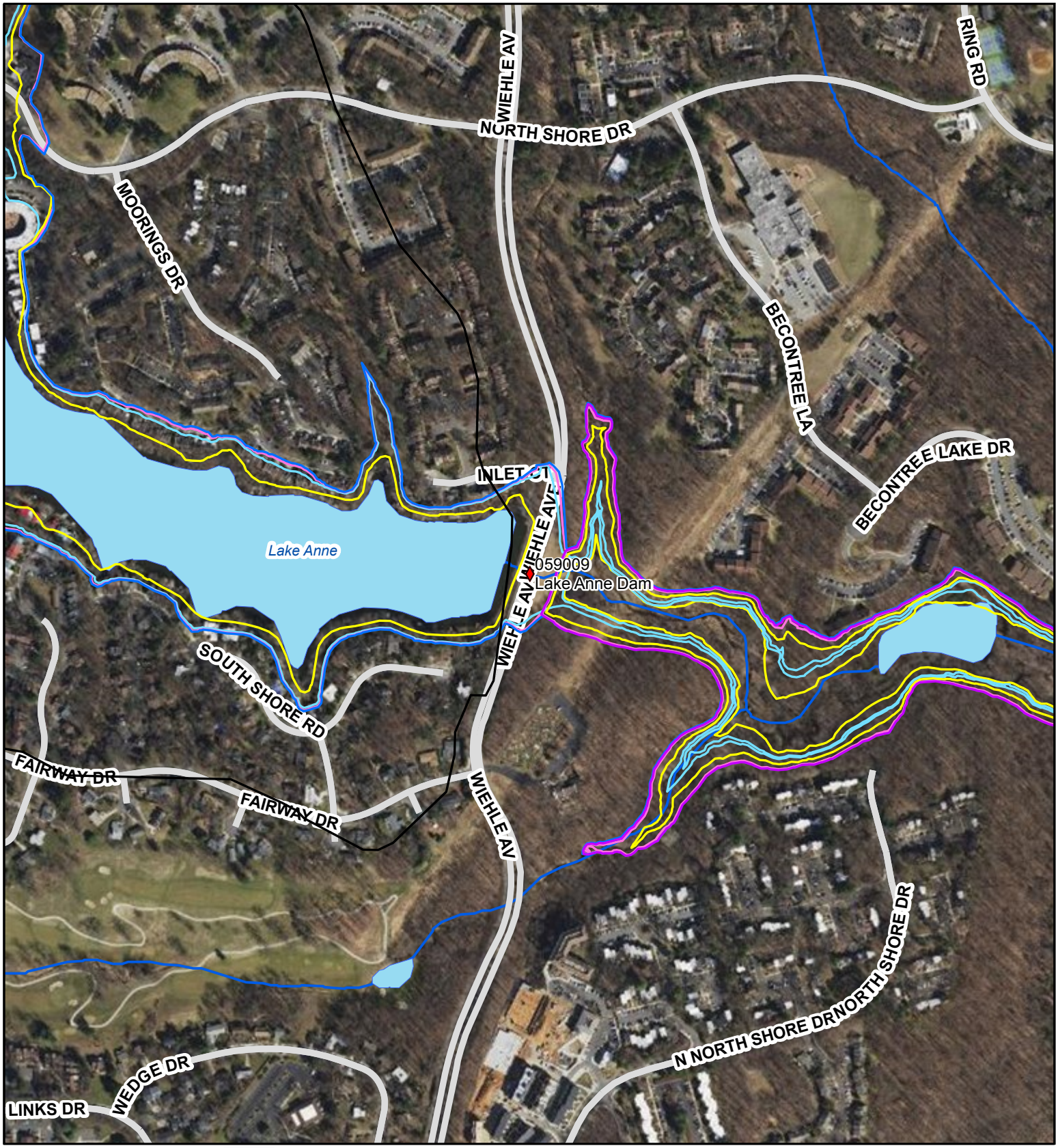
Potential Impact Structures (count):

- 17 Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dams Downstream:

- 059010

Dam Number: **059009**
Dam Name: **Lake Anne Dam**
VAHU6: PL22
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 32
HUC 12: 020700081004
VA House: 36
Watershed Name: Difficult Run
Congressional: 5111
USGS Topo: VIENNA



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Lake Audubon Dam

Inventory Number: 059021

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1979

Dam Owner:
Larry T. Butler
(primary)(703) 435-6501(Office)
12001 Sunrise Valley Drive
Reston VA, 20191-3404

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2025

Days Since Last Inspection: 696

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 1.00 Miles

River or Stream: Snakeden Branch

Technical Basics

Normal Pool Area: 44.00 Acres

Top Surface Area: 89.00 Acres

Normal Pool Capacity: 410.00 Acre-Feet

Top Capacity: 1364.00 Acre-Feet

Normal Pool Elevation: 300.00 Feet

Top Elevation: 314.00 Feet

Normal Pool Height: 32.00 Feet

Top Height: 46.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 2.50 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

24 Hour PMP: 0.00

Available Spillway Design Flow: .90 PMP

Weighted Curve Number:

IDA Spillway Reduction:

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
2/9/2021	Engineer	Satisfactory
2/6/2019	Engineer	Satisfactory
7/6/2012	Engineer	Fair

EAP Quick Reference

Approval Date: 03/22/2019
Expiration Date: 03/22/2025

Dam Location

Dam Address:
Nearest physical address is 2070 Twin Branches Rd Reston
Reston VA, 20191

E911 Direction to Dam:
On Snakeden Branch upstream of Difficult Run, Tax Map: 27-1, DCR Inventory Number: 059013, Latitude/Longitude: 38.936/-77.332 (degrees); located directly under South Lakes Drive.

EAP Contacts

Dam Operator: Larry T. Butler
(primary)(703) 435-6501(Office)
(primary)Larry@reston.org
12001 Sunrise Valley Drive
Reston VA, 20191-3404

Dam Alternate Operator:William Peterson
(571) 233-9943(Mobile); (primary)(703) 435-6535(Office)
(primary)wpeterson@reston.org
12001 Sunrise Valley Drive
Reson VA, 20191

Rain Gauge Observer: William Peterson
(571) 233-9943(Mobile); (primary)(703) 435-6535(Office)
(primary)wpeterson@reston.org
12001 Sunrise Valley Drive
Reson VA, 20191

Alternate Rain Gauge Observer:Larry T. Butler
(primary)(703) 435-6501(Office)
(primary)Larry@reston.org
12001 Sunrise Valley Drive
Reston VA, 20191-3404

24-Hour Dispatch Center: Lorraine Fells-Danzer
(primary)(571) 350-1728(Office)
(primary)Lorraine.Fells-danzer@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Local Government Emergency Services:Seamus Mooney
(primary)(571) 439-4901(Office)
(primary)Seamus.Mooney@fairfaxcounty.gov
4890 Alliance Drive
Suite 2200
Fairfax VA, 22030

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Paul Matticks, P.E.
(primary)(276) 328-9331(Office)
(primary)Paul.Matticks@VDOT.Virginia.gov
870 Bonham Road
Bristol VA, 24201

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Twin Branches Road - 0.0 miles downstream
- Hunters Den Lane - 1.2 miles downstream
- Hunter Station Road SR 766 - 1.4 miles downstream
- Hunter Mill Road SR 674 - 1.6 miles downstream
- Browns Mill Road SR 675 - 4.3 miles downstream
- Leesburg Pike SR 7 - 5.5 miles downstream
- Leigh Mill Road - 7.3 miles downstream

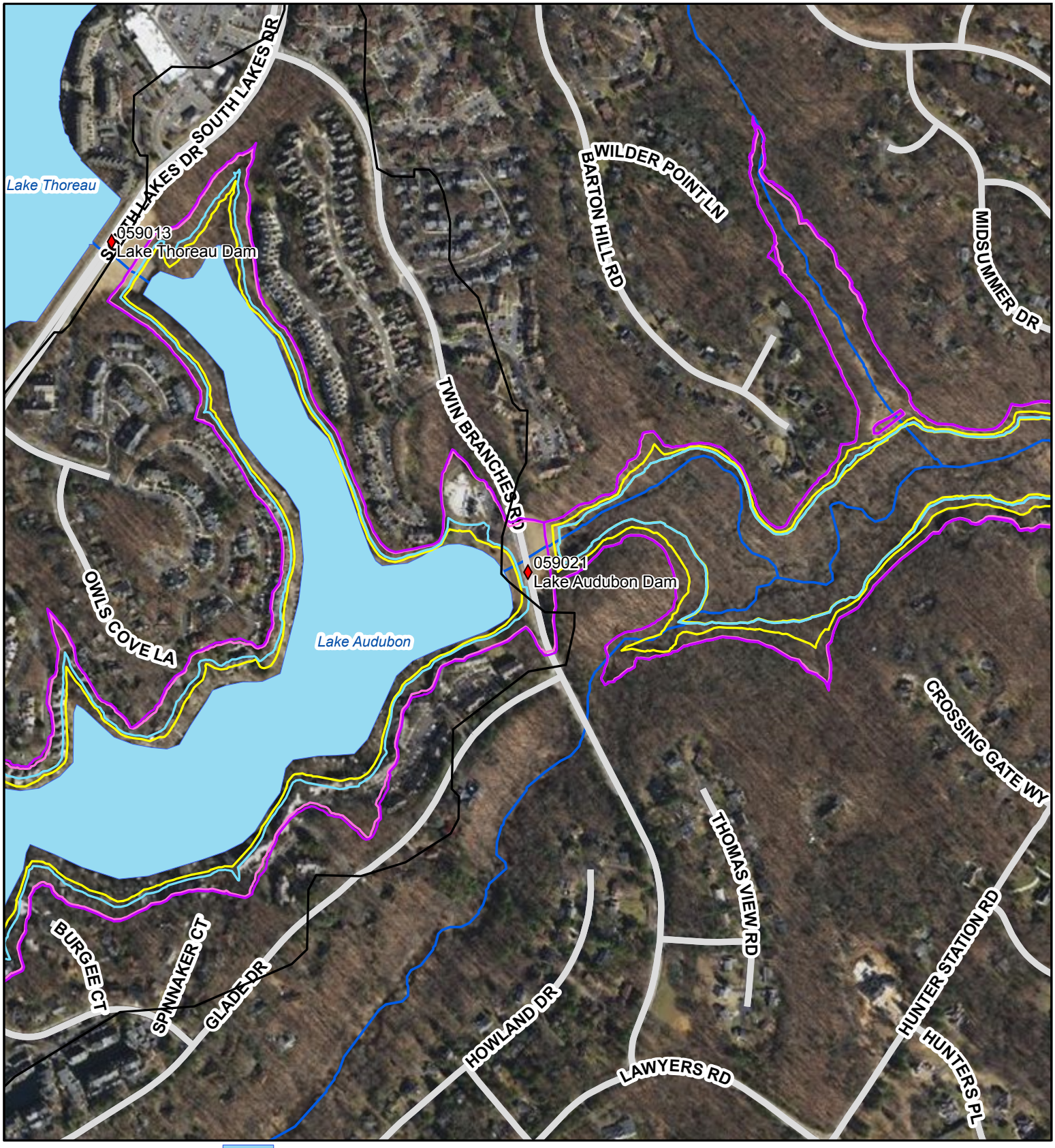
Potential Impact Structures (count):

- 61 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dams Downstream:

- NA

Dam Number: **059021**
Dam Name: **Lake Audubon Dam**
VAHU6: PL22
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 32
HUC 12: 020700081004
VA House: 36
Watershed Name: Difficult Run
Congressional: 5111
USGS Topo: VIENNA



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Lake Fairfax Dam

Inventory Number: 059010

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1956

Dam Owner:
Cynthia Walsh
(primary)(703) 324-8537(Office)
12055 Government Center Parkway
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 09/30/2024

Days Since Last Inspection: 140

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 3.00 Miles

River or Stream: Colvin Run

Technical Basics

Normal Pool Area: 21.00 Acres

Top Surface Area: 44.00 Acres

Normal Pool Capacity: 182.00 Acre-Feet

Top Capacity: 487.00 Acre-Feet

Normal Pool Elevation: 262.00 Feet

Top Elevation: 272.00 Feet

Normal Pool Height: 22.00 Feet

Top Height: 32.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 4.30 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 100.00 YR **Required Spillway Design Flow**: 100.00 YR

Inspections (Last 3 Max)

Date	Type	Condition
8/19/2022	Engineer	Satisfactory
7/21/2021	Owner	Satisfactory
12/23/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 09/13/2012
Expiration Date: 09/13/2018

Dam Location

Dam Address:
Lake Fairfax Dr
Reston VA, 20190

E911 Direction to Dam:
The impoundment structure is located adjacent to Lake Fairfax Dr, which can be accessed via Lake Fairfax Dr.

EAP Contacts

Dam Operator: John McCarthy
(703) 349-9499(Mobile); (primary)(703) 471-5415(Office)
(primary)na
NA
Na VA, 99999

Dam Alternate Operator:Ferlin Mathews
(primary)(703) 759-4768(Office)
(primary)ferlin.mathews@fairfaxcounty.gov
1400 Lake Fairfax Dr.
Reston VA, 20190

Rain Gauge Observer: John McCarthy
(703) 349-9499(Mobile); (primary)(703) 471-5415(Office)
(primary)na
NA
Na VA, 99999

Alternate Rain Gauge Observer:Ferlin Mathews
(primary)(703) 759-4768(Office)
(primary)ferlin.mathews@fairfaxcounty.gov
1400 Lake Fairfax Dr.
Reston VA, 20190

24-Hour Dispatch Center: NA NA
(primary)(571) 350-1225(Office); (571) 439-4901(Office)
(primary)na
4890 Alliance Drive
Fairfax VA, 22030

Local Government Emergency Services:Dave McKernan
(primary)(571) 350-1000(Office)
(primary)na
NA
Na VA, 99999

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Gaby Hakim, PE
(primary)(703) 259-0243(Office); (800) 367-7623(Office)
(primary)na
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

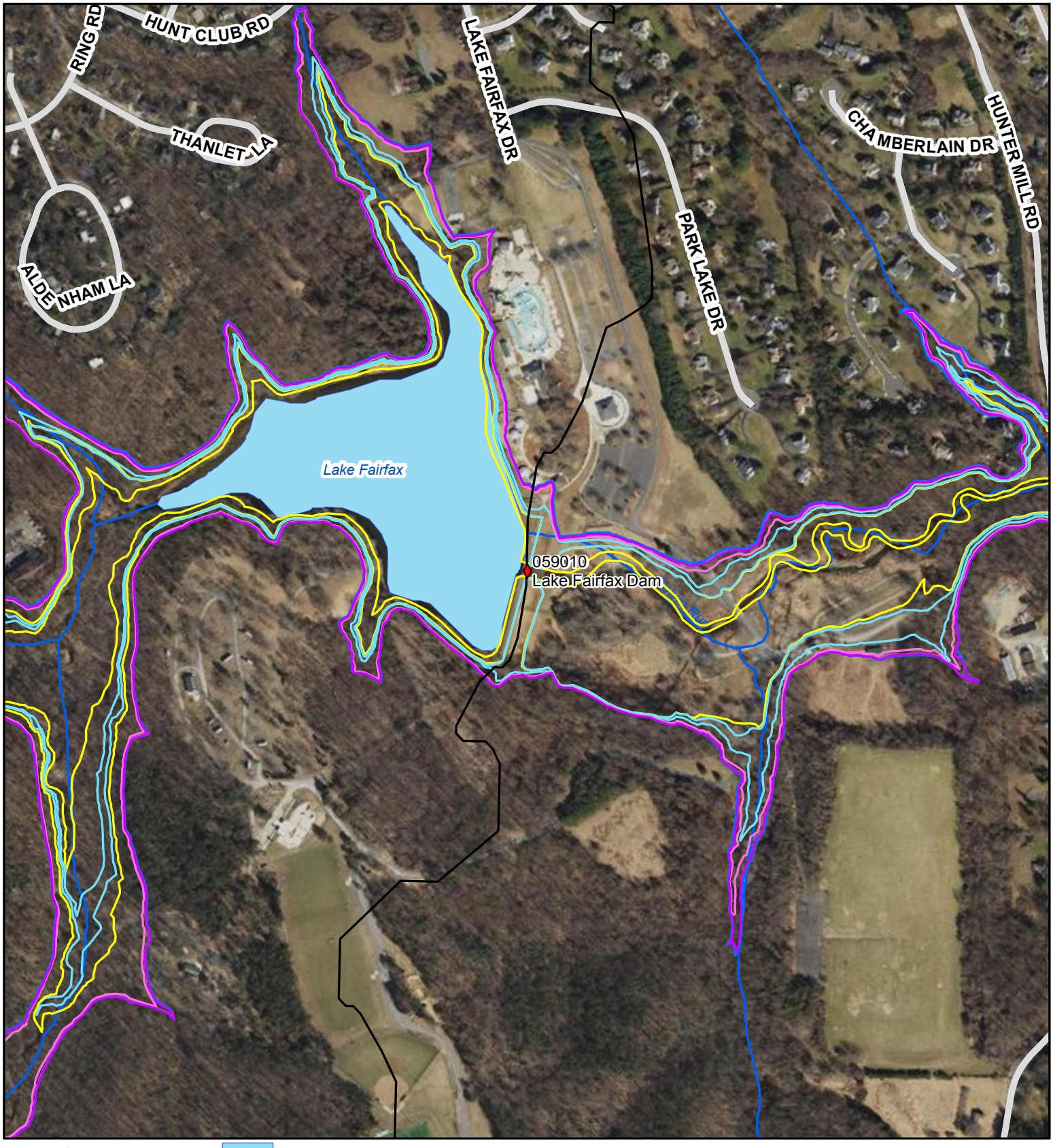
- 674 - 0.45 miles downstream
- 743 - 1.85 miles downstream
- 7 - 2.0 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 11 Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- 1 Parks
- Golf Courses

Dam Number: **059010**
Dam Name: **Lake Fairfax Dam**
VAHU6: PL22
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 31,32
HUC 12: 020700081004
VA House: 34,36
Watershed Name: Difficult Run
Congressional: 5110,5111
USGS Topo: VIENNA



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Lake Jackson Dam

Hazard Classification: Significant

Designed By:

Regional Engineer: Mark Killgore

Dam Owner:
Thomas Smith
(primary)(703) 792-6252(Office)
5 County Complex Ct., Suite 250
Prince William VA, 22912

Inventory Number: 153006

City/County: Prince William County

Constructed By:

Year Constructed: 01/01/1928

Size Classification: Large (>=50,000 ac. ft., >=100')

Certificate Type: Conditional 1 Year Certificate

Certificate Expiration: 11/30/2022

Days Since Last Inspection: 77

Inundation Report: 12/16/2013

Type of Dam
Gravity (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 4.00 Miles

River or Stream: Occoquan River

Technical Basics

Normal Pool Area: 200.00 Acres

Normal Pool Capacity: 1228.00 Acre-Feet

Normal Pool Elevation: 148.00 Feet

Normal Pool Height: 28.00 Feet

Top Surface Area: 200.00 Acres

Top Capacity: 1228.00 Acre-Feet

Top Elevation: 148.00 Feet

Top Height: 28.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

6 Hour PMP: 0.00

12 Hour PMP: 0.00

24 Hour PMP: 0.00

Available Spillway Design Flow: .50 PMP

Drainage Area: 343.00 Sq. Mi.

Time of Concentration:

Weighted Curve Number:

IDA Spillway Reduction:

Required Spillway Design Flow: .50 PMP

Inspections (Last 3 Max)

Date	Type	Condition
10/20/2022	Owner	Satisfactory
10/13/2021	Owner	Satisfactory
6/15/2021	Engineer	Satisfactory

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Lo Ming Chao
(primary)(703) 792-7075(Office)
(primary)lchao@pwcgov.org
5 County Complex Court
Suite VA, 22192

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

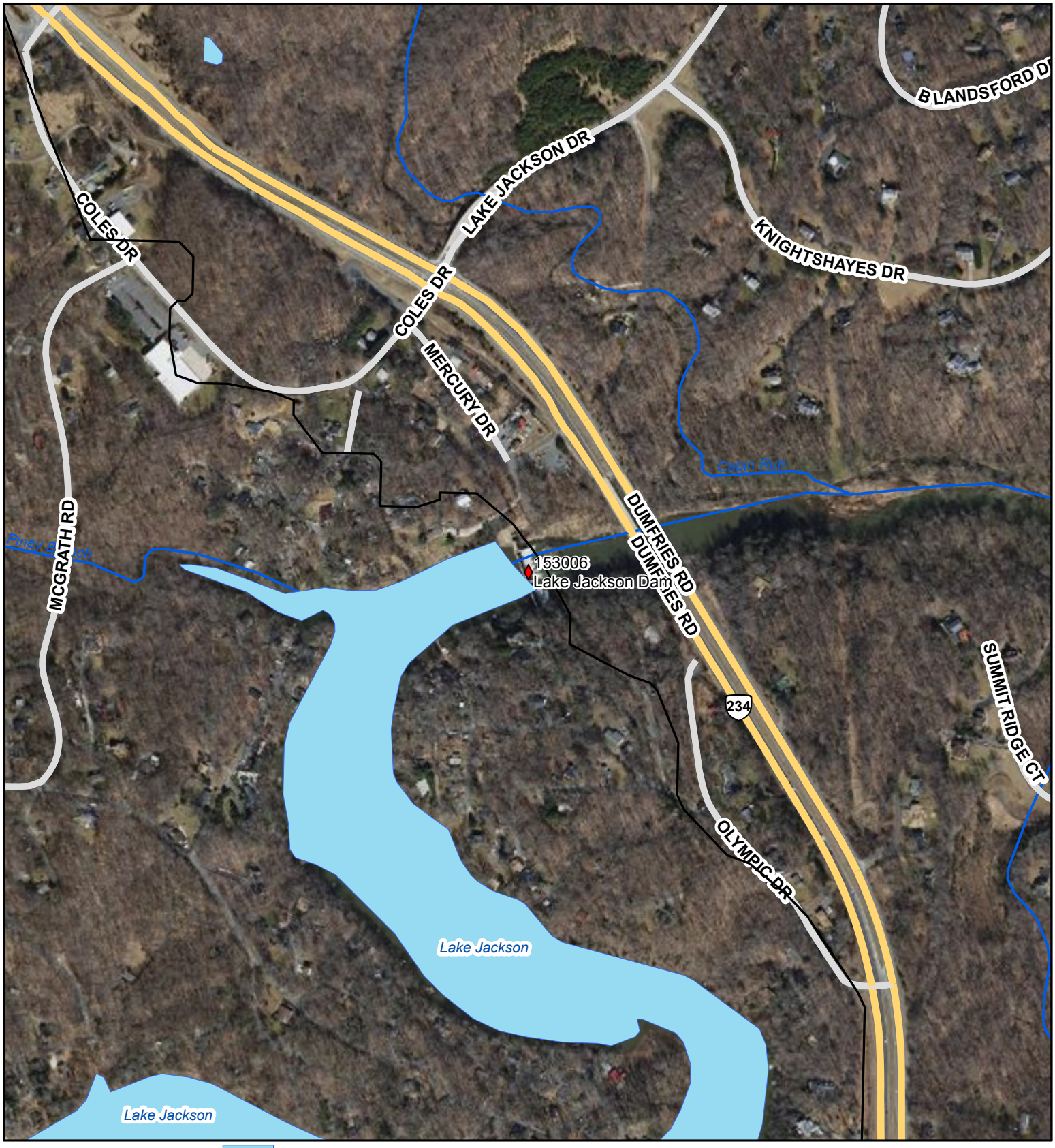
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **153006**
Dam Name: **Lake Jackson Dam**
VAHU6: PL41
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 28,29
HUC 12: 020700100801
VA House: 51
Watershed Name: Occoquan River-Occoquan Reservoir-Lake Jackson
Congressional: 5101,5110
USGS Topo: INDEPENDENT HILL



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Lake Montclair Dam

Inventory Number: 153003

Hazard Classification: High

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1964

Dam Owner:
Montclair Property Owner's Association
(primary)(703) 670-6187(Office)
3561 waterway drive
Montclair VA, 22025

Size Classification: Large (>=50,000 ac. ft., >=100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 05/31/2025

Days Since Last Inspection: 210

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: Powells Creek

Technical Basics

Normal Pool Area: 85.00 Acres

Top Surface Area: 279.00 Acres

Normal Pool Capacity: 2188.00 Acre-Feet

Top Capacity: 5938.00 Acre-Feet

Normal Pool Elevation: 188.00 Feet

Top Elevation: 206.00 Feet

Normal Pool Height: 56.00 Feet

Top Height: 74.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 11.30 Sq. Mi.

6 Hour PMP: 26.30

Time of Concentration:

12 Hour PMP: 30.10

Weighted Curve Number:

24 Hour PMP: 30.10

IDA Spillway Reduction:

Available Spillway Design Flow: .41 PMF **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
6/9/2022	Engineer	Satisfactory
7/20/2021	Owner	Satisfactory
7/28/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 04/19/2019
Expiration Date: 04/19/2025

Dam Location

Dam Address:
4398 Spillway Lane
Dolphin Beach
Montclair VA, 22025

E911 Direction to Dam:
The Earthen Embankment Dam with spillways is 650 feet long and 72 feet high. The primary spillway is a siphon activated spillway with a crest elevation of 188 feet above mean sea level (MSL), with a knife gate valve controlling the low-level 24-inch outlet pipe (elevation about 136 feet MSL). The crest of the dam proper is at elevation ~205 feet MSL with the auxiliary spillway crest at elevation 192.5 feet MSL. The auxiliary spillway (also referenced as Dolphin Beach) is located beyond the right abutment of the dam and has a channel width of about 166 feet. At the water side of the impounding structure (for dam operations) an outflow mechanism includes the concrete structure; this vertical siphon spillway is 6'3" x 8' and is ~60' high. At the bottom is an outflow 235' long 5'x8' concrete tube that carries the water out of the lake. At the lake-side end of this tunnel is a 24" gate used to lower the elevation of the lake, when necessary. When open, this gate flows at a rate of 1,025 gallons per second and lowers the lake at a rate 1" per hour under normal lake inflows.

EAP Contacts

Dam Operator: Jill Allen
(primary)(703) 670-6187(Office)
(primary)na@na.com
3561 Waterway Drive
Montclair VA, 22025

Dam Alternate Operator:Phillip Webber
(540) 455-3971(Mobile); (primary)(703) 670-6187(Office)
(primary)na@na.com
3561 Waterway Drive
Montclair VA, 22025

Rain Gauge Observer: Phillip Webber
(540) 455-3971(Mobile); (primary)(703) 670-6187(Office)
(primary)na@na.com
3561 Waterway Drive
Montclair VA, 22025

Alternate Rain Gauge Observer:Jill Allen
(primary)(703) 670-6187(Office)
(primary)na@na.com
3561 Waterway Drive
Montclair VA, 22025

24-Hour Dispatch Center: Prince William County Public Safety Communications Center
(primary)(703) 792-6500(Office)
(primary)na@na.com
9320 Lee Avenue
Manassas VA, 20110

Local Government Emergency Services:Brian Misner
(primary)(703) 792-5828(Office); (703) 853-3197(Mobile)
(primary)bmisner@pwcgov.org
3 County Complex
Manassas VA, 22192

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Bobby Shetley
(571) 749-8044(Mobile); (primary)(703) 366-1926(Office)
(primary)bobby.shetley@vdot.virginia.gov
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Spillway Lane - 0.1 miles downstream
- Dolphin Drive - 0.1 miles downstream
- Waterway Drive - 0.3 miles downstream
- Northgate Drive - 1.4 miles downstream

Dams Downstream:

- 000000

Potential Impact Structures (count):

- 354 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 3 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **153003**
Dam Name: **Lake Montclair Dam**
VAHU6: PL51
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 36
HUC 12: 020700110103
VA House: 31
Watershed Name: Powells Creek
Congressional: 5101
USGS Topo: QUANTICO

Dam Locations | Waterbodies (NHD) | Interstate | State Primary Highway
Streams (NHD) | US Primary Highway | Secondary

N

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Lake Newport Dam

Inventory Number: 059030

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1981

Dam Owner:
Larry T. Butler
(primary)(703) 435-6501(Office)
12001 Sunrise Valley Drive
Reston VA, 20191-3404

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2025

Days Since Last Inspection: 696

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: TR-Colvin Run

Technical Basics

Normal Pool Area: 12.00 Acres

Top Surface Area: 22.00 Acres

Normal Pool Capacity: 101.00 Acre-Feet

Top Capacity: 240.00 Acre-Feet

Normal Pool Elevation: 370.00 Feet

Top Elevation: 379.00 Feet

Normal Pool Height: 23.00 Feet

Top Height: 32.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.21 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

24 Hour PMP: 0.00

Available Spillway Design Flow: .90 PMP

Weighted Curve Number:

IDA Spillway Reduction:

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
2/9/2021	Engineer	Satisfactory
4/2/2019	DCR Staff Engineer (PE)	Satisfactory
2/6/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 03/22/2019
Expiration Date: 03/22/2025

Dam Location

Dam Address:
11452 Baron Cameron Ave
Reston VA, 20190

E911 Direction to Dam:
The impoundment structure can be accessed via a trail directly to the east of the parking lot across from the Lake Newport tennis courts on Browns Chapel Rd. The impoundment structure can be accessed via a trail directly to the east of the parking lot across from the Lake Newport tennis courts on Browns Chapel Rd.

EAP Contacts

Dam Operator: Larry T. Butler
(primary)(703) 435-6501(Office)
(primary)Larry@reston.org
12001 Sunrise Valley Drive
Reston VA, 20191-3404

Dam Alternate Operator:William Peterson
(571) 233-9943(Mobile); (primary)(703) 435-6535(Office)
(primary)wpeterson@reston.org
12001 Sunrise Valley Drive
Reson VA, 20191

Rain Gauge Observer: William Peterson
(571) 233-9943(Mobile); (primary)(703) 435-6535(Office)
(primary)wpeterson@reston.org
12001 Sunrise Valley Drive
Reson VA, 20191

Alternate Rain Gauge Observer:Larry T. Butler
(primary)(703) 435-6501(Office)
(primary)Larry@reston.org
12001 Sunrise Valley Drive
Reston VA, 20191-3404

24-Hour Dispatch Center: Lorraine Fells-Danzer
(primary)(571) 350-1728(Office)
(primary)Lorraine.Fells-danzer@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Local Government Emergency Services:Seamus Mooney
(primary)(571) 439-4901(Office)
(primary)Seamus.Mooney@fairfaxcounty.gov
4890 Alliance Drive
Suite 2200
Fairfax VA, 22030

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Paul Matticks, P.E.
(primary)(276) 328-9331(Office)
(primary)Paul.Matticks@VDOT.Virginia.gov

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)

870 Bonham Road
Bristol VA, 24201

(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Browns Chapel Road - 0 miles downstream
- Baron Cameron Avenue SR 606 - 0.1 miles downstream
- Village Road - 0.1 miles downstream
- North Shore Drive - 0.1 miles downstream
- Wiehle Avenue - 0.9 miles downstream
- Lake Fairfax Drive - 2.3 miles downstream
- Hunter Mill Road SR 674 - 2.6 miles downstream
- Carpers Farm Way - 4.1 miles downstream
- Leesburg Pike SR 7 - 4.3 miles downstream
- Leigh Mill Road - 6.1 miles downstream
- Old Dominion Drive - 7.1 miles downstream
- Georgetown Pike SR 193 - 7.8 miles downstream

Dams Downstream:

- 059010

Potential Impact Structures (count):

- 304 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **059030**
Dam Name: **Lake Newport Dam**
VAHU6: PL22
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 32
HUC 12: 020700081004
VA House: 36
Watershed Name: Difficult Run
Congressional: 5111
USGS Topo: VIENNA

Dam Locations | Waterbodies (NHD) | Interstate | State Primary Highway
Streams (NHD) | US Primary Highway | Secondary

N

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Lake Thoreau Dam

Inventory Number: 059013

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1971

Dam Owner:
William Peterson
(571) 233-9943(Mobile); (primary)(703) 435-6535(Office)
12001 Sunrise Valley Drive
Reson VA, 20191

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2025

Days Since Last Inspection: 696

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 1.00 Miles

River or Stream: TR-Snakeden Branch

Technical Basics

Normal Pool Area: 40.00 Acres

Top Surface Area: 72.00 Acres

Normal Pool Capacity: 813.00 Acre-Feet

Top Capacity: 1406.00 Acre-Feet

Normal Pool Elevation: 340.00 Feet

Top Elevation: 351.00 Feet

Normal Pool Height: 45.00 Feet

Top Height: 56.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.60 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

24 Hour PMP: 0.00

Available Spillway Design Flow: .90 PMP

Weighted Curve Number:

IDA Spillway Reduction:

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
2/9/2021	Engineer	Satisfactory
4/2/2019	DCR Staff Engineer (PE)	Satisfactory
2/6/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 03/22/2019
Expiration Date: 03/22/2025

Dam Location

Dam Address:
Nearest Address: 11112 Harbor Ct
Fairfax VA, 20191

E911 Direction to Dam:
On Snakeden Branch upstream of Difficult Run, Tax Map: 27-1, DCR Inventory Number: 059013, Latitude/Longitude: 38.936/-77.332 (degrees); located directly under South Lakes Drive.

EAP Contacts

Dam Operator: Larry T. Butler
(primary)(703) 435-6501(Office)
(primary)Larry@reston.org
12001 Sunrise Valley Drive
Reston VA, 20191-3404

Dam Alternate Operator:William Peterson
(571) 233-9943(Mobile); (primary)(703) 435-6535(Office)
(primary)wpeterson@reston.org
12001 Sunrise Valley Drive
Reson VA, 20191

Rain Gauge Observer: William Peterson
(571) 233-9943(Mobile); (primary)(703) 435-6535(Office)
(primary)wpeterson@reston.org
12001 Sunrise Valley Drive
Reson VA, 20191

Alternate Rain Gauge Observer:Larry T. Butler
(primary)(703) 435-6501(Office)
(primary)Larry@reston.org
12001 Sunrise Valley Drive
Reston VA, 20191-3404

24-Hour Dispatch Center: Lorraine Fells-Danzer
(primary)(571) 350-1728(Office)
(primary)Lorraine.Fells-danzer@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Local Government Emergency Services:Seamus Mooney
(primary)(571) 439-4901(Office)
(primary)Seamus.Mooney@fairfaxcounty.gov
4890 Alliance Drive
Suite 2200
Fairfax VA, 22030

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Paul Matticks, P.E.
(primary)(276) 328-9331(Office)
(primary)Paul.Matticks@VDOT.Virginia.gov
870 Bonham Road
Bristol VA, 24201

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- South Lakes Drive - 0 miles downstream
- Twin Branches Road - 0 miles downstream
- Hunters Den Lane - 1.7 miles downstream
- Hunter Statoin Road SR 677 - 1.8 miles downstream
- Hunter Mill Road SR 674 - 2.1 miles downstream
- Dulles Access Road SR 267 - 4.2 miles downstream
- Browns Mill Road SR 675 - 4.8 miles downstream
- Leesburg Pike SR 7 - 6.0 miles downstream
- Leigh Mill Road - 7.8 miles downstream
- Old Dominion Dr SR 738 - 8.7 miles downstream
- Georgetown Pike SR 193 - 9.5 miles downstream

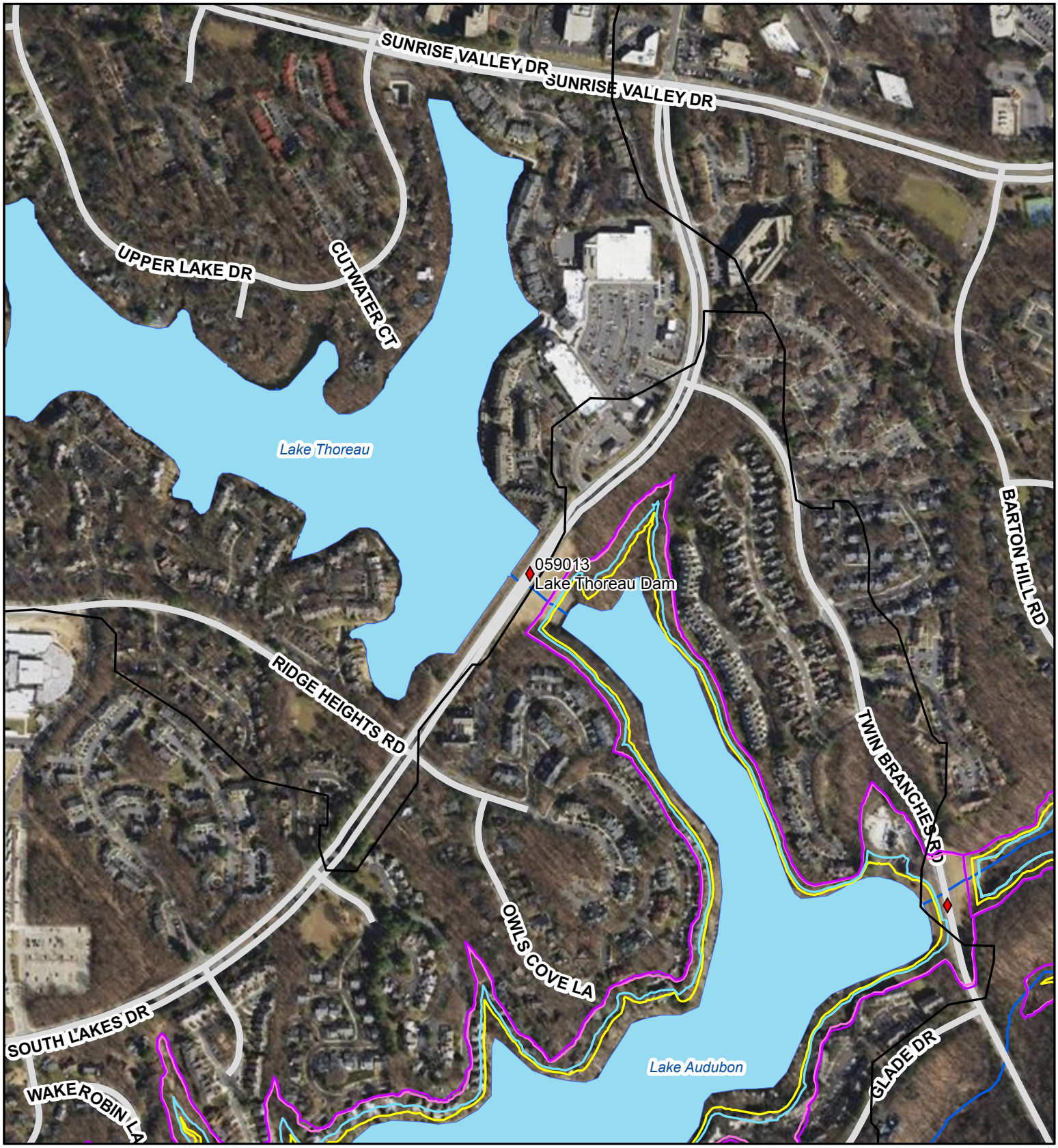
Dams Downstream:

- 059021

Potential Impact Structures (count):

- 344 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **059013**
Dam Name: **Lake Thoreau Dam**
VAHU6: PL22
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 32
HUC 12: 020700081004
VA House: 36
Watershed Name: Difficult Run
Congressional: 5111
USGS Topo: VIENNA



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Locust Shade Park Dam

Inventory Number: 153053

Hazard Classification: High

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Marc Aveni
(primary)(703) 792-4064(Office)
5 County Complex Court, Suite 170
Prince William VA, 22192

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 09/30/2022

Days Since Last Inspection: 1961

Inundation Report: Unknown

Type of Dam

Reservoir Purpose

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 7.53 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 70.00 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 103.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 24.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition
8/23/2017	Owner	Satisfactory
9/23/2016	Engineer	
10/14/2015	Engineer	

EAP Quick Reference

Approval Date: 01/31/2016
Expiration Date: 01/31/2022

Dam Location

Dam Address:
4701 Locust Shade Dr
Triangle VA, 22172

E911 Direction to Dam:
The impoundment structure is located about 200 ft northeast of the Locust Shade Park amphitheater, which is located at 4701 Locust Shade Dr.

EAP Contacts

Dam Operator: Jay Yankey
(primary)(571) 379-7514(Office)
(primary)na
NA
Na VA, 99999

Dam Alternate Operator:Roger F. Flint
(primary)(504) 347-3120(Office)
(primary)na
NA
Na VA, 99999

Rain Gauge Observer: Jay Yankey
(primary)(571) 379-7514(Office)
(primary)na
NA
Na VA, 99999

Alternate Rain Gauge Observer:Roger F. Flint
(primary)(504) 347-3120(Office)
(primary)na
NA
Na VA, 99999

24-Hour Dispatch Center: Glendell Hill
(primary)(703) 792-6070(Office)
(primary)na
NA
Na VA, 99999

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Steven Shannon
(primary)(703) 259-0244(Office); (800) 367-7623(Office)
(primary)Steven.Shannon@vdot.virginia.gov
4975 Alliance Dr
Fairfax VA, 22030

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Route 1 - 99999 miles downstream
- Purvis Rd - 99999 miles downstream
- Berkeley St - 99999 miles downstream
- Poynter St - 99999 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 0 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **153053**
Dam Name: **Locust Shade Park Dam**
VAHU6: PL53
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 36
HUC 12: 020700110105
VA House: 2
Watershed Name: Chopawamsic Creek
Congressional: 5101
USGS Topo: QUANTICO

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Market Center Pond 1 Dam

Inventory Number: 153030

Hazard Classification: Significant

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')
Certificate Type: Regular Operation and Maintenance Certificate
Certificate Expiration: 11/30/2025

Days Since Last Inspection: 440

Inundation Report: 06/17/2013

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream: TR-Little Bun Run

Technical Basics

Normal Pool Area: 0.93 Acres

Top Surface Area: 8.00 Acres

Normal Pool Capacity: 2.40 Acre-Feet

Top Capacity: 175.00 Acre-Feet

Normal Pool Elevation: 325.00 Feet

Top Elevation: 352.00 Feet

Normal Pool Height: 11.00 Feet

Top Height: 37.50 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.16 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF

Required Spillway Design Flow: 1.00 PMF

Inspections (Last 3 Max)

Date	Type	Condition
10/22/2021	DCR Staff Engineer (PE)	Satisfactory
10/21/2019	Engineer	Satisfactory
12/4/2013	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 11/26/2019
Expiration Date: 11/26/2025

Dam Location

Dam Address:
6427 James Madison Highway
Haymarket VA, 20169

E911 Direction to Dam:
southwest quad of Heathcote Blvd. and James Madison Hwy (Rt. 15)

EAP Contacts

Dam Operator: Matthew Stiene
(704) 316-4351(Office); (primary)(704) 774-7826(Mobile)
(primary)mhstiene@novanthealth.org
2085 Frontis Plaza Blvd.
Winston-Salem NC, 27103

Dam Alternate Operator:

Rain Gauge Observer: Matthew Stiene
(704) 316-4351(Office); (primary)(704) 774-7826(Mobile)
(primary)mhstiene@novanthealth.org
2085 Frontis Plaza Blvd.
Winston-Salem NC, 27103

Alternate Rain Gauge Observer:Tim Leopold
(primary)(703) 929-3683(Mobile)
(primary)TLeopold@minnieland.com
15040 Heathcote Blvd.
Haymarket VA, 20169

24-Hour Dispatch Center: Prince William County Public Safety Communications Center
(primary)(703) 792-6500(Office)
(primary)na@na.com
9320 Lee Avenue
Manassas VA, 20110

Local Government Emergency Services:Brian Misner
(703) 792-5627(Office); (primary)(703) 792-5858(Mobile)
(primary)bmisner@pwcgov.org
3 County Complex
Prince William VA, 22192

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:David Brown
(primary)(703) 366-1929(Office)
(primary)david.brown@vdot.virginia.gov
na
Na VA, 12345

National Weather Service:James Lee
(primary)(703) 996-2200(Office)
(primary)james.e.lee@noaa.gov
43858 Weather Service Road
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

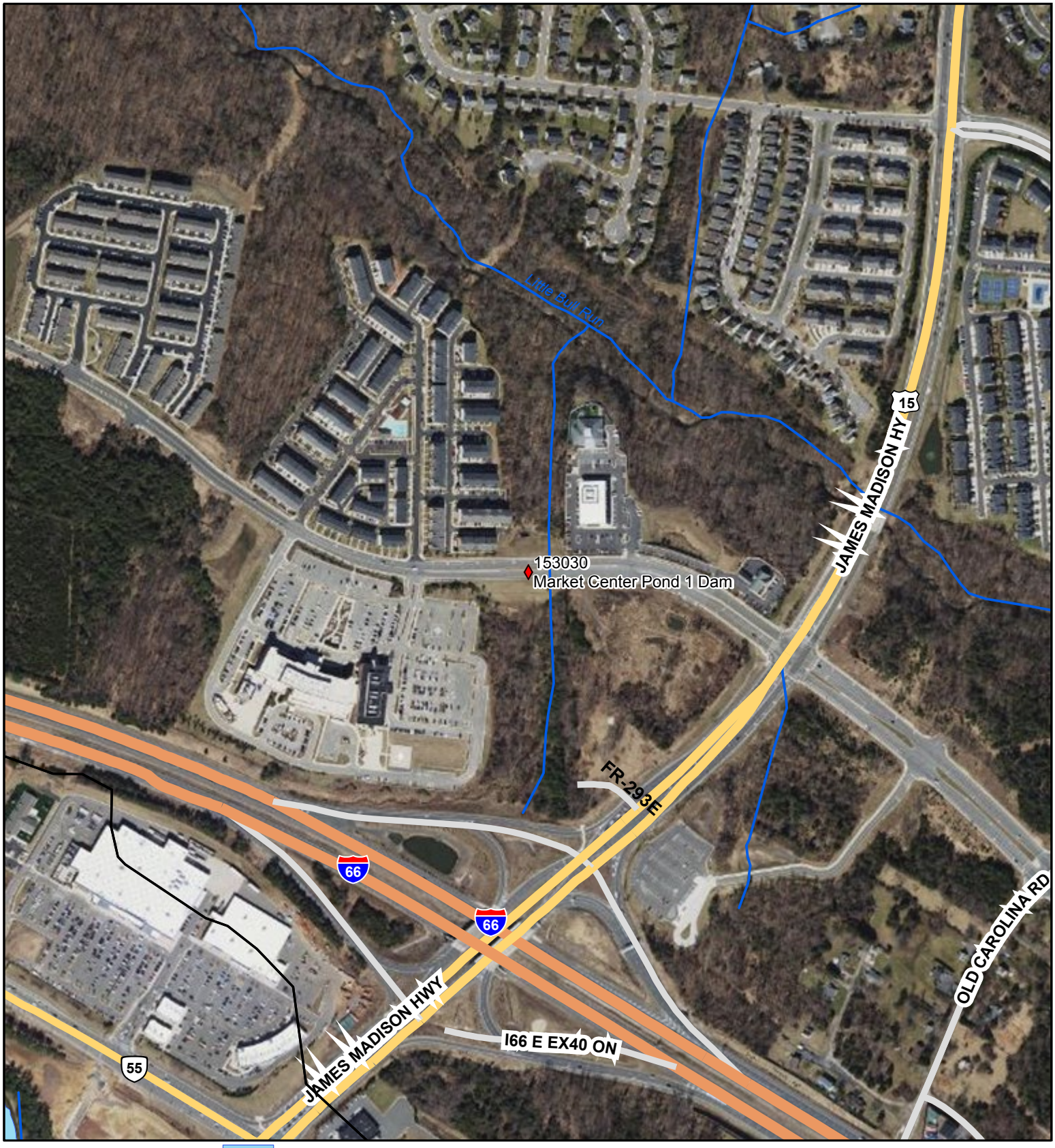
- 15 - 0.5 miles downstream
- Heathcote Blvd. - 0.0 miles downstream
- Old Carolina Road - 0.75 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 0 Homes
- 1 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **153030**
Dam Name: **Market Center Pond 1 Dam**
VAHU6: PL43
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 13,28
HUC 12: 020700100702
VA House: 13,40
Watershed Name: Little Bull Run
Congressional: 5110
USGS Topo: THOROUGHFARE GAP



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Moorefield Station East SWM Pond Dam

Inventory Number: 107040

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 02/01/2018

Dam Owner:
Tim Hemstreet
(primary)(703) 777-0200(Office)
1 Harrison Street SE MSC#2, 5th Floor
P.O. Box 7000
Leesburg VA, 20177

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 05/15/2024

Days Since Last Inspection: 98

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: 6.00 Acres

Top Surface Area: 12.20 Acres

Normal Pool Capacity: 28.30 Acre-Feet

Top Capacity: 136.30 Acre-Feet

Normal Pool Elevation: 249.00 Feet

Top Elevation: 261.20 Feet

Normal Pool Height: 2.00 Feet

Top Height: 14.25 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.44 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
9/29/2022	Engineer	Satisfactory
10/15/2021	Engineer	Fair
9/10/2019	Engineer	Fair

EAP Quick Reference

Approval Date: 04/24/2018
Expiration Date: 05/31/2024

Dam Location

Dam Address:
43706 Hamilton Chapel Terrace
Ashburn VA, 20148

E911 Direction to Dam:
Dam on north side of Loudoun County Pkwy directly across E911 address

EAP Contacts

Dam Operator: Hamilton Lambert
(primary)(703) 934-1147(Office)
(primary)jlambert@claudemoore.org
11350 Random Hills Road, Suite 520
Fairfax VA, 22030

Dam Alternate Operator:Guy Gravett
(703) 509-2424(Office); (primary)(703) 591-7020(Office)
(primary)na
na
Na VA, 12345

Rain Gauge Observer: Hamilton Lambert
(primary)(703) 934-1147(Office)
(primary)jlambert@claudemoore.org
11350 Random Hills Road, Suite 520
Fairfax VA, 22030

Alternate Rain Gauge Observer:Guy Gravett
(703) 509-2424(Office); (primary)(703) 591-7020(Office)
(primary)na
na
Na VA, 12345

24-Hour Dispatch Center: na na
(primary)(703) 777-0637(Office)
(primary)na
801 Sycolin Road SE
Ste 100
Leesburg VA, 20175

Local Government Emergency Services:na na
(primary)(703) 737-8200(Office); (703) 777-2243(Office)
(primary)EOCOps@loudoun.gov
801 Scolin Road SE
Ste 100
Leesburg VA, 20175

Owner's Engineer: Cedric Ruhl
(primary)(703) 488-3700(Office)
(primary)cedric.ruhl@woodplc.com
4795 Meadow Wood Lane
Suite 310 East
Chantilly VA, 20151

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:James Betz
(primary)(703) 259-0245(Office); (800) 367-7623(Office)
(primary)james.betz@vdot.virginia.gov
41 Lawson Road S.E.
Leesburg VA, 20175

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Loudoun County Pkwy - 0.05 miles downstream
- Stokes Chapel Terrace - 0.2 miles downstream

Dams Downstream:

- 000000

Potential Impact Structures (count):

- 44 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **107040**

Dam Name: **Moorefield Station East SWM Pond Dam**

VAHU6: PL17

Municipalities: Loudoun County

Region: 1

SWCD: LOUDOUN

VA Senate: 33

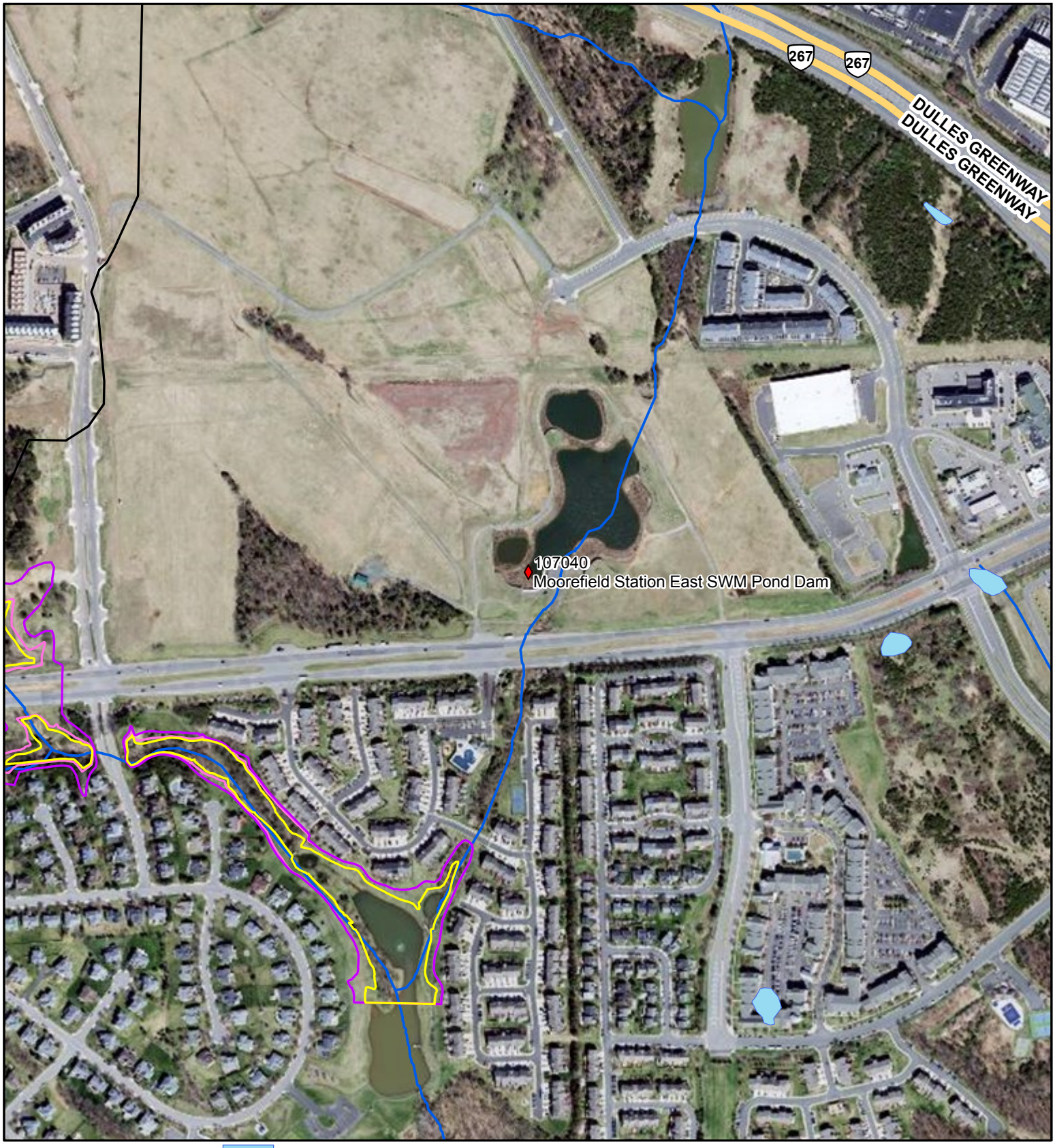
HUC 12: 020700080901

VA House: 32,87

Watershed Name: Broad Run-Lenah Run

Congressional: 5110

USGS Topo: HERNDON



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Moorefield Station West SWM Pond Dam

Inventory Number: 107041

Hazard Classification: High

City/County: Loudoun County

Designed By: Fred Ameen - PHR&A

Constructed By: William Hazel

Regional Engineer: Mark Killgore

Year Constructed: 01/01/2015

Dam Owner:
Tim Hemstreet
(primary)(703) 777-0200(Office)
1 Harrison Street SE MSC#2, 5th Floor
P.O. Box 7000
Leesburg VA, 20177

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 11/30/2023

Days Since Last Inspection: 98

Inundation Report: Unknown

Type of Dam
Concrete (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream: Tributary D to Broad Run

Technical Basics

Normal Pool Area: 3.80 Acres

Top Surface Area: 7.70 Acres

Normal Pool Capacity: 19.60 Acre-Feet

Top Capacity: 95.60 Acre-Feet

Normal Pool Elevation: 256.91 Feet

Top Elevation: 271.30 Feet

Normal Pool Height: 0.00 Feet

Top Height: 14.40 Feet

Technical Hydrology/Hydraulics

Controlling PMP: 6-HR PMP

Drainage Area: 0.34 Sq. Mi.

6 Hour PMP: 27.50

Time of Concentration: 50.00

12 Hour PMP: 31.50

Weighted Curve Number: 84

24 Hour PMP: 31.50

IDA Spillway Reduction: .50 PMP

Available Spillway Design Flow: .50 PMP

Required Spillway Design Flow: .50 PMP

Inspections (Last 3 Max)

Date	Type	Condition
9/29/2022	Engineer	Satisfactory
12/11/2020	Engineer	Satisfactory
6/2/2017	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 04/14/2021
Expiration Date: 04/14/2027

Dam Location

Dam Address:
22452 Foundation Drive
Ashburn VA, 20148

E911 Direction to Dam:
Dam access road is accessible off of Foundation Drive, next to community Clubhouse

EAP Contacts

Dam Operator: J. Hamilton Lambert
(703) 244-5414(Mobile); (primary)(703) 934-1147(Office)
(primary)jlambert@claudemoore.org
11350 Random Hills Road
Suite 520
Fairfax VA, 22030

Dam Alternate Operator:Guy Gravett
(703) 509-2424(Office); (primary)(703) 591-7020(Office)
(primary)na
na
Na VA, 12345

Rain Gauge Observer: Hamilton Lambert
(primary)(703) 934-1147(Office)
(primary)jlambert@claudemoore.org
11350 Random Hills Road, Suite 520
Fairfax VA, 22030

Alternate Rain Gauge Observer:Guy Gravett
(703) 509-2424(Office); (primary)(703) 591-7020(Office)
(primary)na
na
Na VA, 12345

24-Hour Dispatch Center: Loudoun County Emergency Communications Center
(primary)(703) 777-0637(Office)
(primary)na@na.gov
801 Sycolin Road SE
Leesburg VA, 20175

Local Government Emergency Services:Kevin Johnson
(703) 737-8831(Mobile); (primary)(703) 777-2243(Office)
(primary)oem@loudoun.gov
801 Sycolin Road
Suite 100
Leesburg VA, 20175

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:James Betz
(primary)(703) 259-0245(Office); (800) 367-7623(Office)
(primary)james.betz@vdot.virginia.gov
41 Lawson Road S.E.
Leesburg VA, 20175

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 607, Loudoun County Parkway - 0.056 miles downstream

Dams Downstream:

- 000000

Potential Impact Structures (count):

- 15 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **107041**

Dam Name: **Moorefield Station West SWM Pond Dam**

VAHU6: PL17

Municipalities: Loudoun County

Region: 1

SWCD: LOUDOUN

VA Senate: 33

HUC 12: 020700080901

VA House: 32,87

Watershed Name: Broad Run-Lenah Run

Congressional: 5110

USGS Topo: ARCOLA,HERNDON

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: New Bristow Village Regional SWM Facility Dam

Inventory Number: 153026

Hazard Classification: High

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/2005

Dam Owner:
Kristina Codino
(primary)(703) 257-9585(Office)
11976 Bristow Village BLVD
Bristow VA, 20136

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 07/31/2021

Days Since Last Inspection: 2413

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream: Unnamed Tributary to Kettle Run

Technical Basics

Normal Pool Area: 7.90 Acres

Top Surface Area: 13.74 Acres

Normal Pool Capacity: 30.40 Acre-Feet

Top Capacity: 118.00 Acre-Feet

Normal Pool Elevation: 234.00 Feet

Top Elevation: 243.00 Feet

Normal Pool Height: 7.00 Feet

Top Height: 16.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: 6-HR PMP

Drainage Area: 0.29 Sq. Mi.

6 Hour PMP: 27.70

Time of Concentration: 0.30

12 Hour PMP: 31.70

Weighted Curve Number:

24 Hour PMP: 31.70

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMP

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
5/28/2016	Engineer	
10/8/2015	Engineer	
11/3/2011	Engineer	

EAP Quick Reference

Approval Date: 02/05/2021
Expiration Date: 02/05/2027

Dam Location

Dam Address:
11976 Bristow Village Boulevard
Bristow VA, 20136

E911 Direction to Dam:
New Bristow Village

EAP Contacts

Dam Operator: Kristina Codino
(primary)(703) 257-9585(Office)
(primary)NBVManager@nbvhoa.com
11976 Bristow Village BLVD
Bristow VA, 20136

Dam Alternate Operator:Crystal Partin
(primary)(703) 398-4715(Home)
(primary)nbvmanager@nbvhoa.com
11976 Bristow Village Boulevard
Bristow VA, 20136

Rain Gauge Observer: Kristina Codino
(primary)(703) 257-9585(Office)
(primary)NBVManager@nbvhoa.com
11976 Bristow Village BLVD
Bristow VA, 20136

Alternate Rain Gauge Observer:Lyndon Johnson
(primary)(804) 943-7865(Home)
(primary)nbvmanager@nbvhoa.com
11976 Bristow Village Boulevard
Bristow VA, 20136

24-Hour Dispatch Center: Brian Misner
(primary)(703) 792-5627(Office)
(primary)bmisner@pwcgov.org
1 County Complex Court
Prince William VA, 22192

Local Government Emergency Services:Brian Misner
(703) 792-5627(Office); (primary)(703) 792-5858(Mobile)
(primary)bmisner@pwcgov.org
3 County Complex
Prince William VA, 22192

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:VDOT Resident Administrator for Road Closures
(primary)(800) 367-7623(Office)
(primary)na@na.com
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Christopher Strong
(primary)(703) 996-2223(Office)
(primary)christopher.strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20186

Potential Impacts

Roadways Impacted:

- General Kirkland Drive - .1 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 10 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 1 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **153026**

Dam Name: **New Bristow Village Regional SWM Facility Dam**

VAHU6: PL33,PL34

Municipalities: Prince William County

Region: 1

SWCD: PRINCE WILLIAM

VA Senate: 28

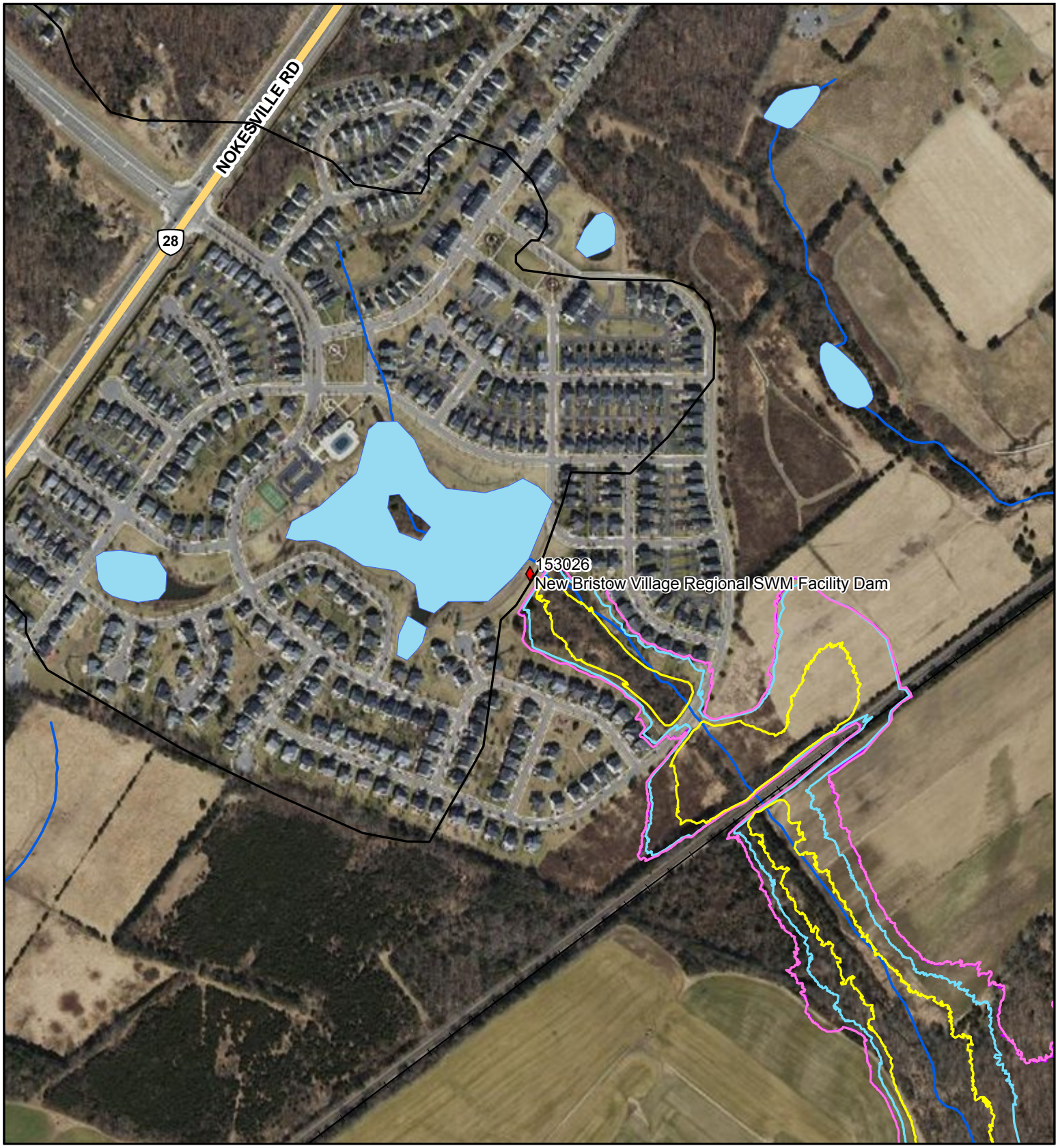
HUC 12: 020700100503,020700100504

VA House: 51

Watershed Name: Broad Run-Rocky Branch,Kettle Run

Congressional: 5101

USGS Topo: NOKESVILLE



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: No. 2 Dam of 4 Kingstowne Park Impoundments

Inventory Number: 059073

Hazard Classification: Significant

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1800

Dam Owner:
Craig Carinci
(primary)(703) 324-5500(Office)
12055 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 09/30/2020

Days Since Last Inspection:

Inundation Report: Unknown

Type of Dam
Other (Primary)

Reservoir Purpose
Tailings (Primary)
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Dogue Creek

Technical Basics

Normal Pool Area: 5.03 Acres

Top Surface Area: 7.19 Acres

Normal Pool Capacity: 29.92 Acre-Feet

Top Capacity: 55.36 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 17.00 Feet

Top Height: 25.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Geoffrey L. Cowan
(primary)(703) 468-2243(Office); (703) 615-0011(Mobile)
(primary)jcowan@dewberry.com
13575 Heathcote Blvd.
Suite 130
Gainesville VA, 20155

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

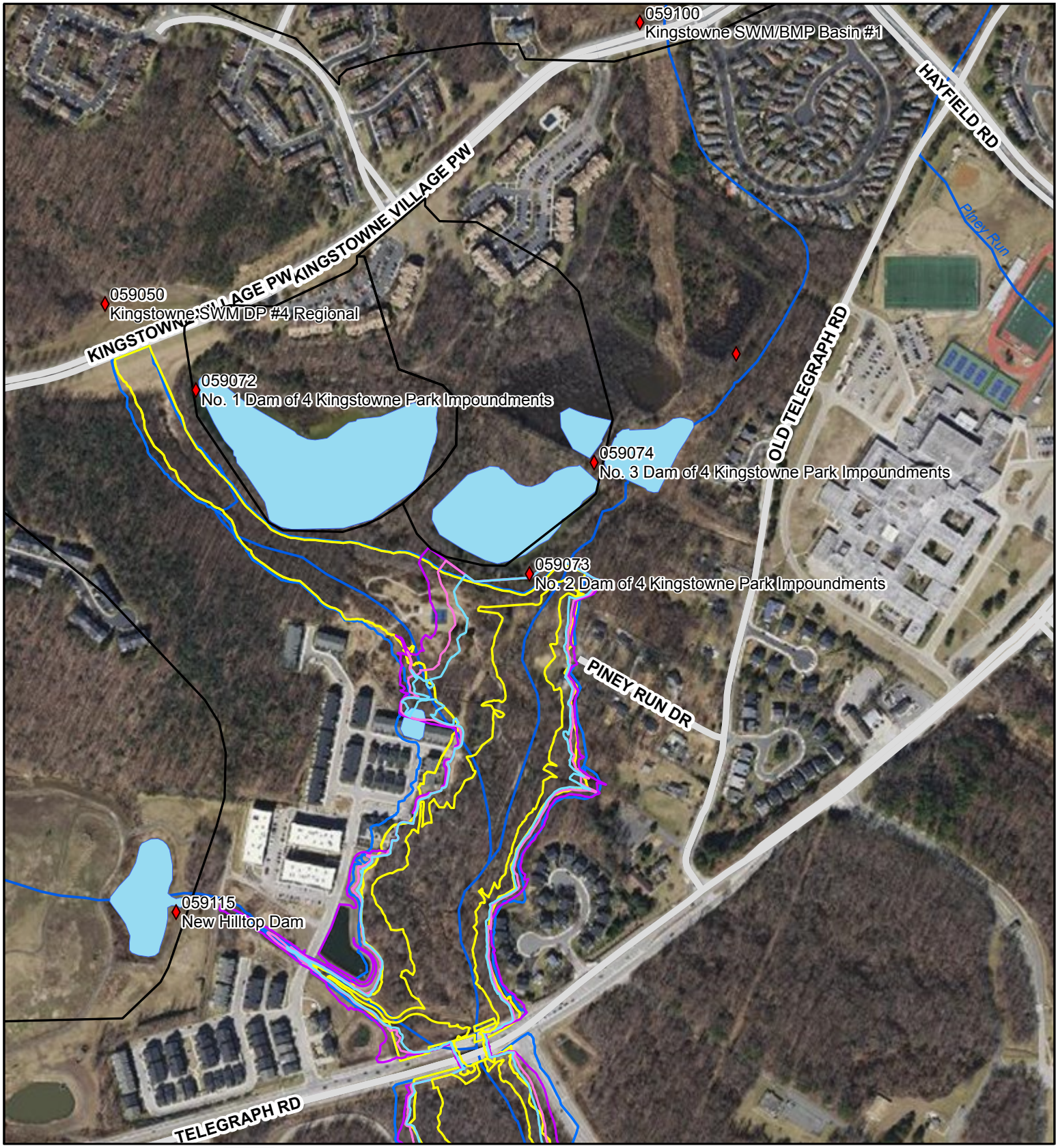
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059073**
Dam Name: **No. 2 Dam of 4 Kingstowne Park Impoundments**
VAHU6: PL27
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 36
HUC 12: 020700100306
VA House: 43
Watershed Name: Dogue Creek
Congressional: 5108
USGS Topo: ANNANDALE,FORT BELVOIR



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: North Fork Wetlands Bank Dam

Inventory Number: 153029

Hazard Classification: High

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1999

Dam Owner:
Ryan Alford
(primary)(615) 934-7962(Mobile)
1600 Antioch Road
Haymarket VA, 20169

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 07/31/2023

Days Since Last Inspection: 194

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Other (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream: North Fork

Technical Basics

Normal Pool Area: 18.60 Acres

Top Surface Area: 64.00 Acres

Normal Pool Capacity: 73.00 Acre-Feet

Top Capacity: 536.00 Acre-Feet

Normal Pool Elevation: 400.00 Feet

Top Elevation: 408.00 Feet

Normal Pool Height: 16.00 Feet

Top Height: 24.35 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 1.26 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMP **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
6/25/2022	Engineer	Satisfactory
6/27/2021	Engineer	Satisfactory
6/8/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 06/28/2017
Expiration Date: 06/28/2023

Dam Location

Dam Address:
16080 Camp Snyder Blvd
Gainesville VA, 20169

E911 Direction to Dam:
Dam is located in Prince William County in northeast quadrant of the intersection between I-66 and Thoroughfare Road (Route 682), approximately 2 miles west of Haymarket, Virginia. The dam is accessed through Camp Snyder and visible from I-66.

EAP Contacts

Dam Operator: Michael Snowden
(primary)(703) 867-0525(Office)
(primary)na
na
Na VA, 12345

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:Brian Misner
(primary)(703) 792-5627(Office)
(primary)bmisner@pwcgov.org
1 County Complex Court
Prince William VA, 22192

Owner's Engineer: Susan I. Hoopes, P.E.
(primary)(703) 679-5600(Office)
(primary)shoopes@wetlands.com
5300 Wellington Branch Drive
Suite 100
Gainesville VA, 20155

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Steven Shannon
(primary)(703) 259-0244(Office); (800) 367-7623(Office)
(primary)Steven.Shannon@vdot.virginia.gov
4975 Alliance Dr
Fairfax VA, 22030

National Weather Service:

Potential Impacts

Roadways Impacted:

- I-66 - 0.1 miles downstream
- John Marshall Hwy (VA 55) - 0.2 miles downstream
- Norfolk Southern Railway - 0.5 miles downstream
- James Madison Hwy - 1.5 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 30 Homes
- 13 Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **153029**
Dam Name: **North Fork Wetlands Bank Dam**
VAHU6: PL32
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 28
HUC 12: 020700100502
VA House: 13,87
Watershed Name: Broad Run-Catletts Branch
Congressional: 5110
USGS Topo: THOROUGHFARE GAP

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: North Twin Lake Dam

Inventory Number: 059012

Hazard Classification: Significant

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1950

Dam Owner:
Cynthia Walsh
(primary)(703) 324-8537(Office)
12055 Government Center Parkway
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 07/31/2025

Days Since Last Inspection: 253

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 5.00 Miles

River or Stream: Moore Creek

Technical Basics

Normal Pool Area: 9.00 Acres

Top Surface Area: 17.80 Acres

Normal Pool Capacity: 60.00 Acre-Feet

Top Capacity: 164.20 Acre-Feet

Normal Pool Elevation: 320.70 Feet

Top Elevation: 329.30 Feet

Normal Pool Height: 17.30 Feet

Top Height: 25.90 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 1.03 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMF **Required Spillway Design Flow**: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
4/28/2022	Engineer	Satisfactory
3/10/2021	Owner	Satisfactory
3/19/2020	Owner	Satisfactory

EAP Quick Reference

Approval Date: 04/29/2019
Expiration Date: 04/29/2025

Dam Location

Dam Address:
4890 Alliance Drive
Fairfax VA, 22030

E911 Direction to Dam:
Department of Public Safety Communications (DPSC)

EAP Contacts

Dam Operator: Todd Johnson
(primary)(703) 324-8678(Office)
(primary)Todd.Johnson@fairfaxcounty.gov
12055 Government Center Parkway
Fairfax VA, 22035

Dam Alternate Operator:Barbara Cosgrove
(primary)(703) 631-9099(Office)
(primary)FCPATwinLakesGC@fairfaxcounty.gov
6201 Union Mill Road
Clifton VA, 20124

Rain Gauge Observer: Rick Cooksey
(primary)(703) 631-9145(Office)
(primary)FCPATwinLakesGC@fairfaxcounty.gov
6201 Union Mill Rd
Clifton VA, 20124

Alternate Rain Gauge Observer:Rick Cooksey
(primary)(703) 631-9145(Office)
(primary)FCPATwinLakesGC@fairfaxcounty.gov
6201 Union Mill Rd
Clifton VA, 20124

24-Hour Dispatch Center: Roy Oliver
(primary)(703) 691-2131(Office)
(primary)DPSCAgency@fairfaxcounty.gov
4890 Alliance Drive
-
Fairfax VA, 22030

Local Government Emergency Services:Seamus Mooney
(571) 350-1000(Office); (primary)(571) 439-4901(Office)
(primary)OEMDutyOfficer@fairfaxcounty.gov
4890 Alliance Drive
Suite 2200
Fairfax VA, 22030

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Gaby Hakim, PE
(primary)(703) 259-0243(Office); (800) 367-7623(Office)
(primary)na
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 3546 - Twin Lakes Drive - 0.32 miles downstream
- (private) - Johnny Moore Lane - 0.57 miles downstream
- 658 - Compton Road - 1.83 miles downstream

Dams Downstream:

- 059011

Potential Impact Structures (count):

- 0 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 1 Parks
- 1 Golf Courses

Dam Number: **059012**
Dam Name: **North Twin Lake Dam**
VAHU6: PL46
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 39
HUC 12: 020700100705
VA House: 40
Watershed Name: Lower Bull Run
Congressional: 5110
USGS Topo: MANASSAS

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: NVCC Annandale Campus Dam

Inventory Number: 059034

Hazard Classification: Significant

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1968

Dam Owner:
Steve Patterson
(primary)(703) 323-3065(Office)
8333 Little River Turnpike
Annandale VA, 22003

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 11/30/2023

Days Since Last Inspection: 57

Inundation Report: 08/25/2010

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream: TR-Accotink Creek

Technical Basics

Normal Pool Area: 2.00 Acres

Top Surface Area: 3.00 Acres

Normal Pool Capacity: 10.70 Acre-Feet

Top Capacity: 24.00 Acre-Feet

Normal Pool Elevation: 329.00 Feet

Top Elevation: 334.00 Feet

Normal Pool Height: 24.00 Feet

Top Height: 28.90 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.04 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

24 Hour PMP: 0.00

Available Spillway Design Flow: 100.00 YR

Weighted Curve Number:

IDA Spillway Reduction:

Required Spillway Design Flow: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
11/10/2022	Owner	Satisfactory
12/9/2021	Owner	Satisfactory
10/8/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 10/19/2017
Expiration Date: 10/19/2023

Dam Location

Dam Address:
4101 West Drive
Annandale VA, 22003

E911 Direction to Dam:
Dam is located at the NVCC Annandale Campus, behind E911 address on Lake Drive.

EAP Contacts

Dam Operator: Steve Harrelson
(primary)(703) 323-3267(Office)
(primary)na@na.com
8333 Little River Turnpike
Annandale VA, 22003

Dam Alternate Operator:Steve Harrelson
(primary)(703) 323-3267(Office)
(primary)na@na.com
8333 Little River Turnpike
Annandale VA, 22003

Rain Gauge Observer: Steve Harrelson
(primary)(703) 323-3267(Office)
(primary)na@na.com
8333 Little River Turnpike
Annandale VA, 22003

Alternate Rain Gauge Observer:Steve Harrelson
(primary)(703) 323-3267(Office)
(primary)na@na.com
8333 Little River Turnpike
Annandale VA, 22003

24-Hour Dispatch Center: 911 Emergency Center
(primary)(703) 691-2131(Office)
(primary)DPSCBridge@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Local Government Emergency Services:Seamus Mooney
(primary)(571) 439-4901(Office)
(primary)Seamus.Mooney@fairfaxcounty.gov
4890 Alliance Drive
Suite 2200
Fairfax VA, 22030

Owner's Engineer: Thomas Roberts, PE, CFM
(540) 449-9024(Mobile); (primary)(540) 953-9024(Office)
(primary)tomroberts@h2r-inc.com
1601 South Main
Blacksburg VA, 24060

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Virginia Department of Transportation VDOT TOC
(primary)(703) 877-3401(Office)
(primary)Joseph.Warner@vdot.virginia.gov
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Upper Spring Lane - 0.17 miles downstream
- Duncan Drive (Route 2453) - 0.21 miles downstream
- Branch Road (Route 2456) - 0.27 miles downstream
- Woodlark Drive (Route 2461) - 0.47 miles downstream

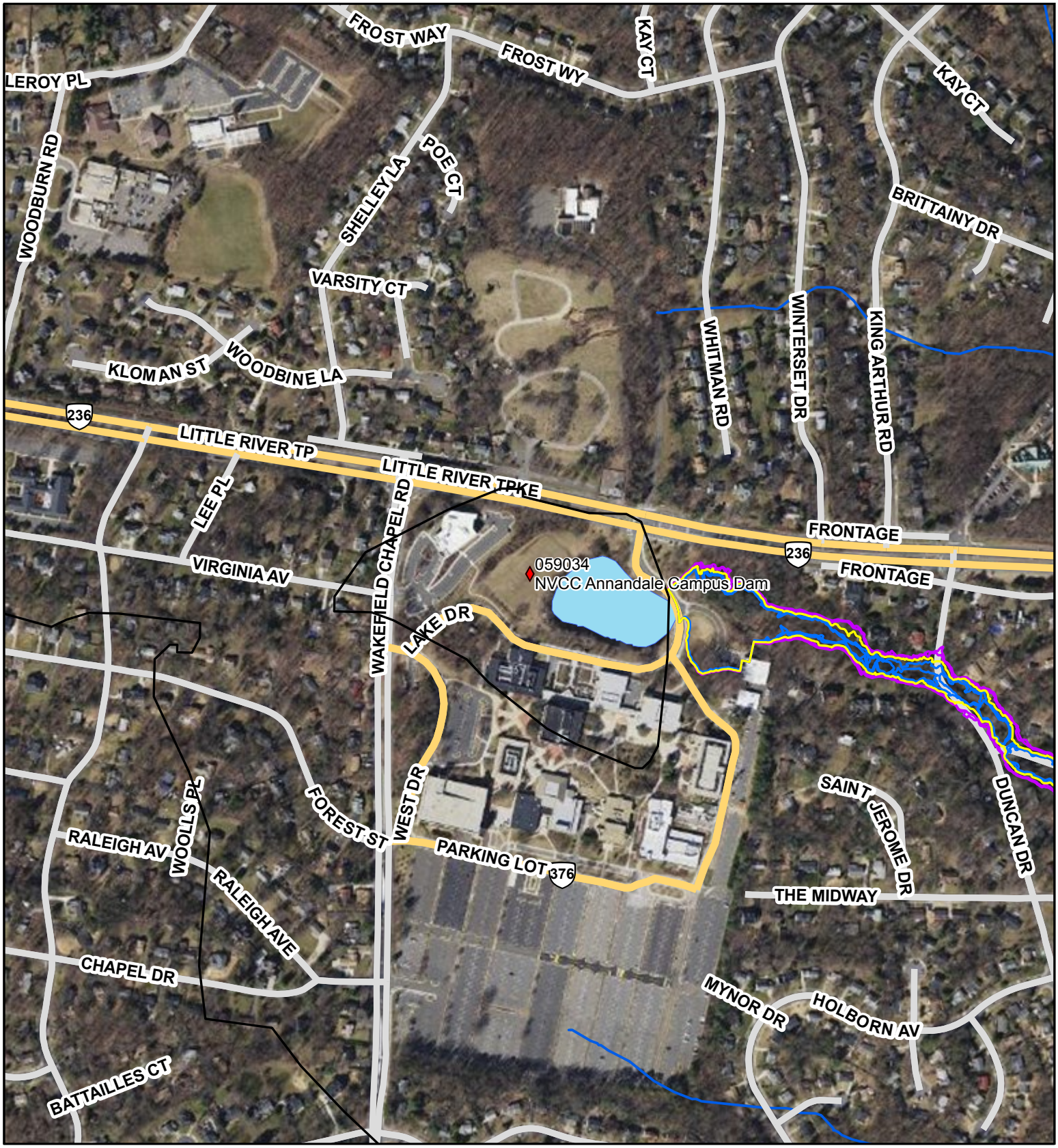
Dams Downstream:

- 000000

Potential Impact Structures (count):

- 2 Homes
- 0 Businesses
- 1 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **059034**
Dam Name: **NVCC Annandale Campus Dam**
VAHU6: PL30
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 34,37
HUC 12: 020700100402
VA House: 39
Watershed Name: Accotink Creek
Congressional: 5111
USGS Topo: ANNANDALE



Dam Locations | Waterbodies (NHD) | Interstate | State Primary Highway
Streams (NHD) | US Primary Highway | Secondary

N

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: NVCC Woodbridge Campus Dam

Inventory Number: 153024

Hazard Classification: Significant

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1975

Dam Owner:
Steve Patterson
(primary)(703) 323-3065(Office)
8333 Little River Turnpike
Annandale VA, 22003

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 11/30/2028

Days Since Last Inspection: 52

Inundation Report: 08/25/2016

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream: TR-Neabsco Creek

Technical Basics

Normal Pool Area: 5.12 Acres

Top Surface Area: 9.00 Acres

Normal Pool Capacity: 50.54 Acre-Feet

Top Capacity: 84.64 Acre-Feet

Normal Pool Elevation: 127.00 Feet

Top Elevation: 132.00 Feet

Normal Pool Height: 44.00 Feet

Top Height: 48.40 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.10 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMF

Required Spillway Design Flow: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
11/14/2022	Owner	Satisfactory
12/2/2021	Engineer	Satisfactory
12/4/2020	Owner	Satisfactory

EAP Quick Reference

Approval Date: 10/13/2016
Expiration Date: 10/13/2022

Dam Location

Dam Address:

,

E911 Direction to Dam:
TBD

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Thomas Roberts, PE, CFM
(540) 449-9024(Mobile); (primary)(540) 953-9024(Office)
(primary)tomroberts@h2r-inc.com
1601 South Main
Blacksburg VA, 24060

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

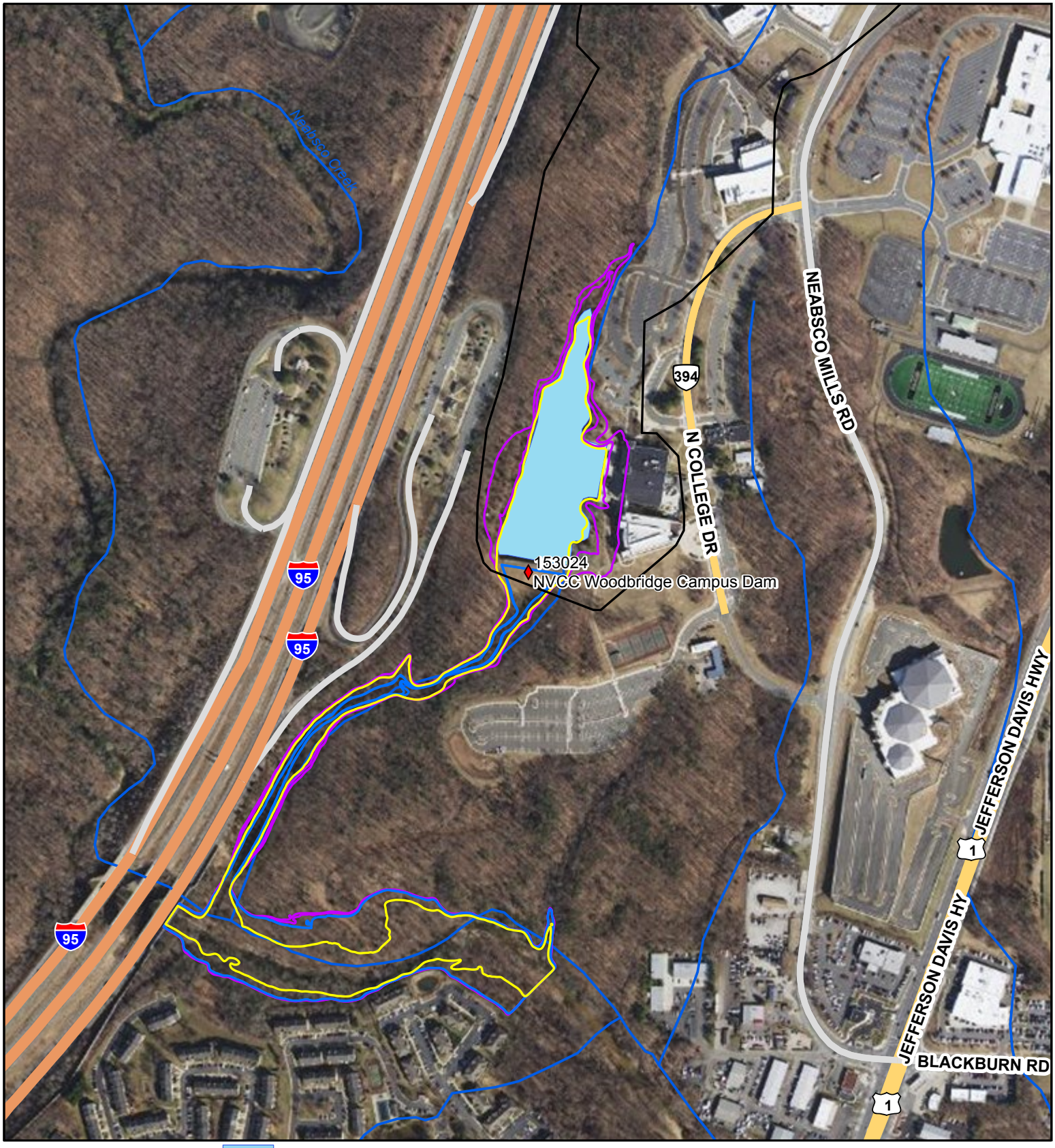
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **153024**
Dam Name: **NVCC Woodbridge Campus Dam**
VAHU6: PL49
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 29
HUC 12: 020700100804
VA House: 52
Watershed Name: Neabsco Creek
Congressional: 5111
USGS Topo: QUANTICO



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Occoquan Lower Storage Dam

Inventory Number: 153005

Hazard Classification: High

City/County: Fairfax County, Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1950

Dam Owner:
Jamie Bain Hedges
(571) 722-3018(Mobile); (primary)(703) 289-6012(Office)
8570 Executive Park Avenue
P.O. Box 1500
Merrifield VA, 22116

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 05/31/2026

Days Since Last Inspection: 449

Inundation Report: Unknown

Type of Dam
Gravity (Primary)

Reservoir Purpose
Water Supply (Primary)
Hydro-electric (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 1.00 Miles

River or Stream: Occoquan River

Technical Basics

Normal Pool Area: 19.00 Acres

Top Surface Area: 19.00 Acres

Normal Pool Capacity: 170.00 Acre-Feet

Top Capacity: 170.00 Acre-Feet

Normal Pool Elevation: 52.00 Feet

Top Elevation: 52.00 Feet

Normal Pool Height: 20.00 Feet

Top Height: 20.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 596.20 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: 100.00 YR

Required Spillway Design Flow: 100.00 YR

Inspections (Last 3 Max)

Date	Type	Condition
10/13/2021	Owner	
11/5/2020	Engineer	Satisfactory
5/7/2020	DCR Regional Engineer (PE)	Satisfactory

EAP Quick Reference

Approval Date: 09/15/2015
Expiration Date: 09/15/2021

Dam Location

Dam Address:

,

E911 Direction to Dam:
TBD

EAP Contacts

Dam Operator: na na
(primary)(703) 641-6603(Office)
(primary)cmurray@fairfaxwater.org
9600 Ox Rd
Lorton VA, 22079

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center: Prince William County Public Safety Communications Center
(703) 792-6500(Office); (primary)(703) 792-7135(Office)
(primary)na@na.com
3 County Complex Court
Woodbridge VA, 22192

Local Government Emergency Services:Sheldon Levi
(primary)(703) 491-1918(Office)
(primary)slevi@occoquanva.gov
na
Occoquan VA, 12345

Owner's Engineer: John Harrison
(primary)(610) 656-4428(Mobile); (610) 696-6066(Office)
(primary)JohnH@schnabel-eng.com
3 Dickinson Drive
Suite 200
Chadds Ford PA, 19317

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Steven Shannon
(primary)(703) 259-0244(Office); (800) 367-7623(Office)
(primary)Steven.Shannon@vdot.virginia.gov
4975 Alliance Dr
Fairfax VA, 22030

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **153005**

Dam Name: **Occoquan Lower Storage Dam**

VAHU6: PL48

Municipalities: Fairfax County,Prince William County

Region: 1

SWCD: NORTHERN VIRGINIA,PRINCE WILLIAM

VA Senate: 39

HUC 12: 020700100803

VA House: 42,51

Watershed Name: Occoquan River-Belmont Bay

Congressional: 5111

USGS Topo: OCCOQUAN

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Oliver Dam

Inventory Number: 107016

Hazard Classification: Significant

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1968

Dam Owner:
Marti Rowntree, Legum & Norman
(primary)(540) 635-8946(Office)
3130 Fairview Park Drive, #200
Falls Church VA, 22042

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2021

Days Since Last Inspection: 3450

Inundation Report: 09/21/2022

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: TR-North Fork Goose Creek

Technical Basics

Normal Pool Area: 14.60 Acres

Top Surface Area: 21.00 Acres

Normal Pool Capacity: 193.00 Acre-Feet

Top Capacity: 337.00 Acre-Feet

Normal Pool Elevation: 446.82 Feet

Top Elevation: 454.80 Feet

Normal Pool Height: 35.80 Feet

Top Height: 43.83 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.60 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMF **Required Spillway Design Flow**: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
7/26/2013	Engineer	
6/20/2012	Engineer	
11/24/2010	Engineer	

EAP Quick Reference

Approval Date: 12/22/2014
Expiration Date: 12/22/2022

Dam Location

Dam Address:

,

E911 Direction to Dam:
TBD

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **107016**
Dam Name: **Oliver Dam**
VAHU6: PL12
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080602
VA House: 33
Watershed Name: North Fork Goose Creek
Congressional: 5110
USGS Topo: LINCOLN

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Omisol Dam

Inventory Number: 153007

Hazard Classification: High

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1940

Dam Owner:
Brian Evans
(primary)(703) 491-8613(Office)
2861 Bufflehead Court
Woodbridge VA, 22192

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 1 Year Certificate

Certificate Expiration: 09/30/2016

Days Since Last Inspection: 3789

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 4.00 Miles

River or Stream: Hooes Run

Technical Basics

Normal Pool Area: 5.21 Acres

Top Surface Area: 19.10 Acres

Normal Pool Capacity: 22.86 Acre-Feet

Top Capacity: 156.40 Acre-Feet

Normal Pool Elevation: 165.00 Feet

Top Elevation: 171.00 Feet

Normal Pool Height: 11.90 Feet

Top Height: 21.10 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 5.21 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .10 PMF **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
8/21/2012	Owner	Fair
7/25/2009	Owner	Fair
7/15/2008	Engineer	

EAP Quick Reference

Approval Date: 07/09/2008
Expiration Date: 07/09/2014

Dam Location

Dam Address:
12912 PINTAIL RD
Woodbridge VA, 22192

E911 Direction to Dam:
Traveling from Bethel, south of Dam, take Minnieville Rd traveling north east, left on Omnisol rd, which ends at Pintail Rd with dam just behind houses. Access only through private property / driveway. From North dam may be accessible through woods from St. Elizabeth Ann Seton Catholic Church parking lot.

EAP Contacts

Dam Operator: Jim Reeve
(primary)(571) 334-5890(Office)
(primary)na
2878 Bufflehead Court
Woodbridge VA, 22192

Dam Alternate Operator:Denar Antelo
(primary)(571) 334-5890(Office)
(primary)na
2878 Bufflehead Court
Woodbridge VA, 22192

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center: na na
(primary)(703) 494-7119(Office)
(primary)na
12400 Hedges Run Dr
Woodbridge VA, 22192

Local Government Emergency Services:Patrick Collins
(primary)(703) 792-5828(Office)
(primary)pcollins@pwcgov.org
3 County complex Court
Prince William VA, 22192

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

- Old Bridge Road - 0.79 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 0 Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **153007**
Dam Name: **Omisol Dam**
VAHU6: PL47
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 36,39
HUC 12: 020700100802
VA House: 51
Watershed Name: Occoquan River/Occoquan Reservoir
Congressional: 5111
USGS Topo: OCCOQUAN

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Pulte McLean SWM Pond Dam

Inventory Number: 059046

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 05/31/2028

Days Since Last Inspection: 248

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 10.00 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 74.00 Acre-Feet

Normal Pool Elevation: 336.60 Feet

Top Elevation: 354.60 Feet

Normal Pool Height: 0.00 Feet

Top Height: 17.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.47 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF **Required Spillway Design Flow**: 1.00 PMF

Inspections (Last 3 Max)

Date	Type	Condition
5/3/2022	Engineer	Satisfactory
5/11/2021	Owner	Satisfactory
5/13/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 04/22/2022
Expiration Date: 05/31/2028

Dam Location

Dam Address:
8522 Lewinsville Road
Mclean VA, 22102

E911 Direction to Dam:
The dam is on Rocky Run (a tributary to Difficult Run), approximately 120 feet south of Lewinsville Road, in Dranesville District, Fairfax County

EAP Contacts

Dam Operator: Chad Crawford
(primary)(703) 324-5500(Office)
(primary)Chad.Crawford@fairfaxcounty.gov
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Dam Alternate Operator:Craig Carinci
(primary)(703) 324-5500(Office)
(primary)Craig.Carinci@fairfaxcounty.gov
12055 Government Center Parkway, Suite 449
Fairfax VA, 22035

Rain Gauge Observer: Bat Phone Holder Bat Phone
(primary)(571) 722-8622(Mobile)
(primary)dipmani.kumar@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

Alternate Rain Gauge Observer:Bat Phone Holder Bat Phone Holder
(primary)(571) 722-8622(Mobile)
(primary)dipmani.kumar@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

24-Hour Dispatch Center: 911 Emergency Center
(primary)(703) 691-2131(Office)
(primary)DPSCBridge@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Local Government Emergency Services:Emergency Operation Center (EOC)
Fairfax County EOC
(primary)(571) 350-1000(Office)
(primary)dems@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Owner's Engineer: Brice Kutch
(primary)(703) 870-7000(Office)
(primary)bkutch@gky.com
None
4229 Lafayette Center Drive, Suite 1850
Chantilly VA, 20151

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Traffic Operations Center (TOC)
(primary)(703) 877-3401(Office)
(primary)Joseph.Warner@vdot.virginia.gov
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Forecaster of the Day NWS
(primary)(571) 888-3500(Office)
(primary)Steven.Zubrick@noaa.gov
43858 Weather Service Road
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 694 - 100 miles downstream

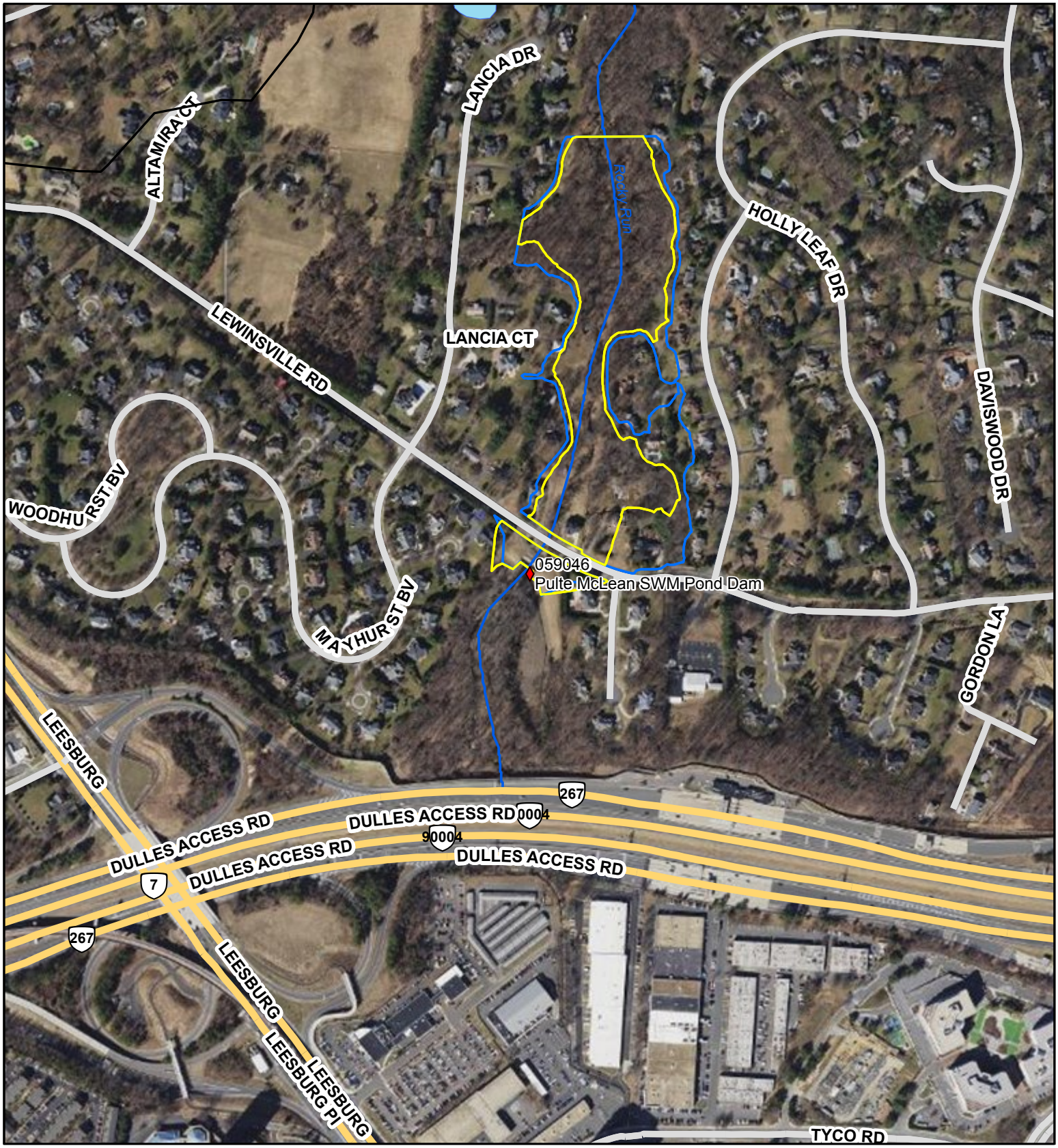
Dams Downstream:

- None

Potential Impact Structures (count):

- 12 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **059046**
Dam Name: **Pulte McLean SWM Pond Dam**
VAHU6: PL22
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 31,32
HUC 12: 020700081004
VA House: 34,35
Watershed Name: Difficult Run
Congressional: 5110,5111
USGS Topo: FALLS CHURCH



Dam Locations | Waterbodies (NHD) | Interstate | State Primary Highway
Streams (NHD) | US Primary Highway | Secondary

N

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Pohick Creek Dam #1

Inventory Number: 059029

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1985

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 05/31/2028

Days Since Last Inspection: 86

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: South Run

Technical Basics

Normal Pool Area: 43.00 Acres

Top Surface Area: 236.00 Acres

Normal Pool Capacity: 1764.00 Acre-Feet

Top Capacity: 4815.00 Acre-Feet

Normal Pool Elevation: 216.00 Feet

Top Elevation: 252.00 Feet

Normal Pool Height: 24.00 Feet

Top Height: 60.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 6.20 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

24 Hour PMP: 0.00

Available Spillway Design Flow: .90 PMP

Weighted Curve Number:

IDA Spillway Reduction:

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
10/12/2022	Owner	Satisfactory
10/14/2021	Engineer	Satisfactory
10/9/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 04/22/2022
Expiration Date: 05/31/2028

Dam Location

Dam Address:
8052 Galla Knoll Circle
Springfield VA, 22153

E911 Direction to Dam:
On South Run (a tributary to Pohick Creek) approximately 1,500 feet northwest of the Hooes Road and Triple Ridge Road intersection

EAP Contacts

Dam Operator: Chad Crawford
(primary)(703) 324-5500(Office)
(primary)Chad.Crawford@fairfaxcounty.gov
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Dam Alternate Operator:Craig Carinci
(primary)(703) 324-5500(Office)
(primary)Craig.Carinci@fairfaxcounty.gov
12055 Government Center Parkway, Suite 449
Fairfax VA, 22035

Rain Gauge Observer: Bat Phone Holder Bat Phone
(primary)(571) 722-8622(Mobile)
(primary)dipmani.kumar@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

Alternate Rain Gauge Observer:Bat Phone Holder Bat Phone Holder
(primary)(571) 722-8622(Mobile)
(primary)dipmani.kumar@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

24-Hour Dispatch Center: 911 Emergency Center
(primary)(703) 691-2131(Office)
(primary)DPSCBridge@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Local Government Emergency Services:Emergency Operation Center (EOC)
(primary)(571) 350-1000(Office)
(primary)dems@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Owner's Engineer: Elfatih Salim
(primary)(703) 324-5667(Office)
(primary)elfatih.salim@fairfaxcounty.gov
12000 Government Center Parkway Suite 448
Fairfax VA, 22035

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Traffic Operations Center (TOC)
(primary)(703) 877-3401(Office)
(primary)Joseph.Warner@vdot.virginia.gov
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:NWS Forecaster of the Day
(primary)(571) 888-3500(Office)
(primary)Steven.Zubrick@noaa.gov
43858 Weather Service Road
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 636 - 1000 miles downstream

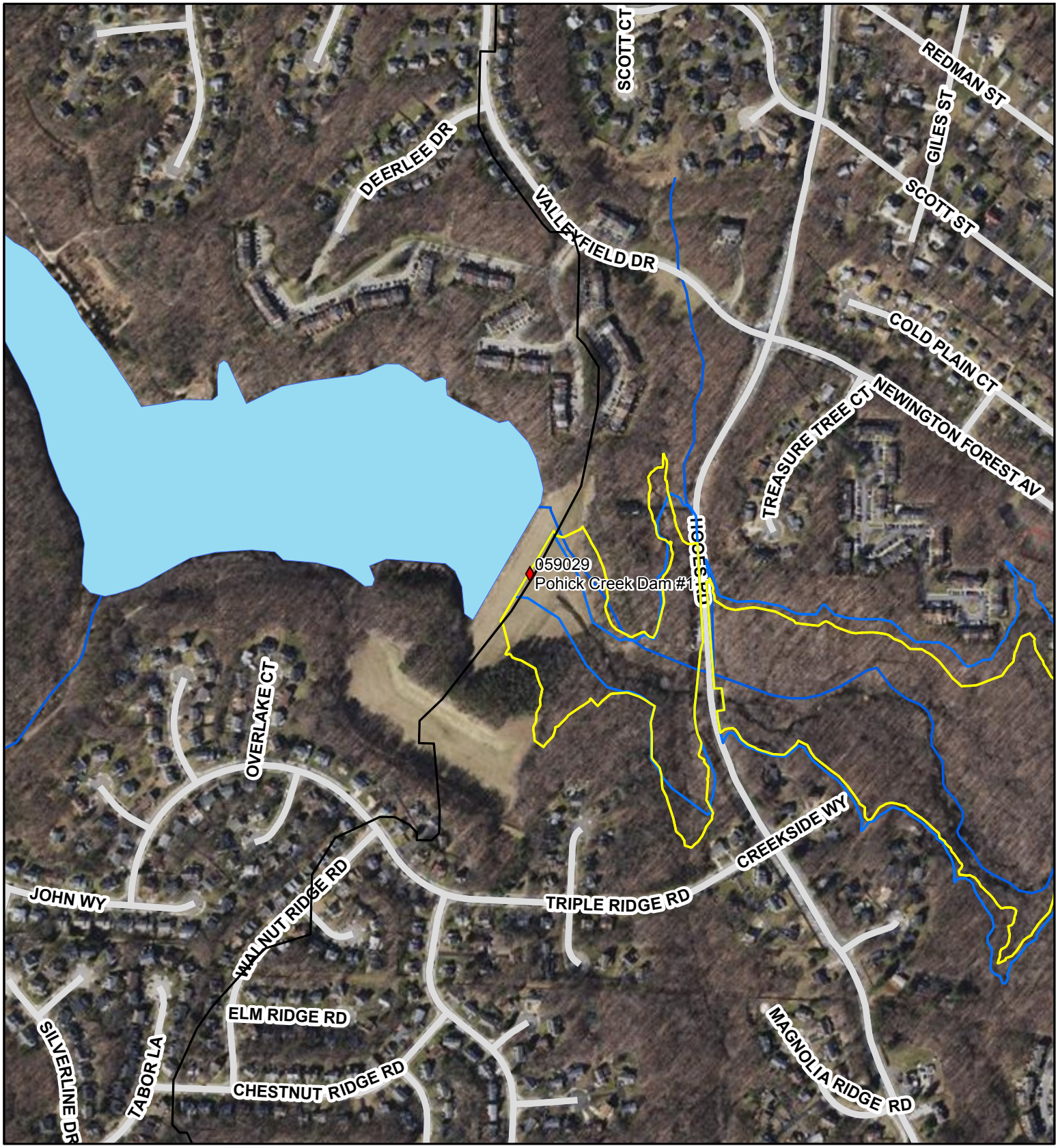
Dams Downstream:

- None

Potential Impact Structures (count):

- 8 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **059029**
Dam Name: **Pohick Creek Dam #1**
VAHU6: PL29
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 39
HUC 12: 020700100401
VA House: 42
Watershed Name: Pohick Creek
Congressional: 5110,5111
USGS Topo: OCCOQUAN



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Pohick Creek Dam #2

Inventory Number: 059023

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1978

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 11/30/2024

Days Since Last Inspection: 86

Inundation Report: 09/07/2018

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 5.00 Miles

River or Stream: TR-Sideburn Branch

Technical Basics

Normal Pool Area: 9.44 Acres

Top Surface Area: 41.26 Acres

Normal Pool Capacity: 80.00 Acre-Feet

Top Capacity: 560.00 Acre-Feet

Normal Pool Elevation: 318.50 Feet

Top Elevation: 341.10 Feet

Normal Pool Height: 21.00 Feet

Top Height: 39.10 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.84 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

24 Hour PMP:

Available Spillway Design Flow: 1.00 PMF

Weighted Curve Number:

IDA Spillway Reduction:

Required Spillway Design Flow: 1.00 PMF

Inspections (Last 3 Max)

Date	Type	Condition
10/12/2022	Engineer	Satisfactory
10/14/2021	Owner	Satisfactory
10/8/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 06/26/2012
Expiration Date: 06/26/2018

Dam Location

Dam Address:
10515 Summit Oak Way
Burke VA, 22015

E911 Direction to Dam:
Turn off of Burke Centre Pkwy onto Oak Leather Dr and continue to the cul de sac. Continue onto Oak Bluff Ct and then turn right onto Summit Oak Way. From there, there is a dirt road/trail that heads about 200 ft south to the impoundment structure.

EAP Contacts

Dam Operator: NA NA
(primary)(703) 877-2800(Office)
(primary)na
10635 West Drive
Fairfax VA, 22030

Dam Alternate Operator:NA NA
(571) 439-4901(Office); (primary)(703) 324-5500(Office)
(primary)na
10635 West Drive
Fairfax VA, 22030

Rain Gauge Observer: NA NA
(571) 439-4901(Office); (primary)(703) 324-5500(Office)
(primary)na
10635 West Drive
Fairfax VA, 22030

Alternate Rain Gauge Observer:

24-Hour Dispatch Center: NA NA
(primary)(703) 250-8900(Office)
(primary)na
5600 Burke Center Pkwy
Fairfax Station VA, 22039

Local Government Emergency Services:NA NA
(primary)(571) 350-1225(Office); (571) 439-4901(Office)
(primary)na
4890 Alliance Drive
Fairfax VA, 22030

Owner's Engineer: Elfatih Salim
(primary)(703) 324-5667(Office)
(primary)elfatih.salim@fairfaxcounty.gov
12000 Government Center Parkway Suite 448
Fairfax VA, 22035

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Gaby Hakim, PE
(primary)(703) 259-0243(Office); (800) 367-7623(Office)
(primary)na
4975 Alliance Drive

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.

Fairfax VA, 22030 Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Roberts Pkwy - 99999 miles downstream
- New Guinea Rd - 99999 miles downstream
- Burke Commons Rd - 99999 miles downstream
- Falmead Ct - 99999 miles downstream
- Lakepointe Dam View Ct - 99999 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 12 Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059023**
Dam Name: **Pohick Creek Dam #2**
VAHU6: PL29
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 34,37
HUC 12: 020700100401
VA House: 41
Watershed Name: Pohick Creek
Congressional: 5111
USGS Topo: FAIRFAX

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Pohick Creek Dam #3

Inventory Number: 059028

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1975

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 11/30/2023

Days Since Last Inspection: 86

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: TR-Sideburn Branch

Technical Basics

Normal Pool Area: 38.00 Acres

Top Surface Area: 72.00 Acres

Normal Pool Capacity: 380.00 Acre-Feet

Top Capacity: 960.00 Acre-Feet

Normal Pool Elevation: 98.00 Feet

Top Elevation: 108.00 Feet

Normal Pool Height: 28.00 Feet

Top Height: 38.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 1.15 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

24 Hour PMP:

Available Spillway Design Flow: .90 PMP

Weighted Curve Number:

IDA Spillway Reduction:

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
10/12/2022	Owner	Satisfactory
10/14/2021	Engineer	Satisfactory
10/8/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 08/09/2017
Expiration Date: 08/09/2023

Dam Location

Dam Address:
5202 Fireside Court
Fairfax VA, 22032

E911 Direction to Dam:
The impoundment structure can be accessed via a paved road that extends from the cul-de-sac at the south end of Fireside Court.

EAP Contacts

Dam Operator: na na
(primary)(703) 877-2800(Office)
(primary)na
10635 West Drive
Fairfax VA, 22030

Dam Alternate Operator:na na
(571) 722-8622(Mobile); (primary)(703) 324-5500(Office)
(primary)na
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

Rain Gauge Observer: na na
(571) 722-8622(Mobile); (primary)(703) 324-5500(Office)
(primary)na
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

Alternate Rain Gauge Observer:

24-Hour Dispatch Center: NA NA
(primary)(703) 250-8900(Office)
(primary)na
5600 Burke Center Pkwy
Fairfax Station VA, 22039

Local Government Emergency Services:Seamus Mooney
(primary)(571) 439-4901(Office)
(primary)Seamus.Mooney@fairfaxcounty.gov
4890 Alliance Drive
Suite 2200
Fairfax VA, 22030

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Gaby Hakim, PE
(primary)(703) 259-0243(Office); (800) 367-7623(Office)
(primary)na
4975 Alliance Drive

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.

Fairfax VA, 22030 Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Sideburn Rd - 99999 miles downstream
- Roberts Rd - 99999 miles downstream
- Roberts Pkwy - 99999 miles downstream
- Guinea Rd - 99999 miles downstream
- New Guinea Rd - 99999 miles downstream
- Coffer Woods Rd - 99999 miles downstream
- Burke Rd - 99999 miles downstream
- Burke Lake Rd - 99999 miles downstream
- Oak Leather Dr - 99999 miles downstream
- Mason Bluff Dr - 99999 miles downstream
- Goldeneye Ln - 99999 miles downstream

Potential Impact Structures (count):

- 73 Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- 1 Railroads
- Utilities
- Parks
- Golf Courses

Dams Downstream:

Dam Number: **059028**
Dam Name: **Pohick Creek Dam #3**
VAHU6: PL29
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 34,37
HUC 12: 020700100401
VA House: 37,41
Watershed Name: Pohick Creek
Congressional: 5111
USGS Topo: FAIRFAX

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Pohick Creek Dam #4

Inventory Number: 059022

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1977

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2028

Days Since Last Inspection: 86

Inundation Report: 02/10/2022

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 1.00 Miles

River or Stream: Rabbit Branch

Technical Basics

Normal Pool Area: 38.00 Acres

Top Surface Area: 171.00 Acres

Normal Pool Capacity: 330.00 Acre-Feet

Top Capacity: 2558.00 Acre-Feet

Normal Pool Elevation: 287.00 Feet

Top Elevation: 311.00 Feet

Normal Pool Height: 18.00 Feet

Top Height: 42.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 3.80 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

24 Hour PMP: 0.00

Available Spillway Design Flow: .90 PMP

Weighted Curve Number:

IDA Spillway Reduction:

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
10/12/2022	Owner	Satisfactory
10/14/2021	Engineer	Satisfactory
10/8/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 02/11/2022
Expiration Date: 03/31/2028

Dam Location

Dam Address:
5536 Starboard Court
Fairfax VA, 22032

E911 Direction to Dam:
End of cul-de-sac near 5536 Starboard Court

EAP Contacts

Dam Operator: Chad Crawford
(primary)(703) 324-5500(Office)
(primary)Chad.Crawford@fairfaxcounty.gov
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Dam Alternate Operator:Craig Carinci
(primary)(703) 324-5500(Office)
(primary)Craig.Carinci@fairfaxcounty.gov
12055 Government Center Parkway, Suite 449
Fairfax VA, 22035

Rain Gauge Observer: Bat Phone Holder Bat Phone Holder
(primary)(571) 722-8622(Mobile)
(primary)dipmani.kumar@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

Alternate Rain Gauge Observer:Bat Phone Holder Bat Phone Holder
(primary)(571) 722-8622(Mobile)
(primary)dipmani.kumar@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

24-Hour Dispatch Center: 911 Emergency Center
(primary)(703) 691-2131(Office)
(primary)DPSCBridge@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Local Government Emergency Services:Emergency Operation Center (EOC) Emergency Operation Center (EOC)
(primary)(571) 350-1000(Mobile)
(primary)oem@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Owner's Engineer: Elfatih Salim
(primary)(703) 397-7273(Mobile)
(primary)elfatih.salim@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Traffic Operations Center Traffic Operations Center
(primary)(703) 383-8368(Office)
(primary)Joseph.Warner@vdot.virginia.gov
4975 Alliance Drive
Fairfax VA, 22033

National Weather Service:Forecaster of the Day Forecaster of the Day
(primary)(571) 888-3500(Office)
(primary)Steven.Zubrick@noaa.gov
43858 Weather Service Road
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 123 - 1 miles downstream

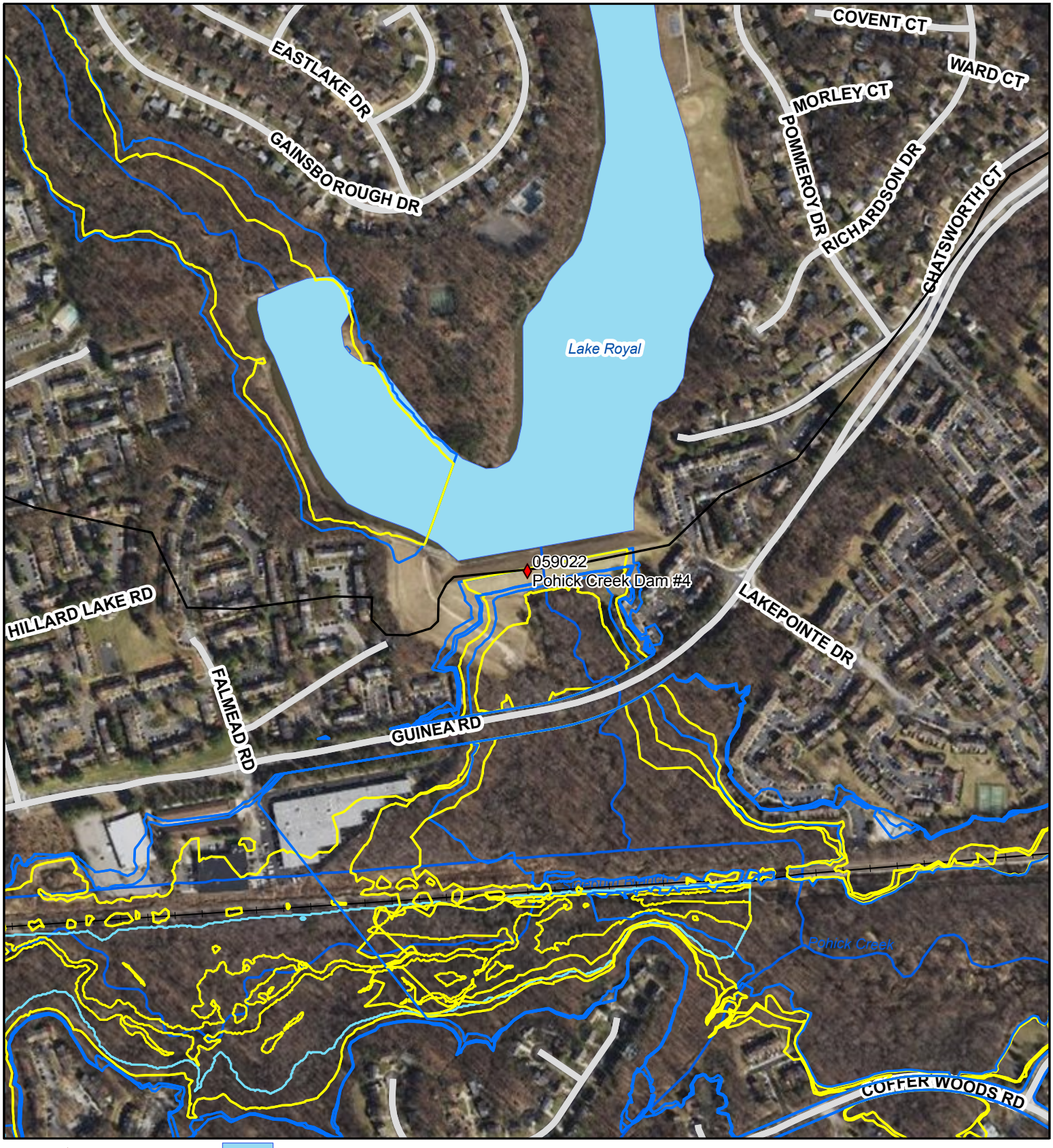
Dams Downstream:

- None

Potential Impact Structures (count):

- 128 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 3 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **059022**
Dam Name: **Pohick Creek Dam #4**
VAHU6: PL29
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 34,37
HUC 12: 020700100401
VA House: 41
Watershed Name: Pohick Creek
Congressional: 5111
USGS Topo: FAIRFAX



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Pohick Creek Dam #7

Inventory Number: 059005

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1970

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 01/31/2025

Days Since Last Inspection: 86

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 1.00 Miles

River or Stream: TR-Pohick Creek

Technical Basics

Normal Pool Area: 18.00 Acres

Top Surface Area: 42.00 Acres

Normal Pool Capacity: 190.00 Acre-Feet

Top Capacity: 554.00 Acre-Feet

Normal Pool Elevation: 295.00 Feet

Top Elevation: 308.00 Feet

Normal Pool Height: 34.00 Feet

Top Height: 47.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.63 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF

Required Spillway Design Flow: 1.00 PMF

Inspections (Last 3 Max)

Date	Type	Condition
10/12/2022	Engineer	Satisfactory
10/14/2021	Engineer	Satisfactory
10/8/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 01/15/2019
Expiration Date: 01/15/2025

Dam Location

Dam Address:
12000 Government Center Parkway, Suite 449,
Fairfax VA, 22035

E911 Direction to Dam:
Fairfax County Government

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Elfatih Salim
(primary)(703) 324-5667(Office)
(primary)elfatih.salim@fairfaxcounty.gov
12000 Government Center Parkway Suite 448
Fairfax VA, 22035

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

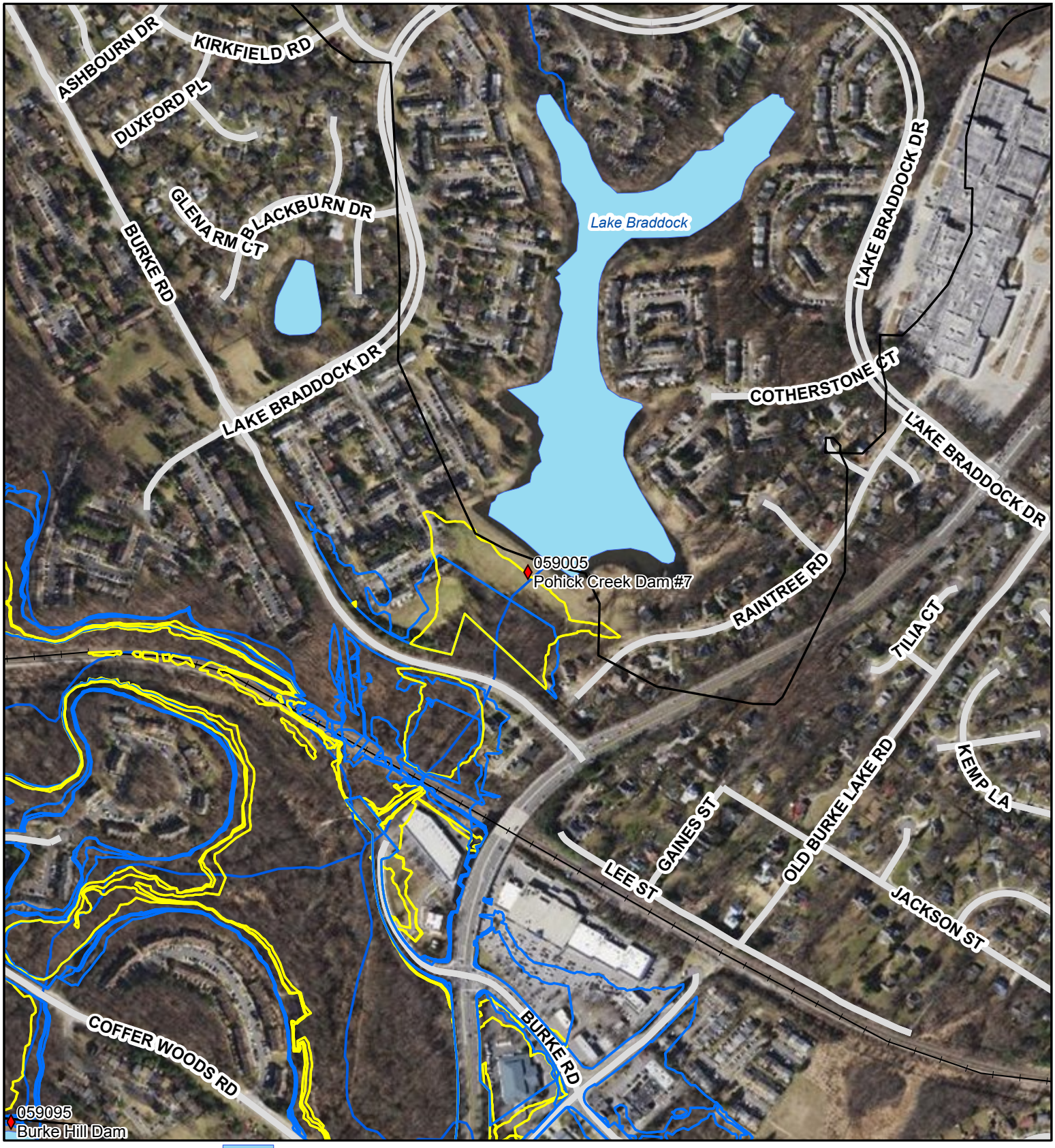
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059005**
Dam Name: **Pohick Creek Dam #7**
VAHU6: PL29
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 37
HUC 12: 020700100401
VA House: 41
Watershed Name: Pohick Creek
Congressional: 5111
USGS Topo: FAIRFAX



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Pohick Creek Dam #8

Inventory Number: 059007

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1973

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 09/30/2027

Days Since Last Inspection: 86

Inundation Report: 08/18/2021

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 4.00 Miles

River or Stream: Middle Run

Technical Basics

Normal Pool Area: 27.00 Acres

Top Surface Area: 109.00 Acres

Normal Pool Capacity: 264.00 Acre-Feet

Top Capacity: 1740.00 Acre-Feet

Normal Pool Elevation: 242.00 Feet

Top Elevation: 266.00 Feet

Normal Pool Height: 22.00 Feet

Top Height: 45.40 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 2.33 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
10/12/2022	Engineer	Satisfactory
10/14/2021	Engineer	Satisfactory
10/8/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 08/12/2021
Expiration Date: 08/30/2027

Dam Location

Dam Address:
700 ft south of Golden Ball Tavern Court
Springfield VA, 22153

E911 Direction to Dam:
The dam is located in the Springfield District of Fairfax County, Virginia. It is situated on Middle Run, approximately 700 ft south of Golden Ball Tavern Court

EAP Contacts

Dam Operator: Chad Crawford
(primary)(703) 324-5500(Office)
(primary)Chad.Crawford@fairfaxcounty.gov
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Dam Alternate Operator:Paul Reynolds
(primary)(571) 460-9515(Mobile)
(primary)paul.reynolds@fairfaxcounty.gov
10635 West Drive
Fairfax VA, 22030

Rain Gauge Observer: Bat Phone Holder Bat Phone Holder
(primary)(571) 722-8622(Mobile)
(primary)dipmani.kumar@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

Alternate Rain Gauge Observer:Bat Phone Holder Bat Phone Holder
(primary)(571) 722-8622(Mobile)
(primary)dipmani.kumar@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

24-Hour Dispatch Center: Dave McKernan
(primary)(571) 350-1000(Office)
(primary)na
NA
Na VA, 99999

Local Government Emergency Services:NA NA
(primary)(571) 350-2100(Office)
(primary)na
4890 Alliance Dr
Fairfax VA, 22030

Owner's Engineer: Brice Kutch
(primary)(703) 870-7000(Office)
(primary)bkutch@gky.com
None
4229 Lafayette Center Drive, Suite 1850
Chantilly VA, 20151

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Joseph Warner
(primary)(703) 324-0000(Office)
(primary)joseph.warner@vdot.com
VDOT
Fairfax VA, 22030

National Weather Service:Jason Elliott
(primary)(703) 996-2234(Office)
(primary)jason.elliott@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 286 - 5000 miles downstream

Dams Downstream:

- None

Potential Impact Structures (count):

- 61 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 7 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **059007**
Dam Name: **Pohick Creek Dam #8**
VAHU6: PL29
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 37
HUC 12: 020700100401
VA House: 42
Watershed Name: Pohick Creek
Congressional: 5110,5111
USGS Topo: FAIRFAX

Dam Locations | Waterbodies (NHD) | Interstate | State Primary Highway
Streams (NHD) | US Primary Highway | Secondary

N

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Possum Point Ash Dam #D

Inventory Number: 153020

Hazard Classification: High

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1989

Dam Owner:
Shaikh Z Rahman
(primary)(804) 387-8263(Mobile)
600 East Canal Street
Richmond VA, 23219

Size Classification: Large (>=50,000 ac. ft., >=100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 11/30/2026

Days Since Last Inspection: 260

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Debris control (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: Off Stream

Technical Basics

Normal Pool Area: 104.00 Acres

Top Surface Area: 120.00 Acres

Normal Pool Capacity: 5500.00 Acre-Feet

Top Capacity: 6400.00 Acre-Feet

Normal Pool Elevation: 142.00 Feet

Top Elevation: 150.00 Feet

Normal Pool Height: 132.00 Feet

Top Height: 140.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.20 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF **Required Spillway Design Flow**: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
4/20/2022	Engineer	Satisfactory
4/27/2021	Engineer	Satisfactory
6/3/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 11/19/2021
Expiration Date: 11/19/2027

Dam Location

Dam Address:
19000 Possum Point Road
Dumfries VA, 22026

E911 Direction to Dam:
The dam is located approximately 0.85 miles northwest of the Possum Point Power Station (E911 address), and is located approximately 1,000 feet northeast of Quantico Creek and 2,000 feet from the Potomac River.

EAP Contacts

Dam Operator: William Reed
(primary)(804) 638-0335(Mobile)
(primary)william.f.reed@dominionenergy.com
2608 C.G. Woodson Rd
New Canton VA, 23123

Dam Alternate Operator:William Reed
(primary)(804) 638-0335(Mobile)
(primary)william.f.reed@dominionenergy.com
2608 C.G. Woodson Rd
New Canton VA, 23123

Rain Gauge Observer: William Reed
(primary)(804) 638-0335(Mobile)
(primary)william.f.reed@dominionenergy.com
2608 C.G. Woodson Rd
New Canton VA, 23123

Alternate Rain Gauge Observer:William Reed
(primary)(804) 638-0335(Mobile)
(primary)william.f.reed@dominionenergy.com
2608 C.G. Woodson Rd
New Canton VA, 23123

24-Hour Dispatch Center: Prince William County Public Safety Communications Center
(703) 792-6500(Office); (primary)(703) 792-7135(Office)
(primary)na@na.com
3 County Complex Court
Woodbridge VA, 22192

Local Government Emergency Services:Brian Misner
(primary)(703) 792-5627(Office)
(primary)bmisner@pwcgov.org
1 County Complex Court
Prince William VA, 22192

Owner's Engineer: Shaikh Z Rahman
(primary)(804) 387-8263(Mobile)
(primary)Shaikh.Z.Rahman@dominionenergy.com
600 East Canal Street
Richmond VA, 23219

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Bobby Shetley
(571) 749-8044(Mobile); (primary)(703) 366-1926(Office)
(primary)bobby.shetley@vdot.virginia.gov
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Possum Point Road - 0.2 miles downstream

Dams Downstream:

- 000000

Potential Impact Structures (count):

- 0 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **153020**

Dam Name: **Possum Point Ash Dam #D**

VAHU6: PL52,PL54

Municipalities: Prince William County

Region: 1

SWCD: PRINCE WILLIAM

VA Senate: 36

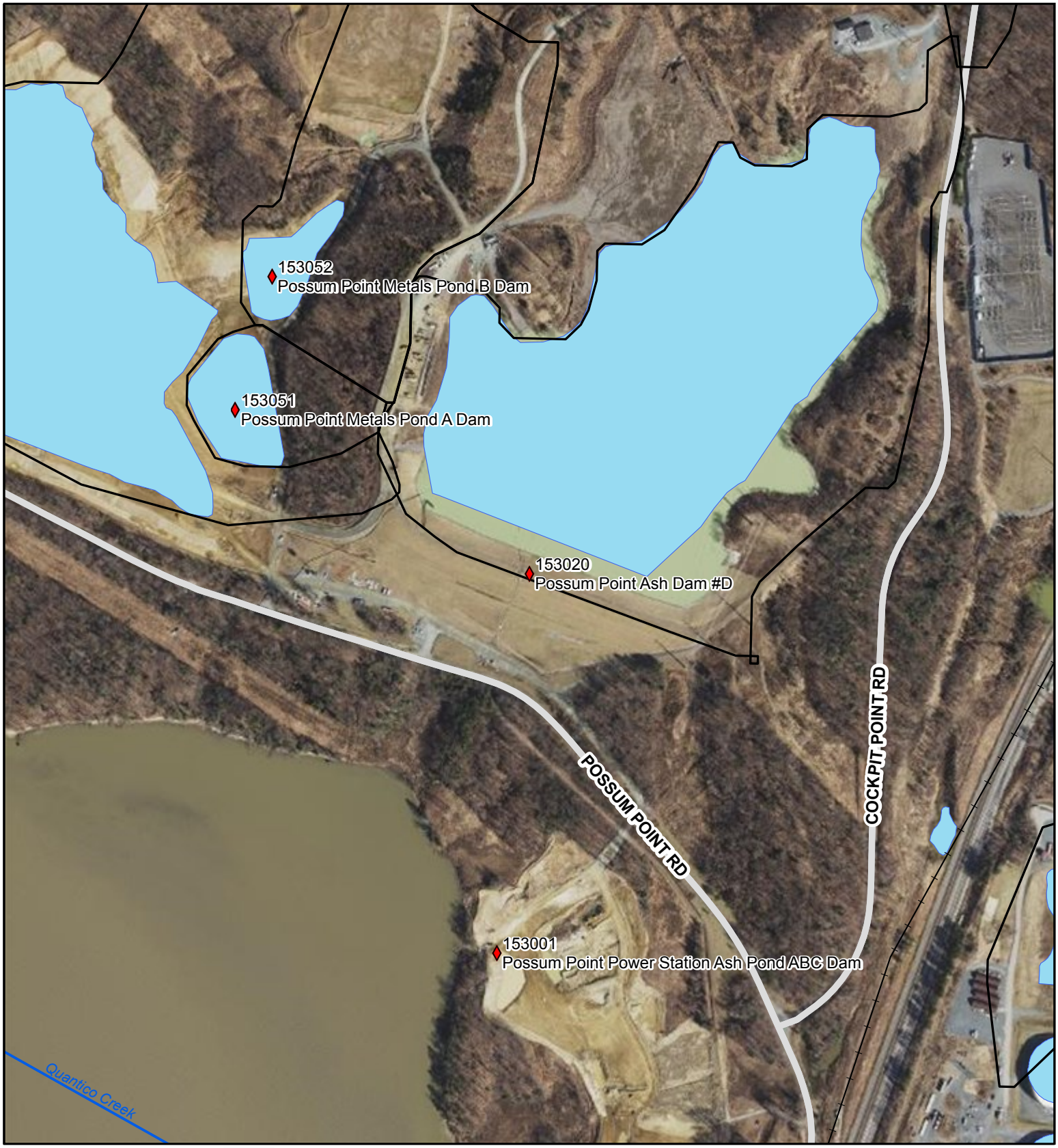
HUC 12: 020700110104,020700110106

VA House: 2

Watershed Name: Potomac River-Tank Creek,Quantico Creek

Congressional: 5111

USGS Topo: QUANTICO



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Potomac Club Regional Pond Dam

Inventory Number: 153031

Hazard Classification: Significant

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/2000

Dam Owner:
Roksana Weaver
(primary)(703) 730-2671(Office)
2180 Potomac Club Parkway
Woodbridge VA, 22191

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 09/30/2027

Days Since Last Inspection: 478

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream: TR-Cow Branch

Technical Basics

Normal Pool Area: 3.76 Acres

Top Surface Area: 7.00 Acres

Normal Pool Capacity: 37.30 Acre-Feet

Top Capacity: 98.60 Acre-Feet

Normal Pool Elevation: 64.00 Feet

Top Elevation: 76.00 Feet

Normal Pool Height: 22.00 Feet

Top Height: 34.12 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.77 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMF

Required Spillway Design Flow: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
9/14/2021	Owner	Satisfactory
8/20/2020	Owner	Satisfactory
4/9/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 06/22/2020
Expiration Date: 06/22/2026

Dam Location

Dam Address:
2314 Potomac Club Pkwy
Woodbridge VA, 22191

E911 Direction to Dam:
northwest intersection of Potomac Branch Drive and Potomac Club Pkwy

EAP Contacts

Dam Operator: Roksana Weaver
(primary)(703) 730-2671(Office)
(primary)RWeaver@legumnorman.com
2180 Potomac Club Parkway
Woodbridge VA, 22191

Dam Alternate Operator:Pete Jahelka
(primary)(703) 600-6000(Office)
(primary)kjahelka@legumnorman.com
3130 Fairview Park Drive
Suite 200
Falls Church VA, 22042

Rain Gauge Observer: Philip Chenenik
(primary)(202) 856-2473(Mobile)
(primary)hd04rider@gmail.com;
pcoa.vicepresident@gmail.com
2673 Sheffield Hill Way
Woodbridge VA, 22191

Alternate Rain Gauge Observer:Scott LaRocca
(primary)(252) 808-7451(Mobile)
(primary)pcoamaster.secretary@gmail.com
14888 Potomac Branch Drive
Woodbridge VA, 22191

24-Hour Dispatch Center: Prince William County Public Safety Communications Center
(primary)(703) 792-6500(Office)
(primary)na@na.com
9320 Lee Avenue
Manassas VA, 20110

Local Government Emergency Services:Brian Misner
(primary)(703) 792-5828(Office); (703) 853-3197(Mobile)
(primary)bmisner@pwcgov.org
3 County Complex
Manassas VA, 22192

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:David Brown
(571) 220-5269(Mobile); (primary)(703) 366-1929(Office)
(primary)david.brown@vdot.virginia.gov
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:National Weather Service
(primary)(703) 996-2200(Office)
(primary)na@na.com
43858 Weather Service Road
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

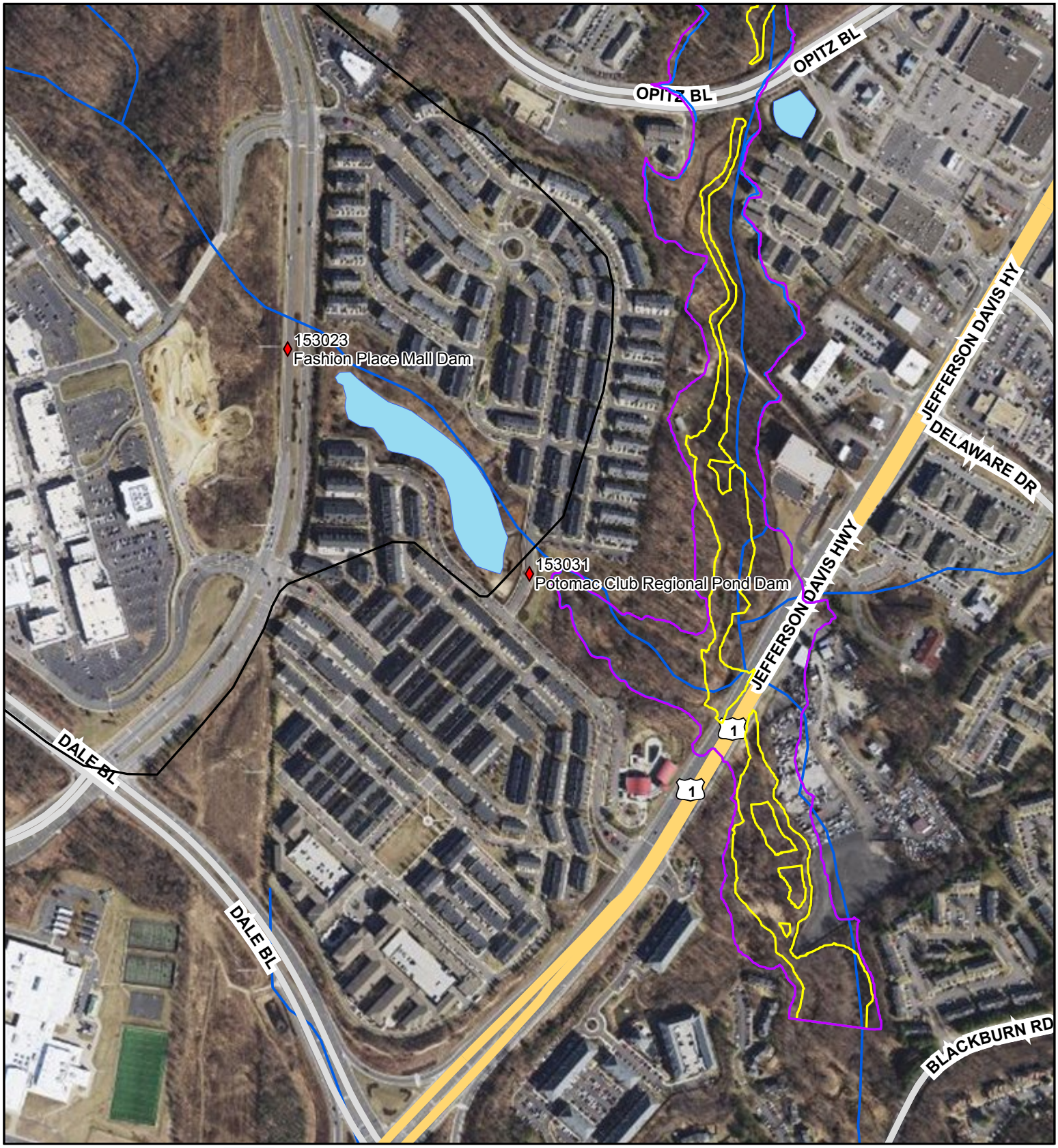
- US Route 1 - 0.22 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 16 Homes
- 2 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **153031**
Dam Name: **Potomac Club Regional Pond Dam**
VAHU6: PL49
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 29
HUC 12: 020700100804
VA House: 2,52
Watershed Name: Neabsco Creek
Congressional: 5111
USGS Topo: OCCOQUAN,QUANTICO



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Precision Dynamics Lake Dam

Inventory Number: 107011

Hazard Classification: Significant

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1967

Dam Owner:
Kevin Rogers
(primary)(301) 370-5175(Office)
2000 Tower Oaks Boulevard, Suite 700
Rockville MD, 20852

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2022

Days Since Last Inspection: 923

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Irrigation (Primary)
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 11.00 Miles

River or Stream: TR-North Fork Goose Creek

Technical Basics

Normal Pool Area: 17.00 Acres

Top Surface Area: 27.00 Acres

Normal Pool Capacity: 204.00 Acre-Feet

Top Capacity: 391.00 Acre-Feet

Normal Pool Elevation: 535.00 Feet

Top Elevation: 543.00 Feet

Normal Pool Height: 28.00 Feet

Top Height: 36.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.80 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .43 PMF

Required Spillway Design Flow: .43 PMF

Inspections (Last 3 Max)

Date	Type	Condition
6/26/2020	Engineer	Satisfactory
9/2/2015	Engineer	Fair
8/3/2012	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 05/10/2010
Expiration Date: 05/10/2016

Dam Location

Dam Address:
18239 Napa Drive
Purcellville VA, 20132

E911 Direction to Dam:
Dam is located on property behind E911 address.

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: Raymond A. Strother II, P.E.
(primary)(540) 667-9300(Office)
(primary)rstrother@triadeng.com
200 Aviation Drive
Winchester VA, 22602

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

- VA-762 - 0.25 miles downstream
- VA-782 - 0.5 miles downstream
- VA-690 - 1.25 miles downstream
- VA-725 - 2.75 miles downstream
- VA-611 - 4 miles downstream
- VA-722 - 6 miles downstream

Dams Downstream:

- 000000

Potential Impact Structures (count):

- 45 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **107011**
Dam Name: **Precision Dynamics Lake Dam**
VAHU6: PL12
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080602
VA House: 33
Watershed Name: North Fork Goose Creek
Congressional: 5110
USGS Topo: BLUEMONT

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Prince William Parkway Regional SWM

Inventory Number: 153022

Hazard Classification: High

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1991

Dam Owner:
Thomas Smith
(primary)(703) 792-6252(Office)
5 County Complex Ct., Suite 250
Prince William VA, 22912

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2027

Days Since Last Inspection: 295

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: Cow Branch

Technical Basics

Normal Pool Area: 3.90 Acres

Top Surface Area: 20.00 Acres

Normal Pool Capacity: 25.00 Acre-Feet

Top Capacity: 316.00 Acre-Feet

Normal Pool Elevation: 185.00 Feet

Top Elevation: 211.00 Feet

Normal Pool Height: 22.00 Feet

Top Height: 47.50 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.48 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF

Required Spillway Design Flow: 1.00 PMF

Inspections (Last 3 Max)

Date	Type	Condition
3/16/2022	Engineer	Satisfactory
6/30/2020	Engineer	Satisfactory
7/22/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 10/19/2020
Expiration Date: 10/19/2026

Dam Location

Dam Address:
2630 Prince William PKWY
Woodbridge VA, 22192

E911 Direction to Dam:
Dam on north side of Prince William Pkwy, accessible from E911 address parking lot

EAP Contacts

Dam Operator: Matt Bowman
(primary)(571) 245-6470(Mobile)
(primary)LBowman@pwcgov.org
5 County Complex CT
Woodbridge VA, 22192

Dam Alternate Operator:Danny Garber
(primary)(703) 906-1715(Mobile)
(primary)dgarber@pwcgov.org
5 County Complex Ct
Woodbridge VA, 22912

Rain Gauge Observer: Curtis Mullins
(primary)(571) 241-5343(Mobile)
(primary)cmullins@pwcgov.org
5 County Complex Ct
Woodbridge VA, 22192

Alternate Rain Gauge Observer:Curtis Mullins
(primary)(571) 241-5343(Mobile)
(primary)Cmullins@pwcgov.org
5 County Complex Ct
Woodbridge VA, 22192

24-Hour Dispatch Center: Katie Kitzmiller
(primary)(571) 359-3501(Mobile)
(primary)KKitzmiller@pwcgov.org
3 County Complex Ct.
Woodbridge VA, 22192

Local Government Emergency Services:Brian Misner
(primary)(703) 853-3197(Mobile)
(primary)bmisner@pwcgov.org
3 County Complex Ct
Woodbridge VA, 22192

Owner's Engineer: Lo Ming Chao
(primary)(703) 792-7075(Office)
(primary)lchao@pwcgov.org
5 County Complex Court
Suite VA, 22192

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:David Brown
(primary)(703) 366-1929(Office)
(primary)david.brown@VDOT.virginia.gov
10228 Residency Road
Manassas VA, 20110

National Weather Service:Tom Cuff
(primary)(301) 427-9778(Office)
(primary)thomas.cuff@noaa.gov
1325 East West Highway
Silver Spring MD, 20910

Potential Impacts

Roadways Impacted:

- Prince William Pkwy (VA 294) - 0.02 miles downstream

Potential Impact Structures (count):

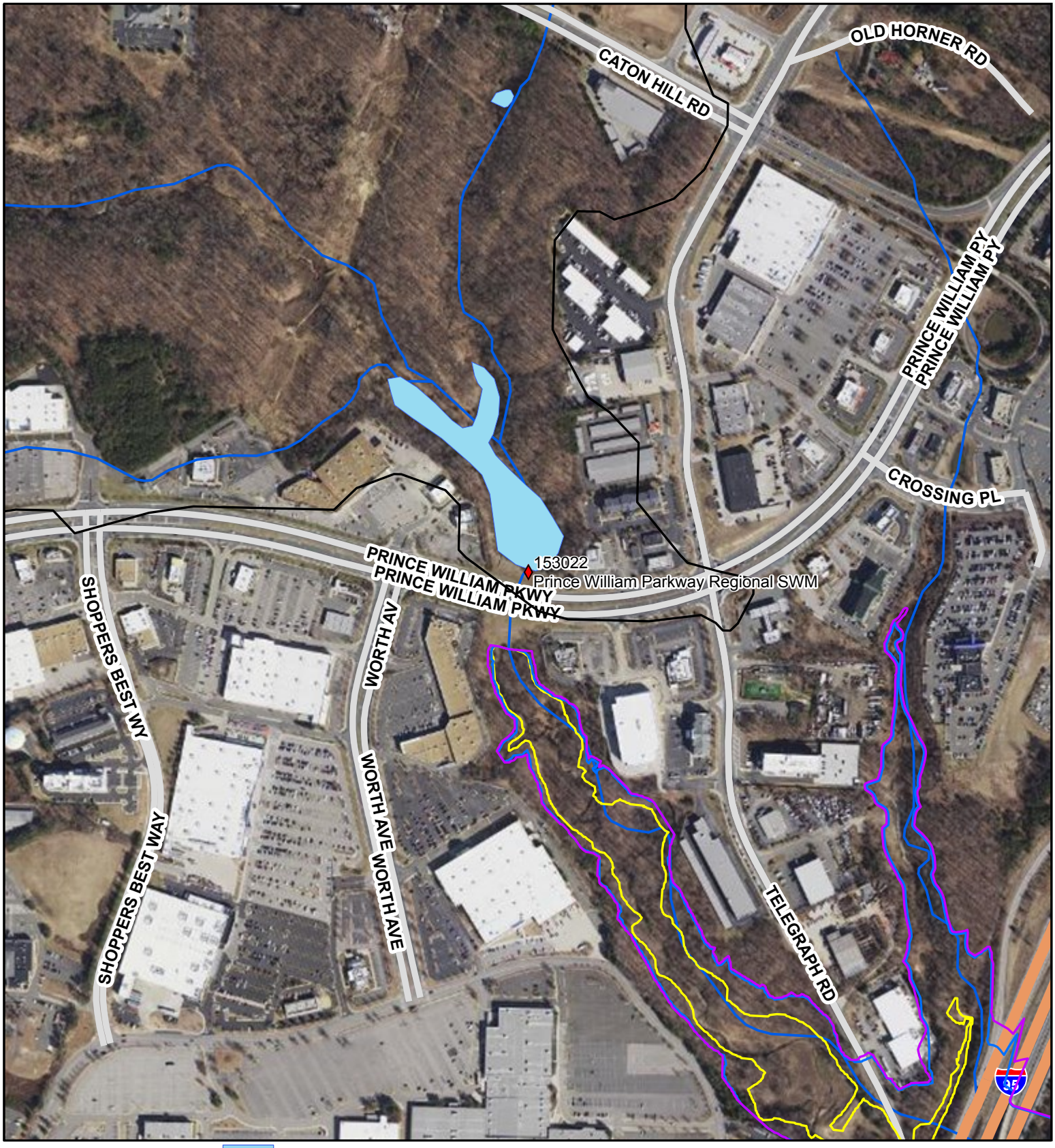
- 14 Homes
- 0 Businesses

- Telegraph Rd (VA 1781) - 0.5 miles downstream

Dams Downstream:

- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **153022**
Dam Name: **Prince William Parkway Regional SWM**
VAHU6: PL49
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 29
HUC 12: 020700100804
VA House: 52
Watershed Name: Neabsco Creek
Congressional: 5111
USGS Topo: OCCOQUAN



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Red Cedar Lake Two Dam

Inventory Number: 107038

Hazard Classification: Significant

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1900

Dam Owner:
Lynda Dean-Duru
(primary)(703) 786-5199(Home)
21679 Channing SQ
Ashburn VA, 20147

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 1 Year Certificate

Certificate Expiration: 09/30/2016

Days Since Last Inspection: 1245

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Irrigation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: TR-Goose Creek

Technical Basics

Normal Pool Area: 4.30 Acres

Top Surface Area: 19.00 Acres

Normal Pool Capacity: 19.30 Acre-Feet

Top Capacity: 174.00 Acre-Feet

Normal Pool Elevation: 284.00 Feet

Top Elevation: 298.00 Feet

Normal Pool Height: 14.00 Feet

Top Height: 28.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.96 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 100.00 YR **Required Spillway Design Flow**: 100.00 YR

Inspections (Last 3 Max)

Date	Type	Condition
8/9/2019	Engineer	Fair
7/10/2015	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 07/22/2015
Expiration Date: 07/22/2021

Dam Location

Dam Address:
21629 Evergreen Ml Road
Leesburg VA, 20175

E911 Direction to Dam:
Dam is located near intersection of Evergreen MI Road and Great Woods Drive.

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

- Great Woods Drive - 0 miles downstream

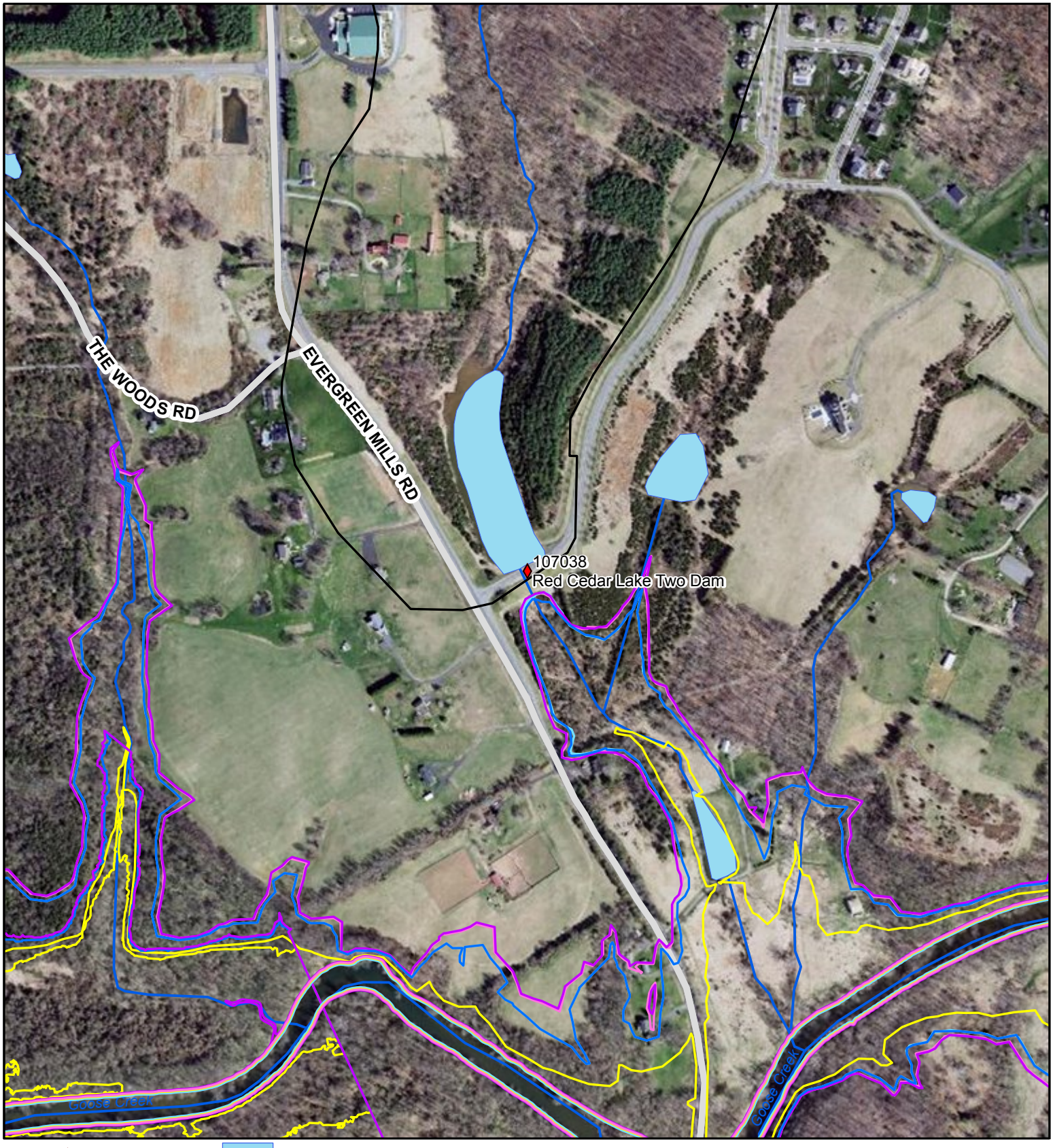
Dams Downstream:

- 000000

Potential Impact Structures (count):

- 13 Homes
- 1 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **107038**
Dam Name: **Red Cedar Lake Two Dam**
VAHU6: PL14
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080702
VA House: 10
Watershed Name: Goose Creek-Big Branch
Congressional: 5110
USGS Topo: LEESBURG



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Reston Northern Sector Pond 1 Dam

Inventory Number: 059042

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 09/30/2026

Days Since Last Inspection: 107

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 11.18 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 70.33 Acre-Feet

Normal Pool Elevation: 338.80 Feet

Top Elevation: 359.60 Feet

Normal Pool Height: 0.00 Feet

Top Height: 20.80 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.41 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: .90 PMP

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
9/21/2022	Engineer	Satisfactory
9/29/2021	Engineer	Satisfactory
9/14/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 07/31/2020
Expiration Date: 07/31/2026

Dam Location

Dam Address:
End of cul-de-sac at 11301 Bright Pond Lane
Reston VA, 20194

E911 Direction to Dam:
End of cul-de-sac at 11301 Bright Pond Lane,
Reston, VA 20194

EAP Contacts

Dam Operator: Chad Crawford
(primary)(703) 324-5500(Office)
(primary)Chad.Crawford@fairfaxcounty.gov
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Dam Alternate Operator:Aaron George
(primary)(703) 870-7000(Office)
(primary)ageorge@gky.com
4229 Lafayette Center Drive
Suite 1850
Chantilly VA, 20151

Rain Gauge Observer: Alex Shahvari
(primary)(703) 877-2800(Office)
(primary)Alireza.Shahvari@fairfaxcounty.gov
10635 West Drive
Fairfax VA, 22030

Alternate Rain Gauge Observer:NA NA
(primary)(703) 877-2800(Office)
(primary)na
10635 West Drive
Fairfax VA, 22030

24-Hour Dispatch Center: Ganesh Thapa
(primary)(703) 877-2800(Office)
(primary)Ganesh.Thapa@fairfaxcounty.gov
10635 West Drive
Fairfax VA, 22030

Local Government Emergency Services:Greg Zebrowski
(primary)(571) 350-2100(Office)
(primary)Gregory.Zebrowski@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Gaby Hakim, PE
(primary)(703) 259-0243(Office); (800) 367-7623(Office)
(primary)na
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Eric Seymour
(757) 899-2415(Office); (primary)(757) 899-4200(Office); (800) 737-8624(Office)
(primary)eric.seymour@noaa.gov
1009 General Mahone Highway
Wakefield VA, 23888

Potential Impacts

Roadways Impacted:

- Bishopsgate Way (Route 6208) - 1 miles downstream

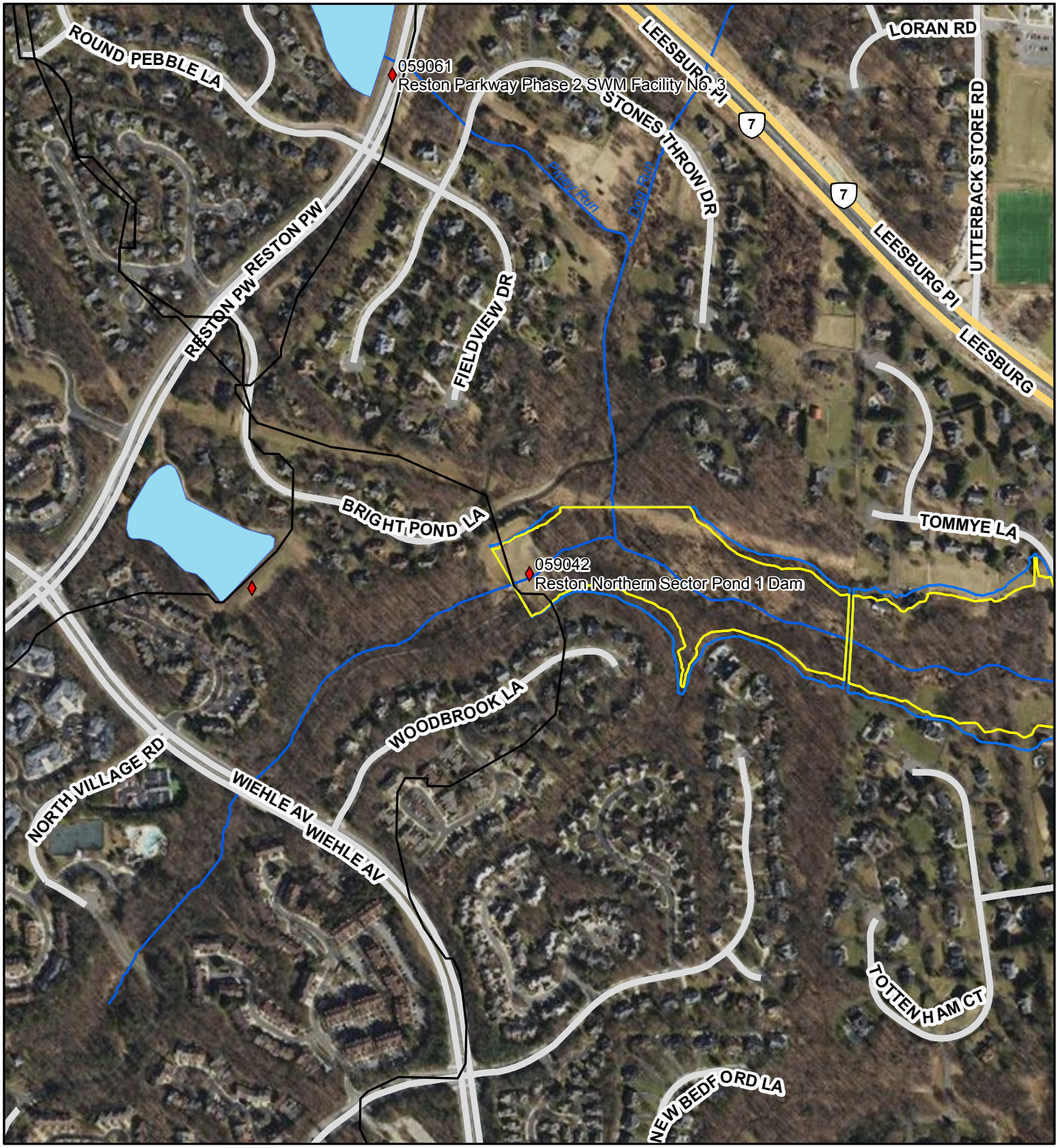
Dams Downstream:

- none

Potential Impact Structures (count):

- 1 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **059042**
Dam Name: **Reston Northern Sector Pond 1 Dam**
VAHU6: PL22
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 32
HUC 12: 020700081004
VA House: 36
Watershed Name: Difficult Run
Congressional: 5111
USGS Topo: VIENNA



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Reston Town Center Western BMP Dam

Inventory Number: 059041

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Barbara Rovin
(primary)(703) 435-6600(Office)
1760 Reston Parkway, Suite 513
Reston VA, 20190

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 07/31/2020

Days Since Last Inspection: 3364

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Sugarland Run tributary

Technical Basics

Normal Pool Area: 3.60 Acres

Top Surface Area: 6.10 Acres

Normal Pool Capacity: 18.30 Acre-Feet

Top Capacity: 56.60 Acre-Feet

Normal Pool Elevation: 348.00 Feet

Top Elevation: 358.20 Feet

Normal Pool Height: 10.50 Feet

Top Height: 20.70 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.15 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .90 PMP

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
10/21/2013	Engineer	Satisfactory
9/27/2011	Engineer	Fair
3/10/2010	Engineer	

EAP Quick Reference

Approval Date: 04/14/2014
Expiration Date: 04/14/2020

Dam Location

Dam Address:
12195 Abington hall Pl
Reston VA, 20190

E911 Direction to Dam:
Dam south of E911 location

EAP Contacts

Dam Operator: Barbara Rovin
(primary)(703) 435-6600(Office)
(primary)brovin@restontc.org
1760 Reston Parkway, Suite 513
Reston VA, 20190

Dam Alternate Operator:

Rain Gauge Observer: Brice Kutch
(primary)(703) 870-7000(Office)
(primary)bkutch@gky.com
None
4229 Lafayette Center Drive, Suite 1850
Chantilly VA, 20151

Alternate Rain Gauge Observer:

24-Hour Dispatch Center: na na
(primary)(703) 437-7575(Office)
(primary)na
1820 Wiehle Ave
Reston VA, 20190

Local Government Emergency Services:NA NA
(primary)(571) 350-1225(Office); (571) 439-4901(Office)
(primary)na
4890 Alliance Drive
Fairfax VA, 22030

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Gaby Hakim, PE
(primary)(703) 259-0243(Office); (800) 367-7623(Office)
(primary)na
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:

Potential Impacts

Roadways Impacted:

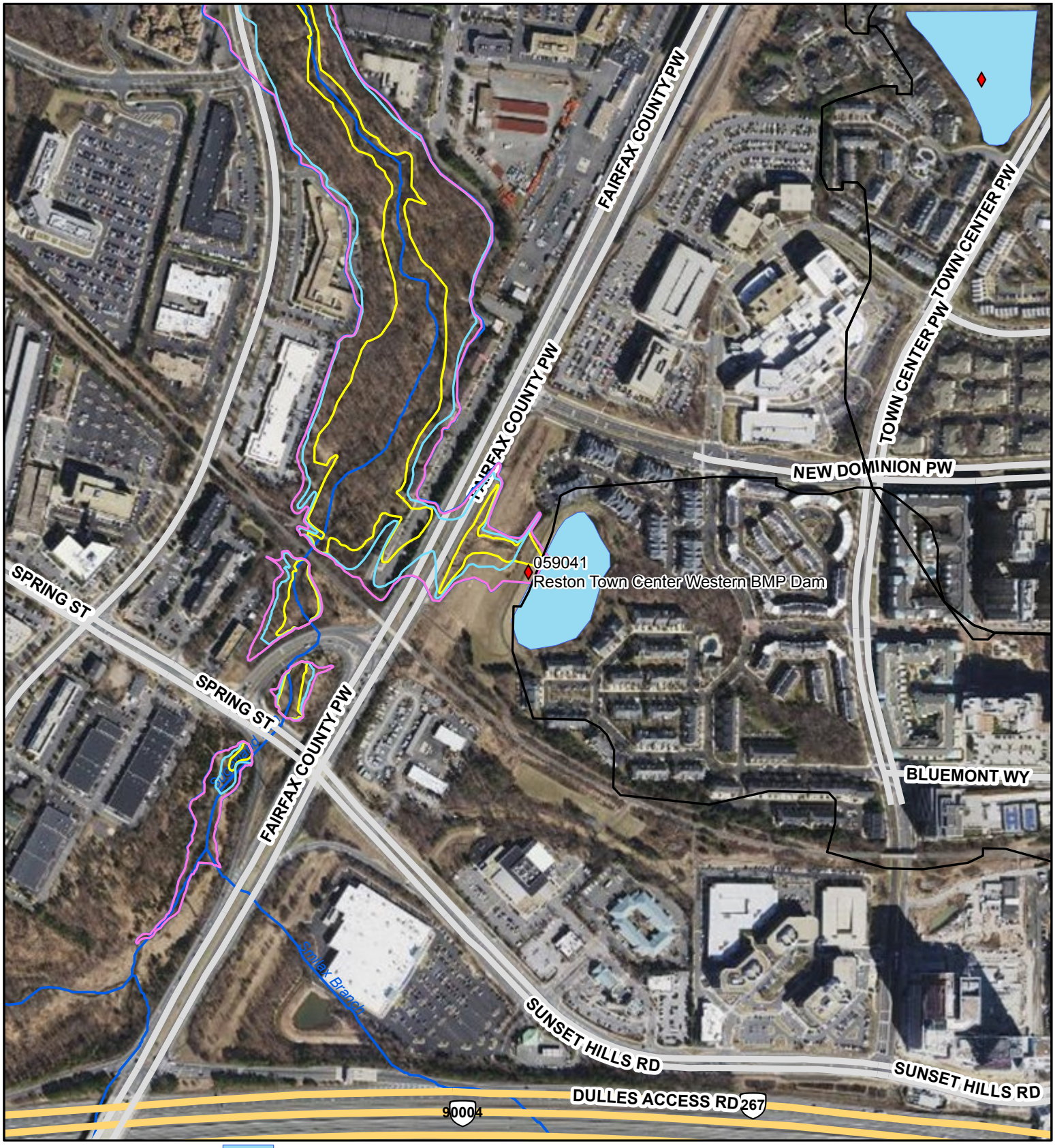
- 286 - 0.07 miles downstream
- 606 - 0.62 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 6 Homes
- 36 Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **059041**
Dam Name: **Reston Town Center Western BMP Dam**
VAHU6: PL21
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 32,33
HUC 12: 020700080905
VA House: 36,86
Watershed Name: Sugarland Run
Congressional: 5111
USGS Topo: VIENNA



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Richmond Square Dam

Inventory Number: 107063

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1900

Dam Owner:
Christopher Tuck
(540) 751-1888(Office)
602 South King Street
Suite 400
Leesburg VA, 20175

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 1 Year Certificate

Certificate Expiration: 09/30/2023

Days Since Last Inspection: 1332

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Cattail Branch

Technical Basics

Normal Pool Area: 6.90 Acres

Top Surface Area: 31.20 Acres

Normal Pool Capacity: 8.30 Acre-Feet

Top Capacity: 112.30 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 2.00 Feet

Top Height: 12.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition
5/14/2019	Engineer	Fair

EAP Quick Reference

Approval Date: 04/01/2020
Expiration Date: 04/01/2026

Dam Location

Dam Address:

,

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

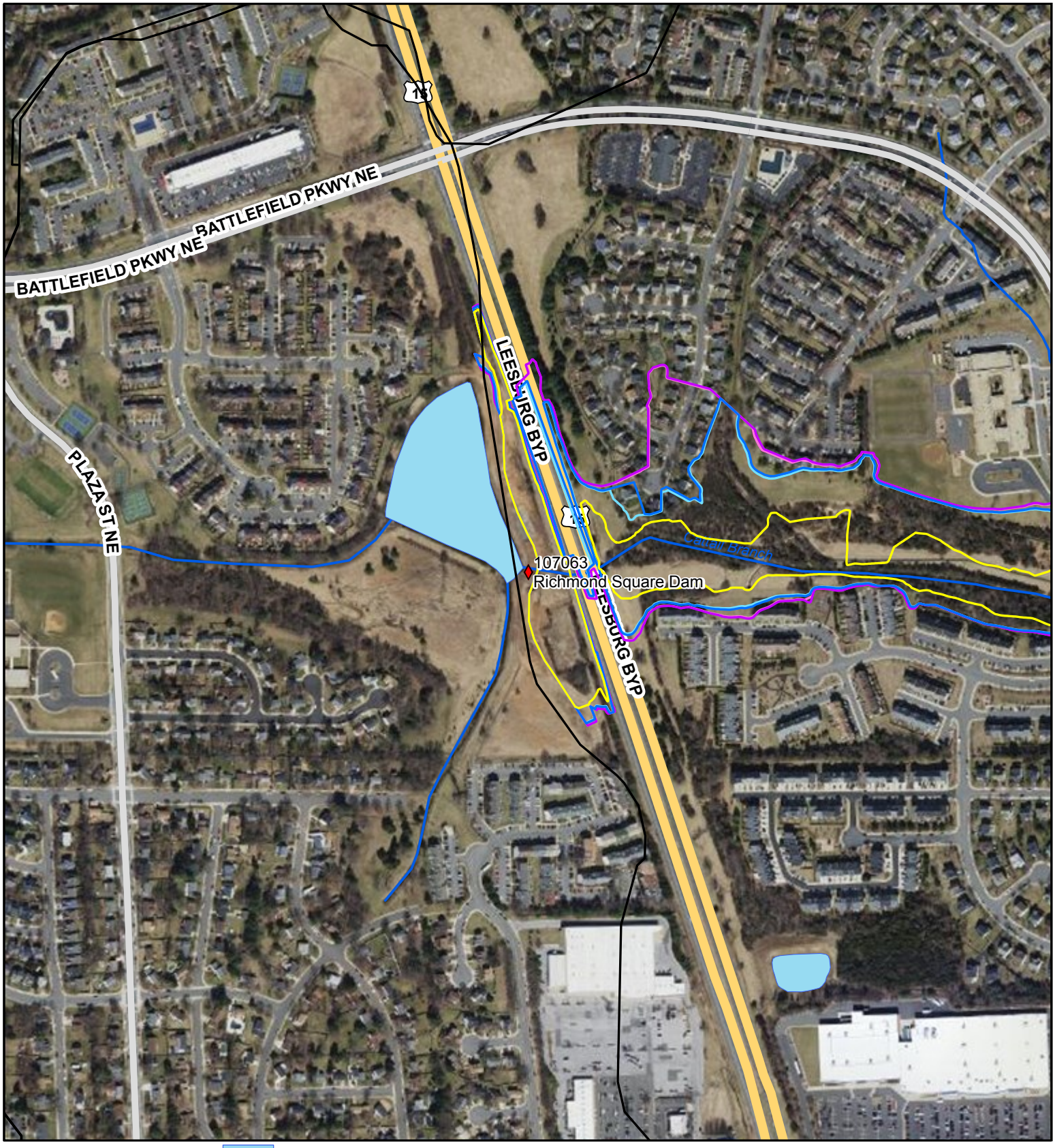
Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **107063**
Dam Name: **Richmond Square Dam**
VAHU6: PL16
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 33
HUC 12: 020700080704
VA House: 10,33
Watershed Name: Goose Creek-Cattail Branch
Congressional: 5110
USGS Topo: LEESBURG



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Rocky Branch Regional SWM Dam

Inventory Number: 153025

Hazard Classification: High

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
David Kerns
(primary)(571) 444-0350(Office)
7524 Iron Barn Lane
Gainesville VA, 20155

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 05/31/2024

Days Since Last Inspection: 194

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream: Rocky Branch

Technical Basics

Normal Pool Area: 1.15 Acres

Top Surface Area: 42.00 Acres

Normal Pool Capacity: 4.30 Acre-Feet

Top Capacity: 375.90 Acre-Feet

Normal Pool Elevation: 308.00 Feet

Top Elevation: 327.00 Feet

Normal Pool Height: 2.00 Feet

Top Height: 21.50 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 1.02 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMF

Required Spillway Design Flow: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
6/25/2022	Engineer	Satisfactory
3/24/2021	Engineer	Satisfactory
6/1/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 08/02/2018
Expiration Date: 08/02/2024

Dam Location

Dam Address:
8001 Linton Hall Rd
Gainesville VA, 20155

E911 Direction to Dam:
Dam located on north side of Linton Hall Rd at intersection of Linton Hall and Glenkirk Rd. Vehicle access via small gate / concrete barrier with driveway off Linton Hall.

EAP Contacts

Dam Operator: Robert Meadows
(primary)(571) 458-6719(Office)
(primary)na
na
Na VA, 12345

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center: Prince William County Public Safety Communications Center
(primary)(703) 792-6500(Office)
(primary)na@na.com
9320 Lee Avenue
Manassas VA, 20110

Local Government Emergency Services:Brian Misner
(primary)(703) 792-5627(Office)
(primary)bmisner@pwcgov.org
1 County Complex Court
Prince William VA, 22192

Owner's Engineer: Frederic C Tucker
(primary)(703) 849-0643(Office)
(primary)ftucker@dewberry.com
13575 Hearthcote Boulevard
Suite 130
Gainsville VA, 20155

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Steven Shannon
(primary)(703) 259-0244(Office); (800) 367-7623(Office)
(primary)Steven.Shannon@vdot.virginia.gov
4975 Alliance Dr
Fairfax VA, 22030

National Weather Service:

Potential Impacts

Roadways Impacted:

- Linton Hall Rd (VA 619) - 0.05 miles downstream

Potential Impact Structures (count):

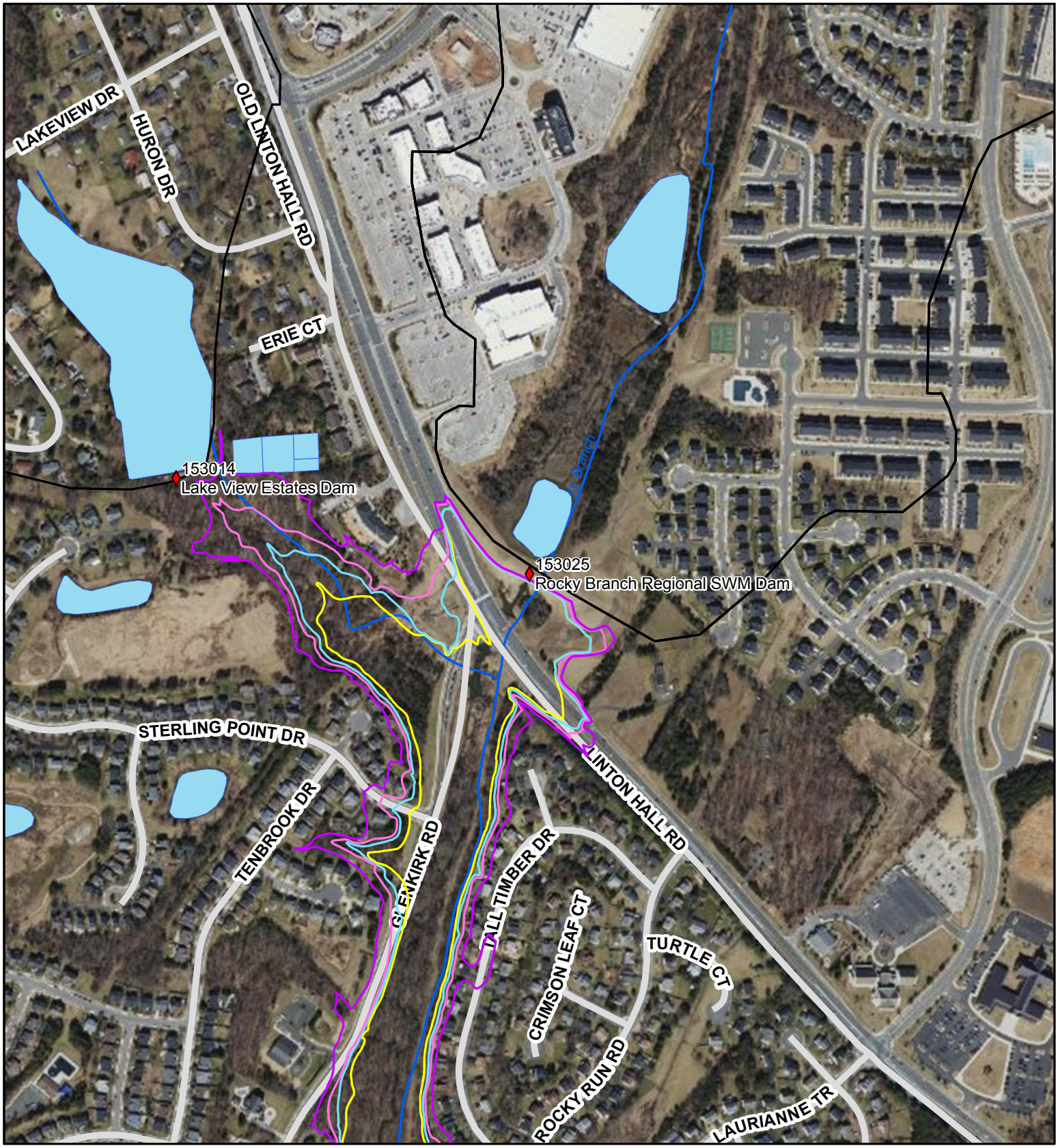
- 42 Homes
- Businesses

- Glenkirk Rd (VA 675) - 0.1 miles downstream

Dams Downstream:

- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **153025**
Dam Name: **Rocky Branch Regional SWM Dam**
VAHU6: PL34
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 13
HUC 12: 020700100504
VA House: 13
Watershed Name: Broad Run-Rocky Branch
Congressional: 5101
USGS Topo: GAINESVILLE



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Silver Lake Dam

Inventory Number: 153012

Hazard Classification: High

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1961

Dam Owner:
Debbie Andrew
(primary)(703) 792-4217(Office)
14420 Bristow Road
Manassas VA, 20112

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 09/30/2023

Days Since Last Inspection: 940

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.00 Miles

River or Stream: Little Bull Run

Technical Basics

Normal Pool Area: 23.00 Acres

Top Surface Area: 49.00 Acres

Normal Pool Capacity: 175.00 Acre-Feet

Top Capacity: 526.00 Acre-Feet

Normal Pool Elevation: 100.00 Feet

Top Elevation: 108.00 Feet

Normal Pool Height: 19.00 Feet

Top Height: 27.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 1.88 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: 100.00 YR **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
6/9/2020	Engineer	Satisfactory
3/8/2018	Owner	Satisfactory
3/29/2017	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 07/18/2017
Expiration Date: 07/18/2023

Dam Location

Dam Address:
15801 TANNING HOUSE PL
Haymarket VA, 20169

E911 Direction to Dam:
From Gainesville traveling north on James Madison Hwy (VA 15), left on Dominion Valley Dr., right on Waverly Farm Dr. left on Tanninghouse Pl.

EAP Contacts

Dam Operator: Roy Gunrdstrom
(primary)(703) 792-8777(Office)
(primary)na
na
Na VA, 12345

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:Brian Misner
(primary)(703) 792-5627(Office)
(primary)bmisner@pwcgov.org
1 County Complex Court
Prince William VA, 22192

Owner's Engineer: Edward Umbrell
(primary)(703) 468-2258(Office)
(primary)eumbrell@dewberry.com
13575 Heathcote Boulevard
Suite 130
Gainesville VA, 20155

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Steven Shannon
(primary)(703) 259-0244(Office); (800) 367-7623(Office)
(primary)Steven.Shannon@vdot.virginia.gov
4975 Alliance Dr
Fairfax VA, 22030

National Weather Service:

Potential Impacts

Roadways Impacted:

- Dominion Valley Drive - 0.72 miles downstream

Potential Impact Structures (count):

- 155 Homes
- Businesses

- James Madison Hwy (VA 15) - 2.45 miles downstream
- Old Carolina Rd (VA 625) - 2.70 miles downstream
- Catharpin Rd (VA 676) - 4.04 miles downstream

- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dams Downstream:

Dam Number: **153012**
Dam Name: **Silver Lake Dam**
VAHU6: PL43
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 28
HUC 12: 020700100702
VA House: 87
Watershed Name: Little Bull Run
Congressional: 5110
USGS Topo: THOROUGHFARE GAP

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Sleeter Lake Dam

Inventory Number: 107010

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1966

Dam Owner:
Kevin Rogers
(primary)(301) 370-5175(Office)
2000 Tower Oaks Boulevard, Suite 700
Rockville MD, 20852

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 03/31/2024

Days Since Last Inspection: 924

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Irrigation (Primary)
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 11.00 Miles

River or Stream: North Fork Goose Creek

Technical Basics

Normal Pool Area: 120.00 Acres

Top Surface Area: 136.00 Acres

Normal Pool Capacity: 1815.00 Acre-Feet

Top Capacity: 3159.00 Acre-Feet

Normal Pool Elevation: 491.00 Feet

Top Elevation: 501.00 Feet

Normal Pool Height: 45.00 Feet

Top Height: 55.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 10.00 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow: .33 PMF

Inspections (Last 3 Max)

Date	Type	Condition
6/25/2020	Engineer	Satisfactory
8/1/2019	Engineer	Satisfactory
2/22/2018	Engineer	Fair

EAP Quick Reference

Approval Date: 05/27/2010
Expiration Date: 05/27/2016

Dam Location

Dam Address:
17749 Lakefield Rd
Round Hill VA, 20141

E911 Direction to Dam:
The impoundment structure is located just south of 17749 Lakefield Rd.

EAP Contacts

Dam Operator: Kenneth Fleming
(primary)(540) 338-4024(Office)
(primary)na
NA
Na VA, 99999

Dam Alternate Operator:NA NA
(primary)(301) 370-5175(Office)
(primary)na
P.O. Box 2308
Leesburg VA, 20177

Rain Gauge Observer: Kenneth Fleming
(primary)(540) 338-4024(Office)
(primary)na
NA
Na VA, 99999

Alternate Rain Gauge Observer:

24-Hour Dispatch Center: NA NA
(primary)(703) 777-0333(Office)
(primary)na
801 Sycolin Rd, SE Suite 200
Leesburg VA, 20175

Local Government Emergency Services:Kevin Johnson
(703) 737-8831(Mobile); (primary)(703) 777-2243(Office)
(primary)oem@loudoun.gov
801 Sycolin Road
Suite 100
Leesburg VA, 20175

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:James Betz
(primary)(703) 259-0245(Office); (800) 367-7623(Office)
(primary)james.betz@vdot.virginia.gov
41 Lawson Road S.E.
Leesburg VA, 20175

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 762 - 0.25 miles downstream
- 782 - 0.5 miles downstream
- 690 - 1.25 miles downstream
- 725 - 2.75 miles downstream
- 611 - 4 miles downstream
- 722 - 6 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 14 Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- 1 Utilities
- Parks
- Golf Courses

Dam Number: **107010**
Dam Name: **Sleeter Lake Dam**
VAHU6: PL12
Municipalities: Loudoun County
Region: 1
SWCD: LOUDOUN
VA Senate: 13
HUC 12: 020700080602
VA House: 33
Watershed Name: North Fork Goose Creek
Congressional: 5110
USGS Topo: BLUEMONT

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: South Twin Lake Dam

Inventory Number: 059011

Hazard Classification: Significant

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1967

Dam Owner:
Cynthia Walsh
(primary)(703) 324-8537(Office)
12055 Government Center Parkway
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 05/31/2025

Days Since Last Inspection: 253

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 5.00 Miles

River or Stream: Moore Creek

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 0.00 Acres

Normal Pool Capacity: 83.00 Acre-Feet

Top Capacity: 118.00 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 14.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 0.00 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: .30 PMF **Required Spillway Design Flow**: .30 PMF

Inspections (Last 3 Max)

Date	Type	Condition
4/28/2022	Engineer	Satisfactory
3/10/2021	Owner	Satisfactory
3/19/2020	Owner	Satisfactory

EAP Quick Reference

Approval Date: 01/09/2019
Expiration Date: 01/09/2025

Dam Location

Dam Address:
6201 Union Mill Road
Clifton VA, 20124

E911 Direction to Dam:
Twin Lakes Golf Course Clubhouse (6201 Union Mill Rd, Clifton, VA 20124)

EAP Contacts

Dam Operator: Todd Johnson
(primary)(703) 324-8678(Office)
(primary)Todd.Johnson@fairfaxcounty.gov
12055 Government Center Parkway
Fairfax VA, 22035

Dam Alternate Operator:Rick Cooksey
(primary)(703) 631-9145(Office)
(primary)FCPATwinLakesGC@fairfaxcounty.gov
6201 Union Mill Rd
Clifton VA, 20124

Rain Gauge Observer: Ian J. Whitehead
(primary)(703) 810-1206(Office)
(primary)IWhitehead@ecslimited.com
14026 Thunerbolt Pl. Suite 100
Chantilly VA, 20151

Alternate Rain Gauge Observer:Cynthia Walsh
(primary)(703) 324-8537(Office)
(primary)Cynthia.walsh@fairfaxcounty.gov
12055 Government Center Parkway
Fairfax VA, 22035

24-Hour Dispatch Center: Roy Oliver
(primary)(703) 691-2131(Office)
(primary)DPSCAgency@fairfaxcounty.gov
4890 Alliance Drive
-
Fairfax VA, 22030

Local Government Emergency Services:Seamus Mooney
(571) 350-1000(Office); (primary)(571) 439-4901(Office)
(primary)OEMDutyOfficer@fairfaxcounty.gov
4890 Alliance Drive
Suite 2200
Fairfax VA, 22030

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:VDOT Resident Administrator for Road Closures
(primary)(800) 367-7623(Office)
(primary)na@na.com
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Twin Lakes Drive - 0.04 miles downstream
- Johnny Moore Lane - 0.32 miles downstream
- Compton Road - 1.64 miles downstream

Dams Downstream:

- N/A

Potential Impact Structures (count):

- 0 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 1 Golf Courses

Dam Number: **059011**
Dam Name: **South Twin Lake Dam**
VAHU6: PL46
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 39
HUC 12: 020700100705
VA House: 40
Watershed Name: Lower Bull Run
Congressional: 5110
USGS Topo: MANASSAS

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Southern Shores Drive Dam

Inventory Number: 153054

Hazard Classification: Significant

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 03/31/2030

Dam Owner:
Brian English
(primary)(703) 493-1747(Office)
1740 Dunnington Pl
Potomac Shores VA, 22026

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type:

Certificate Expiration:

Days Since Last Inspection:

Inundation Report: 09/17/2021

Type of Dam
Earth (Secondary)

Reservoir Purpose
Flood Control or storm water management (Secondary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 0.00 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 43.69 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 0.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 34.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow:

Required Spillway Design Flow:

Inspections (Last 3 Max)

Date	Type	Condition

EAP Quick Reference

Approval Date:
Expiration Date:

Dam Location

Dam Address:

E911 Direction to Dam:

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **153054**
Dam Name: **Southern Shores Drive Dam**
VAHU6: PL54
Municipalities: Prince William County
Region: 1
SWCD: PRINCE WILLIAM
VA Senate: 36
HUC 12: 020700110106
VA House: 2
Watershed Name: Potomac River-Tank Creek
Congressional: 5111
USGS Topo: QUANTICO

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: T. Nelson Elliott Dam

Inventory Number: 153002

Hazard Classification: High

City/County: Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1968

Dam Owner:
Tony Dawood
(primary)(703) 257-8382(Office)
8500 Public Works Drive
Manassas VA, 20110

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Conditional 1 Year Certificate

Certificate Expiration: 11/30/2022

Days Since Last Inspection: 447

Inundation Report: 09/07/2010

Type of Dam
Gravity (Primary)

Reservoir Purpose
Water Supply (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream: Broad Run

Technical Basics

Normal Pool Area: 790.00 Acres

Top Surface Area: 1275.00 Acres

Normal Pool Capacity: 16000.00 Acre-Feet

Top Capacity: 33000.00 Acre-Feet

Normal Pool Elevation: 290.00 Feet

Top Elevation: 308.00 Feet

Normal Pool Height: 58.00 Feet

Top Height: 76.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 60.00 Sq. Mi.

6 Hour PMP: 22.20

Time of Concentration:

12 Hour PMP: 23.70

Weighted Curve Number:

24 Hour PMP: 24.00

IDA Spillway Reduction:

Available Spillway Design Flow: **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
10/15/2021	Owner	Satisfactory
9/9/2020	Engineer	Satisfactory
4/27/2015	Owner	Satisfactory

EAP Quick Reference

Approval Date: 10/06/2021
Expiration Date: 10/06/2027

Dam Location

Dam Address:
14312 Glenkirk Rd
Nokesville VA, 20181

E911 Direction to Dam:
Lake Manassas on Broad Run in Nokesville, Virginia
Latitude: 38.7637-deg Longitude: -77.6226-deg

EAP Contacts

Dam Operator: Tony Dawood
(primary)(703) 257-8382(Office)
(primary)tdawood@ci.manassas.va.us
8500 Public Works Drive
Manassas VA, 20110

Dam Alternate Operator:William Shifflett
(primary)(703) 257-8471(Office)
(primary)wshifflett@ci.manassas.va.us
14329 Glenkirk Rd
Nokesville VA, 20181

Rain Gauge Observer: Stephen Siler
(703) 477-1953(Mobile); (primary)(703) 754-8117(Office)
(primary)ssiler@ci.manassas.va.us
14329 Glenkirk Rd
Nokesville VA, 20181

Alternate Rain Gauge Observer:James Mauger
(primary)(703) 754-8117(Office); (716) 345-7118(Mobile)
(primary)jmauger@ci.manassas.va.us
14329 Glenkirk Rd
Nokesville VA, 20181

24-Hour Dispatch Center: Utility Operations
(primary)(703) 257-8353(Office); (703) 257-8437(Office)
(primary)operations@manassasva.gov
8500 Public Works Dr
Manassas VA, 20110

Local Government Emergency Services:William Garrett
(primary)(703) 257-8465(Office)
(primary)wgarrett@manassasva.gov
9324 West Street #103
Manassas VA, 20110

Owner's Engineer: Richard Walker
(primary)(301) 944-2551(Office); (585) 613-6966(Mobile)
(primary)richard.f.walker@aecom.com
12420 Milestone Center Drive
Suite 150
Germantown MD, 20876

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:William Garrett
(primary)(703) 257-8465(Office)
(primary)wgarrett@manassasva.gov
9324 West Street #103
Manassas VA, 20110

National Weather Service:Chris Strong
(primary)(703) 996-2200(Office)
(primary)christopher.strong@noaa.gov
1325 East West Highway
Silver Spring MD, 20910

Potential Impacts

Roadways Impacted:

- Glenkirk Rd - 0.03 miles downstream
- Rollins Ford Rd - 0.26 miles downstream
- Sudley Manor Dr - 4.43 miles downstream
- Linton Hall Rd - 5.86 miles downstream
- Nokesville Rd - 8.48 miles downstream
- Brentsville Rd - 15.13 miles downstream
- Lucasville Rd - 14.25 miles downstream

Dams Downstream:

- 153006

Potential Impact Structures (count):

- 3869 Homes
- 90 Businesses
- 2 Schools
- 0 Hospitals
- 2 Critical Infrastructure
- 2 Railroads
- 2 Utilities
- 2 Parks
- 2 Golf Courses

Dam Number: **153002**

Dam Name: **T. Nelson Elliott Dam**

VAHU6: PL32,PL34

Municipalities: Prince William County

Region: 1

SWCD: PRINCE WILLIAM

VA Senate: 13,29

HUC 12: 020700100502,020700100504

VA House: 13,51

Watershed Name: Broad Run-Catletts Branch,Broad Run-Rocky Branch

Congressional: 5101

USGS Topo: GAINESVILLE,THOROUGHFARE GAP

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: The Lakes at Red Rock Dam

Inventory Number: 107049

Hazard Classification: High

City/County: Loudoun County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Dan Catlett
(primary)(703) 771-1485(Office)
PO Box 4061
Leesburg VA, 20177

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 05/31/2021

Days Since Last Inspection: 1855

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Recreation (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.10 Miles

River or Stream: Cattail Branch

Technical Basics

Normal Pool Area: 7.33 Acres

Top Surface Area: 15.50 Acres

Normal Pool Capacity: 45.70 Acre-Feet

Top Capacity: 126.02 Acre-Feet

Normal Pool Elevation: 238.50 Feet

Top Elevation: 246.00 Feet

Normal Pool Height: 10.50 Feet

Top Height: 18.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 2.40 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: **Required Spillway Design Flow**: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
12/7/2017	Engineer	Satisfactory
1/5/2015	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 03/02/2015
Expiration Date: 03/02/2021

Dam Location

Dam Address:
18400 Mill Run Ct
Leesburg VA, 20176

E911 Direction to Dam:
Alternative address: 43131 Lake Ridge Pl. Dam access from River Creek Pkwy or Battlefield Pkwy to Edwards Ferry Rd NE

EAP Contacts

Dam Operator: Dan Catlett
(primary)(703) 771-1485(Office)
(primary)dan.catlett@dcremgmt.com
PO Box 4061
Leesburg VA, 20177

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

- River Creek Pkwy (Rte. 773) - 0.11 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks

- Golf Courses

Dam Number: **107049**

Dam Name: **The Lakes at Red Rock Dam**

VAHU6: PL05,PL16

Municipalities: Loudoun County

Region: 1

SWCD: LOUDOUN

VA Senate: 33

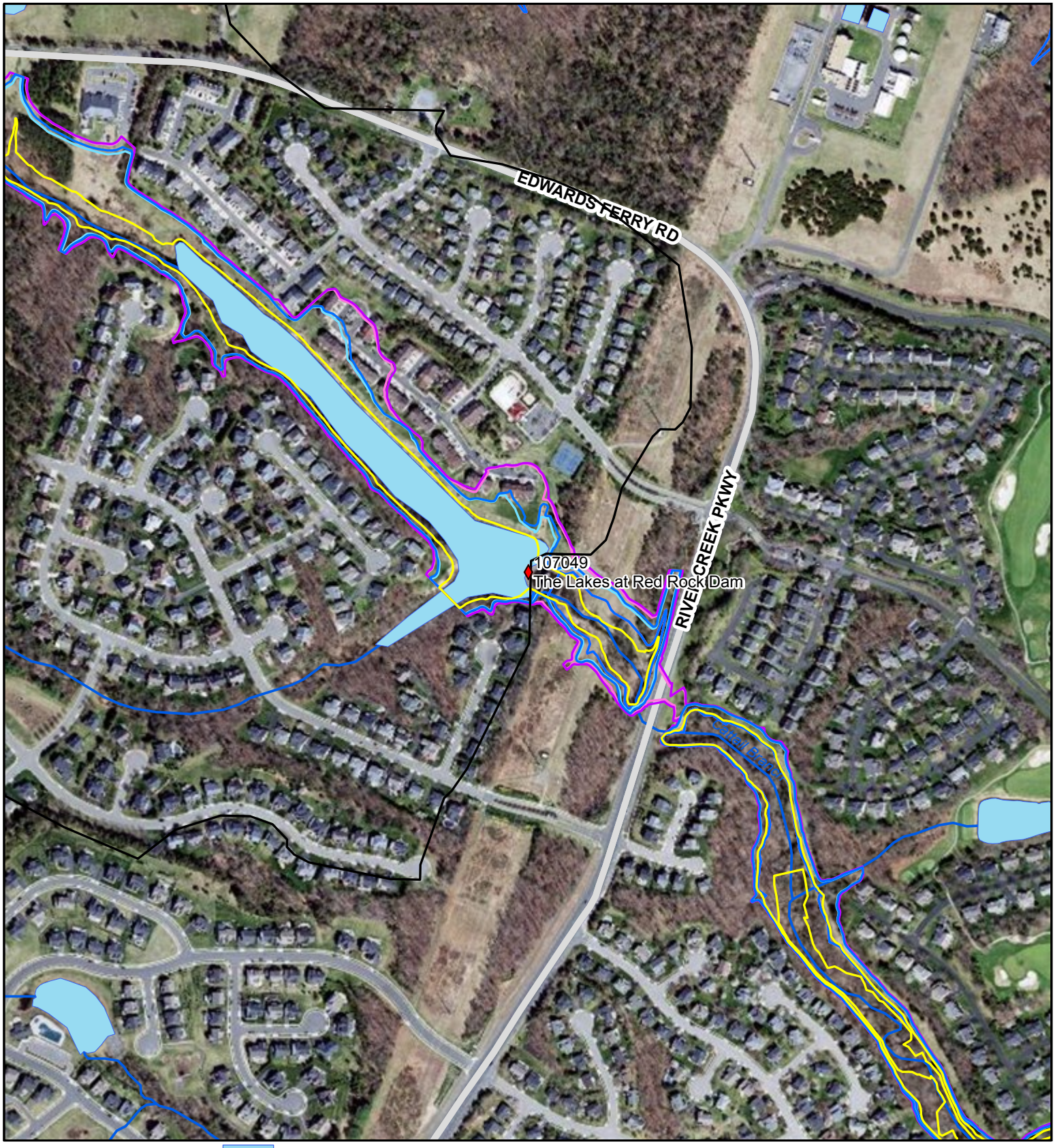
HUC 12: 020700080403,020700080704

VA House: 10

Watershed Name: Goose Creek-Cattail Branch,Potomac River-Limestone B

Congressional: 5110

USGS Topo: LEESBURG



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Upper Occoquan Dam

Inventory Number: 153004

Hazard Classification: High

City/County: Fairfax County, Prince William County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1955

Dam Owner:
Jamie Bain Hedges
(571) 722-3018(Mobile); (primary)(703) 289-6012(Office)
8570 Executive Park Avenue
P.O. Box 1500
Merrifield VA, 22116

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 05/31/2026

Days Since Last Inspection: 792

Inundation Report: Unknown

Type of Dam
Gravity (Primary)

Reservoir Purpose
Water Supply (Primary)
Hydro-electric (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 1.00 Miles

River or Stream: Occoquan River

Technical Basics

Normal Pool Area: 1840.00 Acres

Top Surface Area: 1840.00 Acres

Normal Pool Capacity: 25472.00 Acre-Feet

Top Capacity: 25472.00 Acre-Feet

Normal Pool Elevation: 122.00 Feet

Top Elevation: 122.00 Feet

Normal Pool Height: 65.00 Feet

Top Height: 65.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 595.00 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF

Required Spillway Design Flow: 1.00 PMF

Inspections (Last 3 Max)

Date	Type	Condition
11/5/2020	Engineer	Satisfactory
1/8/2020	Owner	Satisfactory
1/31/2019	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 09/15/2015
Expiration Date: 09/15/2021

Dam Location

Dam Address:

,

E911 Direction to Dam:
TBD

EAP Contacts

Dam Operator:

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center:

Local Government Emergency Services:

Owner's Engineer: John Harrison
(primary)(610) 656-4428(Mobile); (610) 696-6066(Office)
(primary)JohnH@schnabel-eng.com
3 Dickinson Drive
Suite 200
Chadds Ford PA, 19317

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:

National Weather Service:

Potential Impacts

Roadways Impacted:

Dams Downstream:

Potential Impact Structures (count):

- Homes
- Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- Utilities
- Parks
- Golf Courses

Dam Number: **153004**

Dam Name: **Upper Occoquan Dam**

VAHU6: PL47,PL48

Municipalities: Fairfax County,Prince William County

Region: 1

SWCD: NORTHERN VIRGINIA,PRINCE WILLIAM

VA Senate: 39

HUC 12: 020700100802,020700100803

VA House: 42,51

Watershed Name: Occoquan River-Belmont Bay,Occoquan River/Occoquar

Congressional: 5111

USGS Topo: OCCOQUAN

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Upper Occoquan Sewage Authority Dam

Inventory Number: 059024

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1976

Dam Owner:
Matthew Brooks
(primary)(703) 830-2200(Office)
14631 Compton Rd
Centreville VA, 20121

Size Classification: Medium (>= 1000 - <50,000 ac. ft., >=40' <100')

Certificate Type: Regular Operation and Maintenance Certificate

Certificate Expiration: 11/30/2025

Days Since Last Inspection: 106

Inundation Report: Unknown

Type of Dam
Earth (Primary)

Reservoir Purpose
Other (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 1.00 Miles

River or Stream: TR-Bull Run

Technical Basics

Normal Pool Area: 54.00 Acres

Top Surface Area: 98.00 Acres

Normal Pool Capacity: 515.00 Acre-Feet

Top Capacity: 1130.00 Acre-Feet

Normal Pool Elevation: 188.00 Feet

Top Elevation: 195.00 Feet

Normal Pool Height: 34.00 Feet

Top Height: 41.00 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 0.90 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF

Required Spillway Design Flow: .90 PMP

Inspections (Last 3 Max)

Date	Type	Condition
9/22/2022	Engineer	Fair
10/18/2021	Owner	Satisfactory
9/16/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 11/01/2019
Expiration Date: 11/25/2025

Dam Location

Dam Address:
14631 Compton Road
Centreville VA, 20121

E911 Direction to Dam:
!4631 Compton road

EAP Contacts

Dam Operator: Matthew Brooks
(primary)(703) 830-2200(Office)
(primary)Matt.Brooks@uosa.org
14631 Compton Rd
Centreville VA, 20121

Dam Alternate Operator:Matthew Brooks
(primary)(703) 830-2200(Office)
(primary)Matt.Brooks@uosa.org
14631 Compton Rd
Centreville VA, 20121

Rain Gauge Observer: Matthew Brooks
(primary)(703) 830-2200(Office)
(primary)Matt.Brooks@uosa.org
14631 Compton Rd
Centreville VA, 20121

Alternate Rain Gauge Observer:Matthew Brooks
(primary)(703) 830-2200(Office)
(primary)Matt.Brooks@uosa.org
14631 Compton Rd
Centreville VA, 20121

24-Hour Dispatch Center: Lorraine Fells-Danzer
(primary)(571) 350-1728(Office)
(primary)Lorraine.Fells-danzer@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Local Government Emergency Services:Katie Kitzmiller
(primary)(703) 792-6813(Office)
(primary)k.kitzmiller@pwcgov.org
1 county complex court
Woodbridge VA, 22192

Owner's Engineer: Emmanuel Carrasco
(primary)(703) 376-5109(Office)
(primary)Emmanuel.CarrascoMercado@jacobs.com
2551 Dulles View Drive
Suite 700
Herndon VA, 20171

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Steven Shannon
(primary)(703) 259-0244(Office); (800) 367-7623(Office)
(primary)Steven.Shannon@vdot.virginia.gov
4975 Alliance Dr
Fairfax VA, 22030

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

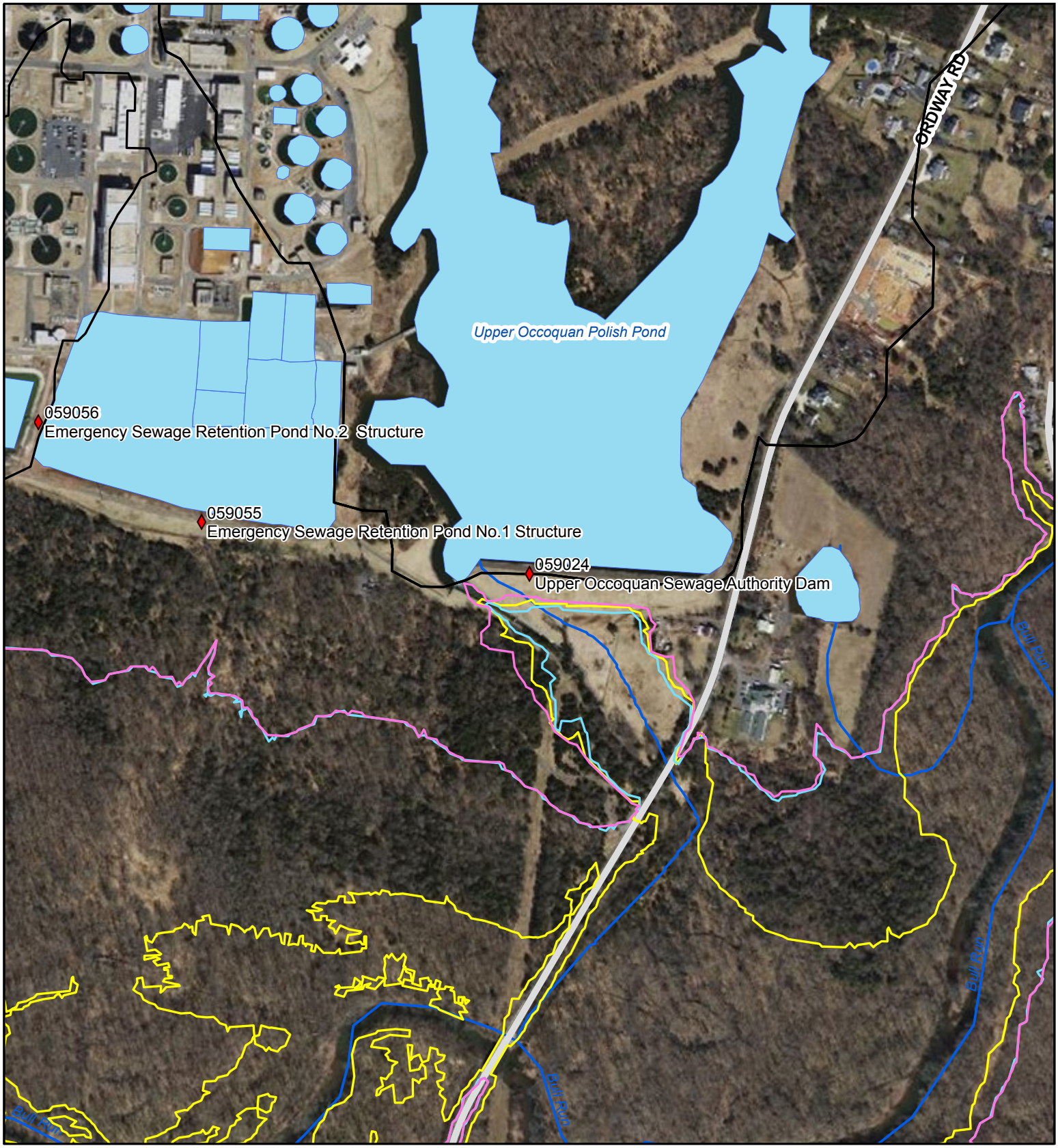
- 616 - .25 miles downstream
- 28 - 1.2 miles downstream
- 612 - 9.5 miles downstream

Dams Downstream:

Potential Impact Structures (count):

- 0 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **059024**
Dam Name: **Upper Occoquan Sewage Authority Dam**
VAHU6: PL46
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 37
HUC 12: 020700100705
VA House: 40
Watershed Name: Lower Bull Run
Congressional: 5110
USGS Topo: MANASSAS



Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: West Ox Road BMP Dam

Inventory Number: 059038

Hazard Classification: High

City/County: Fairfax County

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed:

Dam Owner:
Chad Crawford
(primary)(703) 324-5500(Office)
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 07/31/2024

Days Since Last Inspection: 156

Inundation Report: 07/19/2022

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: Miles

River or Stream:

Technical Basics

Normal Pool Area: 0.00 Acres

Top Surface Area: 0.00 Acres

Normal Pool Capacity: 0.00 Acre-Feet

Top Capacity: 142.30 Acre-Feet

Normal Pool Elevation: 0.00 Feet

Top Elevation: 340.00 Feet

Normal Pool Height: 0.00 Feet

Top Height: 25.50 Feet

Technical Hydrology/Hydraulics

Controlling PMP: Unknown

Drainage Area: 1.67 Sq. Mi.

6 Hour PMP: 0.00

Time of Concentration:

12 Hour PMP: 0.00

Weighted Curve Number:

24 Hour PMP: 0.00

IDA Spillway Reduction:

Available Spillway Design Flow: 1.00 PMF **Required Spillway Design Flow**: 1.00 PMF

Inspections (Last 3 Max)

Date	Type	Condition
8/3/2022	Engineer	Satisfactory
7/15/2021	Engineer	Satisfactory
8/13/2020	Engineer	Satisfactory

EAP Quick Reference

Approval Date: 07/12/2022
Expiration Date: 07/31/2028

Dam Location

Dam Address:
West Ox Rd
Mclearen Rd
Herndon VA, 20171

E911 Direction to Dam:
Dam Less than 500 ft south of Intersection of
West Ox and Mclearen Rd

EAP Contacts

Dam Operator: Chad Crawford
(primary)(703) 324-5500(Office)
(primary)Chad.Crawford@fairfaxcounty.gov
12000 Government Center Parkway, Suite 449
Fairfax VA, 22035

Dam Alternate Operator:Paul Reynolds
(primary)(571) 460-9515(Mobile)
(primary)paul.reynolds@fairfaxcounty.gov
10635 West Drive
Fairfax VA, 22030

Rain Gauge Observer: Bat Phone Holder Bat Phone
(primary)(571) 722-8622(Mobile)
(primary)dipmani.kumar@fairfaxcounty.gov
12000 Government Center Parkway
Suite 449
Fairfax VA, 22035

Alternate Rain Gauge Observer:VDEM EOC
(primary)(804) 674-2400(Office)
(primary)veoc@vdem.virginia.gov
7700 Midlothian Turnpike
North Chesterfield VA, 23235

24-Hour Dispatch Center: 911 Emergency Center
(primary)(703) 691-2131(Office)
(primary)DPSCBridge@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Local Government Emergency Services:Emergency Operation Center (EOC)
Fairfax County EOC
(primary)(571) 350-1000(Office)
(primary)dems@fairfaxcounty.gov
4890 Alliance Drive
Fairfax VA, 22030

Owner's Engineer:

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:Traffic Operations Center (TOC)
(primary)(703) 877-3401(Office)
(primary)Joseph.Warner@vdot.virginia.gov
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:NWS Forecaster of the Day
(primary)(571) 888-3500(Office)
(primary)Steven.Zubrick@noaa.gov
43858 Weather Service Road
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- 608 - 0.01 miles downstream

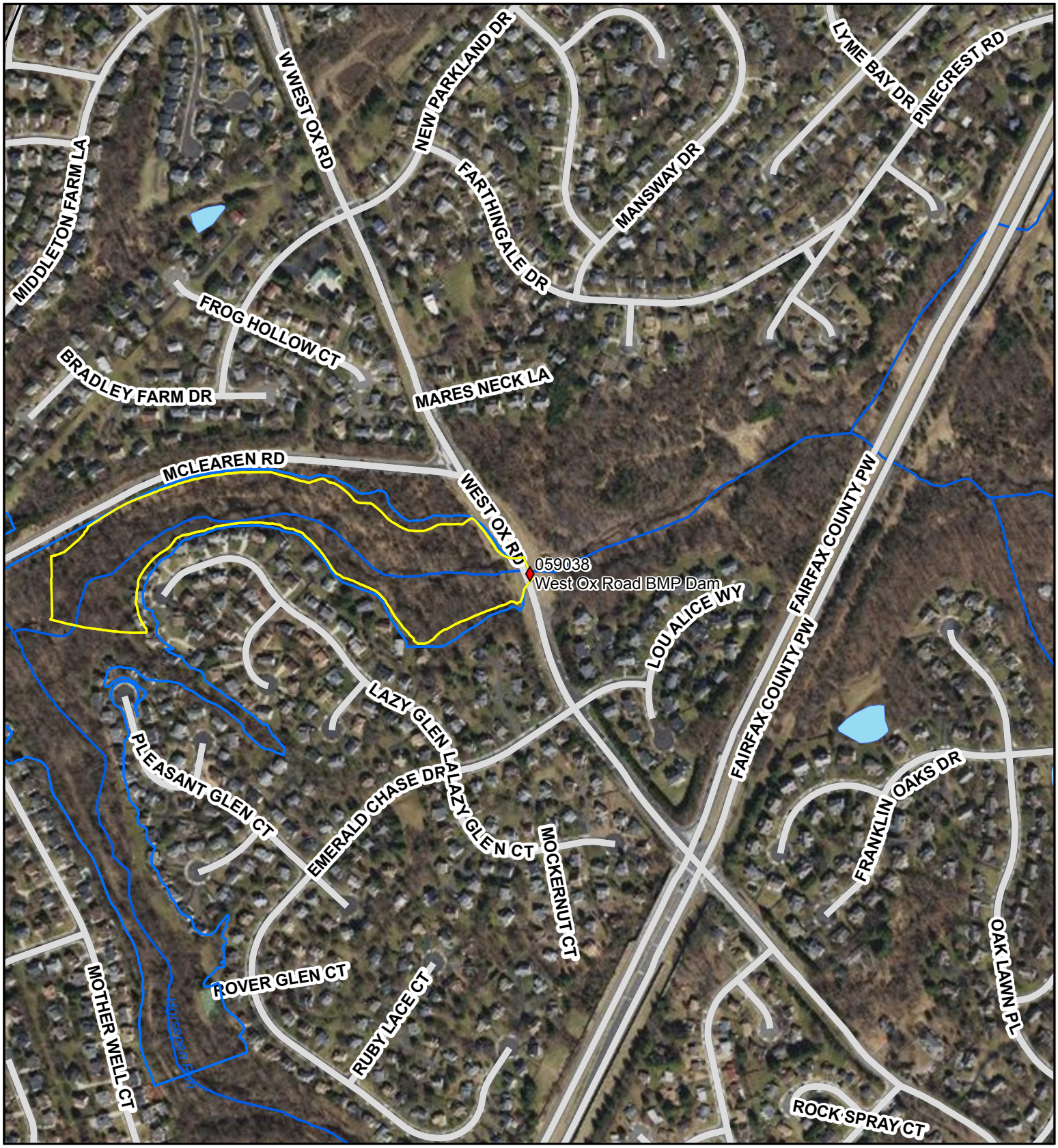
Dams Downstream:

- None

Potential Impact Structures (count):

- 5 Homes
- 0 Businesses
- 0 Schools
- 0 Hospitals
- 0 Critical Infrastructure
- 0 Railroads
- 0 Utilities
- 0 Parks
- 0 Golf Courses

Dam Number: **059038**
Dam Name: **West Ox Road BMP Dam**
VAHU6: PL18
Municipalities: Fairfax County
Region: 1
SWCD: NORTHERN VIRGINIA
VA Senate: 32
HUC 12: 020700080902
VA House: 86
Watershed Name: Horsepen Run
Congressional: 5110,5111
USGS Topo: HERNDON



Dam Locations | Waterbodies (NHD) | Interstate | State Primary Highway
Streams (NHD) | US Primary Highway | Secondary

N

Dam Safety Data Sheet

Department of Conservation and Recreation
Division of Dam Safety and Flood Plain Management
600 E Main St, Richmond, VA 23219

General

Name of Dam: Winters Branch Dam

Inventory Number: 683001

Hazard Classification: Significant

City/County: City of Manassas

Designed By:

Constructed By:

Regional Engineer: Mark Killgore

Year Constructed: 01/01/1997

Dam Owner:
Darren Branch
(primary)(703) 257-8380(Office)
8500 Public Works Drive
PO Box 560
Manassas VA, 20110

Size Classification: Small (>=50 - <1000 ac. ft., >=25' and <40')

Certificate Type: Conditional 2 Year Certificate

Certificate Expiration: 12/31/2024

Days Since Last Inspection: 588

Inundation Report: 05/26/2022

Type of Dam
Earth (Primary)

Reservoir Purpose
Flood Control or storm water management (Primary)

Type of Spillway

Type	Width	Outlet Gates

Watershed

Nearest City:

Nearest City Distance: 0.55 Miles

River or Stream: Winters Branch

Technical Basics

Normal Pool Area: 1.10 Acres

Top Surface Area: 18.00 Acres

Normal Pool Capacity: 3.60 Acre-Feet

Top Capacity: 175.00 Acre-Feet

Normal Pool Elevation: 215.00 Feet

Top Elevation: 236.00 Feet

Normal Pool Height: 6.00 Feet

Top Height: 26.50 Feet

Technical Hydrology/Hydraulics

Controlling PMP:

Drainage Area: 1.02 Sq. Mi.

6 Hour PMP:

Time of Concentration:

12 Hour PMP:

Weighted Curve Number:

24 Hour PMP:

IDA Spillway Reduction:

Available Spillway Design Flow: .50 PMF **Required Spillway Design Flow**: .50 PMF

Inspections (Last 3 Max)

Date	Type	Condition
5/27/2021	Engineer	Satisfactory
12/15/2015	Engineer	
1/23/2015	Engineer	

EAP Quick Reference

Approval Date: 09/14/2015
Expiration Date: 09/14/2021

Dam Location

Dam Address:
9601B Peony Court
Manassas VA, 20110

E911 Direction to Dam:
Dam is visible from E911 address.

EAP Contacts

Dam Operator: Bruce Goudarzi
(571) 364-1574(Mobile); (primary)(703) 257-8245(Office)
(primary)na@na.com
8500 Public Works Drive
Manassas VA, 20110

Dam Alternate Operator:

Rain Gauge Observer:

Alternate Rain Gauge Observer:

24-Hour Dispatch Center: William Garrett
(primary)(703) 257-8465(Office)
(primary)wgarrett@manassasva.gov
9324 West Street #103
Manassas VA, 20110

Local Government Emergency Services:Patrick Collins
(primary)(703) 792-5828(Office)
(primary)pcollins@pwcgov.org
3 County complex Court
Prince William VA, 22192

Owner's Engineer: Edward Umbrell, P.E.
(703) 203-9067(Mobile); (primary)(703) 468-2258(Office)
(primary)eumbrell@dewberry.com
13575 Heathcote Boulevard
Suite 130
Gainesville VA, 20155

DCR Regional Engineer:
Mark Killgore
804-396-5346
mark.killgore@dcr.virginia.gov
600 East Main Street
Richmond VA, 23219

Transportation Administrator:David Brown
(571) 220-5269(Mobile); (primary)(703) 366-1929(Office)
(primary)david.brown@vdot.virginia.gov
4975 Alliance Drive
Fairfax VA, 22030

National Weather Service:Chris Strong
(703) 260-0107(Office); (primary)(703) 996-2200(Office)
(primary)Christopher.Strong@noaa.gov
43858 Weather Service Rd.
Sterling VA, 20166

Potential Impacts

Roadways Impacted:

- Godwin Drive / Hastings Drive - 0.6 miles downstream
- Prince William Parkway - 1.2 miles downstream

Dams Downstream:

- 000000

Potential Impact Structures (count):

- 30 Homes
- 2 Businesses
- Schools
- Hospitals
- Critical Infrastructure
- Railroads
- 1 Utilities
- Parks
- Golf Courses

Dam Number: **683001**
Dam Name: **Winters Branch Dam**
VAHU6: PL34
Municipalities: City of Manassas
Region: 1
SWCD:
VA Senate: 29
HUC 12: 020700100504
VA House: 50
Watershed Name: Broad Run-Rocky Branch
Congressional: 5110
USGS Topo: INDEPENDENT HILL