Central Shenandoah Regional Wildfire Protection Plan 2020

Prepared by the:
Central Shenandoah
Planning District Commission

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ACKNOWLEDGEMENTS

The Central Shenandoah Regional Wildfire Protection Plan (CSRWPP) was a created through a collaborative effort involving local, regional, state, and federal organizations, and local stakeholders. Technical assistance was provided by the staff of the Central Shenandoah Planning District Commission. The Federal Emergency Management Agency's Pre-Disaster Mitigation Grant Program (PDM) provided funding for this planning project.

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TABLE OF CONTENTS

List of Communities Profiled:

Augusta County

Bath County

Highland County

Rockbridge County

Rockingham County

City of Buena Vista

City of Harrisonburg

City of Lexington

City of Staunton

City of Waynesboro

Town of Bridgewater

Town of Broadway

Town of Craigsville

Town of Dayton

Town of Elkton

Town of Glasgow

Town of Goshen

Town of Grottoes

Town of Monterey

Town of Mount Crawford

Town of Timberville

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Section 1: INTRODUCTION

1.1 Purpose

The Central Shenandoah Region (CSR) is in the western part of Virginia and nestled in the Appalachian Mountains. Forests and wildlands are found throughout the Region and include the Shenandoah National Park, the George Washington and Jefferson National Forests, several State Forests, State Parks, and privately-owned properties. Development by communities throughout the Region has encroached these wildland and forested areas causing a higher risk of damaging wildfires in this Wildland-Urban Interface (WUI) zone. Natural factors such as topography and weather conditions also increase the risk of wildfire throughout the Region.

The purpose of this regional plan is similar to that of Community Wildfire Protection Plans. It is to provide a strategy to decrease the vulnerability to wildfires that may occur in the Region. The plan consists of several components including hazardous fuels reduction and fire prevention, vulnerability mitigation, and effective response to incidents that occur. This plan identifies issues and outlines prioritized actions to mitigate wildfire risks.

In 2003, the Healthy Forests Restoration Act (HFRA) (P.L. 108-148) was created to reduce the destructive threat from wildfires. Through this Act, community level wildfire planning and risk assessment began with the creation of Community Wildfire Protection Plans (CWPPs). The CWPP process enables communities to be more involved in determining their Wildland Urban Interface and address wildfire vulnerability through wildland fire and fuels mitigation provided through the HFRA legislation. Using an approach with a wider scope, the Central Shenandoah Regional Wildfire Protection Plan (CSRWPP) serves as the entry point to wildfire mitigation planning for communities in the Region. It is hoped that the Hazard and Risk Assessment and Mitigation Strategies developed in this plan at the regional level will serve as a springboard for community-level planning.

1.2 Need

Much of the Region is located or adjacent to wooded areas that serve as sources of fuels for wildfire. Values at risk in the area consist of human lives, property, and infrastructure that are located predominantly within the rural areas of the CSR.

The heavy vegetation and the terrain of the Appalachian Mountains can facilitate the rapid spread of wildfire, as evidenced by the 2012 Easter Complex fires which resulted in excess of 39,000 acres burned, including over 5,000 acres of private land.

This Plan aims to provide an assessment of the risks of wildland fire in the Region and to outline specific mitigation strategies to help reduce this vulnerability. This planning process also serves as an educational tool to make the public aware and provide actional steps that can be taken that lessen the risk.

1.3 Planning Process

A collaborative process was used to create the CSRWPP. This process involved a Steering Committee, public input, and resources from state and federal governments. The Steering Committee included local fire personnel and other staff, staff from relevant state and federal agencies, and citizen stakeholders who reside in woodland communities. The Steering Committee used a combination of public input, analytical data, and other resources to create the Plan with an emphasis on fuel reduction and structural ignitability. Public input was gathered at community events in the Region and through an on-line survey. For results of the survey, please see the survey report that can be found in the appendices section of the plan. The delineation of a region-wide Wildland Urban Interface (WUI) was also part of the planning process. As mitigation strategies, including fuel reduction are implemented, areas in the WUI will be the first areas of importance. Public input suggests awareness of the wildfire risks associated with living in woodland areas is needed. Education regarding mitigation and landscaping methods that can be used to reduce the risk is also needed. This plan begins a long-term journey to make the Central Shenandoah Region wildfire-resistant.

1.4 Regulatory Framework

The Central Shenandoah Regional Wildfire Protection Plan is not a legal document, but rather a planning document that covers multiple jurisdictions. There is no legal requirement to implement the recommendations made in the plan. Actions on public lands will be subject to applicable federal, state, and local policies and procedures. Action on private land may require compliance with each jurisdiction's land use codes, building codes, and local covenants. There are several federal legislative acts that set policy and provide guidance to the development of local CWPPs which were also considered in this regional plan:

· Healthy Forests Restoration Act (HFRA) (2003) – The purpose of this act is to:

1. Reduce wildfire risk to communities, municipal water supplies, and other at-risk Federal land through a collaborative process of planning, prioritizing, and implementing hazardous fuel reduction projects;

2. to authorize grant programs to improve the commercial value of forest biomass (that otherwise contributes to the risk of catastrophic fire or insect or disease infestation) for production electric energy, useful heat, transportation fuel, and petroleum-based product substitutes, and for other commercial purposes;

3. to enhance efforts to protect watersheds and address threats to forest and rangeland health, including catastrophic wildfire across the landscape;

4. to promote systematic gathering of information to address the impact of insect and disease infestations and other damaging agents on forest and rangeland health;

5. to improve the capacity to detect insect and disease infestations at an early stage,

particularly with respect to hardwood forests; and

6. to protect, restore, and enhance forest ecosystem components.

· National Fire Plan and 10-year Comprehensive Strategy (2001) – The strategy emphasizes measures to reduce the risk to communities and the environment and provides an effective framework for collaboration to accomplish this. An open, collaborative process among multiple levels of government and a range of interests will characterize the fulfillment of this strategy. The end results sought by all stakeholders are healthier watersheds, enhanced community protection, and diminished risk and consequences of severe wildland fires. The primary goals of the 10-year comprehensive strategy are:

1. Improved Prevention and Suppression
2. Reduce Hazardous Fuels
3. Restore Fire Adapted Ecosystems
4. Promote Community Assistance

This community-based approach to wildland fire issues combines cost-effective fire preparedness and suppression to protect communities and the environment with a proactive approach that recognizes fire as part of a healthy, sustainable ecosystem.

· Federal Emergency Management Agency (FEMA) Disaster Mitigation Act (2000) – The act provides the legal basis for FEMA mitigation planning requirements for State, local and Indian Tribal governments as a condition of mitigation grant assistance. It also provides an opportunity for States, Tribes, and local governments to take a new and revitalized approach to mitigation planning. Local mitigation plans must demonstrate that proposed mitigation actions are based on sound planning process that accounts for the inherent risk and capabilities of the individual community.

1.5 Mission, Vison, and Goals

Mission: The mission of the Central Shenandoah Regional Wildfire Protection Plan (CWPP) is to undertake a proactive planning process that empowers citizens and protects firefighters by developing mitigation strategies and promoting safety measures within and surrounding the Wildland Urban Interface (WUI). This Plan will incorporate collaboration, prioritize fuel reduction, and recommend structural ignitability reduction strategies as part of the planning process.

Vision: Those involved in the planning process envision a Region that consists of citizens and first responders educated about the Wildland Urban Interface, designated Firewise Communities region-wide, and the existence of a healthier forest. As a result of the plan, mitigation projects, education and outreach programs, prioritized fuel reduction, and reduction of structural ignitability will be introduced to the area.

Goal Statements:

- Increase the safety of Firefighters and other Emergency Responders.
- Increase the awareness and implementation of wildfire mitigation in the WUI and other forested areas by its residents.

- Develop Firewise Communities throughout the region.
- Create a public that is more aware of wildfires.

To achieve these goals, activities may involve:

- Citizens
- Elected officials
- Community planning and zoning
- Federal, state, and local government
- Local Fire and Rescue Departments and volunteer fire companies

Reaching these goals provides the following benefits:

- Increased safety and protection of life and property.
- Financial incentives for taxpayers.
- Reduced demand for local, state, and federal resources and staff.
- Conservation of the forest and other valuable natural resources.

The following conditions must exist to reach these goals:

- Buy-in from local government staff and elected officials.
- Citizens prioritizing wildfire prevention and mitigation.
- Communication of planning and implementation processes by the media and other sources.
- Easy access to information about the plan, as well as programs and projects that follow the planning process.
- Availability of the necessary financial support and other resources.

Goal Benchmarks include:

- More incentives for the public to implement mitigation projects.
- Additional Firewise in the Region.
- Positive media coverage.
- Firewise or similar projects taking place throughout the Region, such as a Community Clean-up.
- Mitigation as a constant activity throughout the Region, especially in the Wildland Urban Interface (WUI) areas.
- Fewer fires and less property damage.

Section 2: WILDLAND FIRE MANAGEMENT PRIMER

Wildland fire is defined as a non-structure fire that burns wildland fuels. There are three distinct types of wildland fires; wildfire, wildland fire use, and prescribed fire. A wildfire is an unplanned, unwanted wildland fire that includes unauthorized human-caused fires, escaped prescribed fire projects, escaped wildland fire use events, and all other wildland fires where the objective is to put the fire out. Wildland fire use is the application of the appropriate management response to naturally-ignited wildland fires to accomplish specific resource management objectives. A prescribed fire is a planned fire ignited by land managers to accomplish resource management objectives.

2.1 Wildland Fire Behavior

Fire Behavior

Fire behavior describes how a fire burns, where it burns, how fast it travels, how much heat it releases, and how much fuel it consumes.

Combustion and Heat Transfer

Oxygen, heat, and fuel must be present in a proper combination for a fire to ignite and initiate combustion. Fire releases heat through combustion. The change a fire goes through is organized into five phases of combustion; pre-ignition, flaming combustion, smoldering combustion, glowing combustion, and extinction. Convection, radiation, and conduction transfer the heat produced during combustion to other fuels. Fire intensity measures the rate of heat released by the fire.

Fire Spread

There are four ways that wildland fires spread from one area to another.

1. Ground Fires - restricted to the layer of duff, roots, and buried or partially buried dead and decaying logs.
2. Surface Fires - spread through fuels on the forest surface, such as small trees, shrubs, vegetation, and litter.
3. Crown Fires - spread through the aerial strata of the forest, mostly independent of surface fires.
4. Spotting - occurs when fire brands (hot wood embers) are transported naturally by wind, convection, or gravity beyond the main perimeter of the fire.

Fire Growth

The growth of a fire follows a similar cycle regardless of fire type, size, or intensity. A wildland fire will move from ignition through an initiation state, during which rate-of-spread accelerates to a steady state. The initiation state of a fire is the period after ignition until a fire reaches a steady rate of spread. Wildland fire generally starts from a single ignition point, such as a lightning strike, match, or spark. During the initiation stage, there is a build-up of heat and the fuel present at the point of origin is consumed. The fire will begin to expand its perimeter outward. If all fuel conditions remain constant, the fire perimeter will expand at an accelerating rate for 10 to 30 minutes, at which point the rate of spread reaches a steady state. The flaming zone moves at a nearly constant rate with the same intensity. The steady state rate of spread is maintained as fuel, weather, and topographical conditions remain stable;

although stable conditions are unlikely to occur in wildland fires.

Extreme Fire Behavior

The level of fire behavior that goes beyond human methods of fire control and prediction is known as Extreme Fire Behavior. Extreme Fire Behavior accounts for the most fire-related injuries and fatalities. Characteristics of Extreme Fire Behavior include: very high to extreme rates of spread; prolific crowning and torching; fire whirls; tall, well-developed convection columns; long flame lengths; and excessive spotting. Fire whirls are spinning vertical vortices of hot air and gases rising from a fire carrying embers, flames, smoke, and debris that can have a diameter of less than one foot to more than 500 feet and have the intensity of a small tornado. Extreme Fire Behavior results from topography, abundant available fuels, low relative humidity, drought, atmospheric instability, and/or strong winds

2.2 Fuels

Fuel is all plant material (living and dead) that can be ignited by a fire. Fires vary widely in the kind of fuels that burn; the total amount of fuels that burn; and the intensity at which these fuels burn. It is the fuel consumption characteristics that determine peak temperatures reached, duration of heat, and stratification of heat above and below the soil surface.

Fuel Categories

- Ground fuels consist of organic soils, forest floor duff, stumps, dead roots, and buried fuels. Ground fuels lie below the litter layer or within soil and can ignite and smolder for days to months following flaming front passage. Ground fires produce persistent and harmful smoke and can re-ignite surface fuels.
- Surface fuels consist of the litter layer, downed woody materials, and dead and live plants up to six feet in height, which are considered understory plants. The availability of surface fuels is determined by particle size, horizontal continuity, moisture content, compactness, and fuel type.
- Ladder fuels consist of vine or liana fuels and draped foliage fuels. Ladder fuels provide vertical continuity between understory, mid-story, surface fuels, and canopy fuels. Another important type of ladder fuel can be draped dead foliage, especially pine needle litter on vines or shrubs. Following storms in forests, such as hurricanes, tornadoes, or ice storms, hanging branches can become important ladder fuels.
- Canopy fuels consist of the crowns of the trees that form the overstory.

Physical Fuel Properties

Combustion and fire behavior are influenced by physical fuel properties such as size, shape, loading, and arrangement.

- Particle size is an important characteristic because the larger the particle, the more heat that is needed to ignite and combust the particle. Smaller particles have low heat capacities and require smaller amounts of heat energy for ignition and combustion.
- Fuel shape is determined by a surface area-to-volume ratio. Fuels with high surface area-to-volume ratios, such as foliage fuels and pine needle litter, have lower heat capacity and ignite more rapidly that fuels with small surface

area-to-volume ration fuels like downed logs.

- Fuel loading, which is expressed in weight per unit area, is the amount of live and dead fuel. Site productivity, recent disturbance history, and fire regime cause fuel loads to vary considerably. Disturbances can include removing or adding fuel such as in fires or hurricanes. Higher fuel loads exist in long-unburned stands compared to stands that have been managed with prescribed fire.
- Fuel arrangement consists of two aspects: packing ration and fuel placement. Loosely packed fuels allow for rapid ignition and combustion compared to densely packed fuels. Placement of fuel is also a factor because fuels placed within the flaming zone are the ones that will be combustible.

Fuel Moisture

Fuel moisture can significantly affect fire behavior. More specifically, moisture determines how much fuel is available for burning and how much is consumed. Moisture absorbs heat from combustion making it less available for ignition. Fuel moisture content also affects fire severity and smoke generation.

2.3 Fire Weather

Weather is defined as the state of the atmosphere described in terms of temperature, humidity, stability, pressure, wind speed and direction, clouds, and precipitation. Fire behavior can be controlled by the interaction of weather elements. Fire weather consists of examining the atmosphere's current state between the surface and five to ten miles above the surface and seeing how the change in this state will affect and impact fires. Knowledge of fire weather in conjunction with information on fuels and topography can allow for the assessments of potential fire behavior and danger.

Air Temperature

Air temperature directly influences many other weather elements including moisture, stability, wind speed, and direction. Air movement is caused by differences in temperature that create differences in air density and atmospheric pressure.

Atmospheric Moisture (Humidity)

Atmospheric moisture directly affects the flammability of forest fuels. Indirectly, atmospheric moisture also affects other fire behaviors because of its relationship to other weather factors. For example, moisture is necessary for the development of lightning which, particularly in mountainous areas, can cause a wildfire.

Atmospheric Stability

Atmospheric stability is the resistance of the atmosphere to vertical motion and can greatly affect fire behavior. Indicators of stability include wind flow characteristics, type of cloud, time of day, and the season.

Wind Speed and Direction

Wind speed and direction also affect fire behavior. General winds, convective winds, air masses, and fronts are several types of winds that are factors.

- General Winds, which are also known as winds aloft, are caused by broad scale circulation patterns high above the earth. Large scale convective circulation between the Equator and the polar regions and the rotation of the earth on

it's axis result in these general winds that circulate air throughout the atmosphere. Vegetated areas and forests contribute to air turbulence.

- Convective Winds originate from local temperature differences and may be strengthened, weakened, or eliminated by general winds. Familiar convective winds include: winds associated with convective cumulus and thunderstorm clouds; land and sea breezes; whirlwinds; and valley and slope winds.
- An Air Mass is a large body of air with only small horizontal variations of temperature, pressure, and moisture. The boundaries between two air masses of different temperatures is called a front. Day-to-day fire weather depends on either the character of the prevailing air mass or the interaction of two or more air masses.

Clouds and Precipitation

Clouds and precipitation are also indicators of fire weather. Clouds are visible evidence of atmospheric moisture and motion. The formation of clouds is caused by the condensation of water vapor. Clouds are classified by their structure, stratus or cumulus; altitude, high, middle, or low; and their vertical development. When cloud droplets grow to sizes large enough, precipitation occurs. The beginning, ending, and severity of local fire seasons is controlled by the amount and seasonal distribution of precipitation.

Thunderstorms, Lightning, and Tornadoes

Thunderstorms are violent local storms produced by a cumulonimbus cloud and are accompanied by thunder and lightning. They represent extreme convective activity in the atmosphere with their updrafts and downdrafts reaching high speeds. Mature stage thunderstorms are important in fire control because they start fires by lightning, blow them out of control with downdraft and outflow, or put them out with rain.

Conditions necessary for thunderstorm development:

- Conditionally unstable through a deep layer of air.
- Some mechanism to release the instability, such as orographic or frontal lifting, low-level converging flow, or heating below.
- There are three lifting process which can act singly or together:
  1. Convection is a common process by which the air is lifted when the atmosphere is unstable. For example, surface heating can make lower levels of the atmosphere unstable during the daytime. Because wildland fires can also be a source of heat, they can also initiate convection, produce clouds, and even rare showers.
  2. Orographic Lifting is an important process along the Appalachian Mountains where layers of air that flow in response to pressure gradients are lifted up over the mountains. In an unstable atmosphere this process can cause the flow of air to keep rising to the condensation level and for clouds to form.
  3. Frontal Lifting is like orographic lifting but instead of being lifted by sloped topography it is lifted by the slope of a heavier air mass.
  - Sufficient moisture in the air. Without this moisture, even if other factors are in place, thunderstorm development is unlikely.

Stages of Development for a Thunderstorm:

Thunderstorms are composed of one or more individual convection cells. A storm composed of a cluster of cells will contain cells in various stages of development and decay. The life cycle of each cell can be from 20 minutes to 1 1/2 hours in duration. For clusters of cells, the process may last for 6 hours or more.

The three stages of development and decay of a cell:

1. Cumulus Stage - a cumulus cloud grows into a cumulonimbus and cloud droplets grow to raindrop size. This stage causes very little effect to surface weather, but if an updraft passes over a going fire it can cause it to become active.
2. Mature Stage - the beginning of this stage is marked by the start of rain. In the mature state, the convection cell · reaches its maximum height. The visible cloud top flattens to an "anvil" shaped top. The mature stage is the most intense period of the thunderstorm. Maximum lightning frequency, heavy rain, and strong gusty winds at ground level are typical.
3. Dissipating Stage - downdrafts continue to develop but updrafts weaken. When the entire thunderstorm cell becomes an area of downdrafts it enters the dissipating stage. Finally, the downdraft then weakens and the rainfall lessens and stops.

Types of Thunderstorms:

- Frontal Thunderstorms are caused by warm, moist air being forced over a wedge of cold air.
- Air Mass Thunderstorms are scattered or isolated and may be further classified as convective or orographic, although these lifting processes often act together.
- High Level Thunderstorms, also known as dry thunderstorms, are especially important because of their ability to start fires. The cloud bases of these storms are so high that precipitation is mostly or totally evaporated before it reaches the ground. This results in lightning striking the ground and starting fires in dry fuels.

Lightning occurs in a thunderstorm when a strong enough electrical potential builds up to exceed the resistance of the atmosphere to a flow of electrons between the centers of opposite charge. Sometimes lightning can occur in the cumulus stage but it reaches its greatest frequency and height when the cell reaches maturity. The start of rain beneath the cloud base, when the cell begins the mature stage, marks the onset of the greatest lightning danger.

Severe thunderstorms can create the environment favorable for the development of Tornadoes. A tornado is a violently whirling storm whose destruction is caused by very strong winds and extremely low pressures. Tornadoes have the potential to blow down timber in forested areas which creates higher wildland fire hazards.

2.4 Prescribed Fire

Prescribed fire is used to accomplish many resource management objectives, such as ecosystem maintenance, hazardous fuels reduction, plant species diversity, noxious and invasive weed abatement, and wildlife habitat improvement. Multiple resource management objectives are often achieved concurrently. The use of prescribed fire in the Wildland Urban Interface (WUI) is carefully planned, enacted only under favorable weather conditions, and must meet air quality requirements. Prescribed fire may be broadcast over a defined area or concentrated in localized burn piles. Broadcast burns are used to simulate naturally occurring fire but they only occur under carefully pre-planned and specified conditions. Pile burns are the use of fire to dispose of concentrations of non-merchantable, woody fuel that are collected after a mechanical treatment. Pile burning is utilized when cost or issues of access make other methods of disposal unrealistic.

2.5 Wildland Urban Interface (WUI)

A WUI is where vegetative fuels that are potentially flammable are adjacent to or overlap with homesites and other infrastructure. A WUI fire is not a singular kind of fire; instead it is a combination of both wildland and structural fires. As time has progressed, there has been an increase in urbanization and population densities leading to an increase of dispersed development happening in fire adapted landscapes. Converting former rural lands into developed lands has disrupted the landscape and raised wildfire risks, thus increasing the need for more awareness on WUI fires.

Special Considerations

Traditionally, wildland fires and structural fires are each treated differently by firefighting organizations. But with increased Wildland Urban Interfaces, the two types of firefighting are merging, and both structural and wildland firefighters are working side-by-side. This teamwork is also present for suppression and prevention activities. Firefighters that treat WUI fires have multiple scenarios that need to be taken into consideration; like fire-induced hysteria, toxic fertilizers, pesticides and herbicides, and gas, propane, and other above ground flammable liquids. WUI fire behavior also presents a unique case for firefighters, seeing as WUI fires consist of fire patterns from both man-made structures and vegetation burning. A plant's characteristics and arrangement, such as dry vegetation on steep slopes with the additive of high wind, can influence the fire behavior through increasing fire intensity and rate of spread. As for structural fires, construction materials are heavier with low fuel moisture which helps flame residence times last longer. Interagency cooperation and collaboration are paramount. Firefighting agencies on the local, state, and federal levels must work together effectively.

Mitigation

One of the main ways to help reduce loss of life, property, and resources is to have planners, developers, fire agencies, and homeowners working together to define, enforce, and maintain fire safety standards that are reasonable. But barriers may arise that disrupt planned fire mitigation. In most cases these barriers consist of the residents'

resistance to future plans regarding fire safety. Rather than taking precautions residents may prefer to wait until the event happens, or some residents may think that WUI fires are innately uncontrollable, thus the damage resulted deemed random—which in turn lessens investments for firefighting. There are multiple sources available that outline programs and standards of fire safety, fuel management, and risk assessments for WUI fires. But in the end, actually experiencing a wildfire may be the only modifier of risky behavior (Beebe and Omi, 1993).

Risk Assessments

Many variants are encompassed in risk assessments. In making risk assessments, localities and homeowners find areas of improvement and organization for being prepared for fires, like looking into new ways to guide community development, finding assistance with landscaping and home design, and creating treatment plans for fuel modification. Home traits and surrounding environments also play a role in the risk of fires and should be subjects investigated when creating assessments; like knowing the types, arrangement, size, and volume of vegetative fuels. The most efficient and cost-effective time to make preparations to protect the home and other structures from fire is during initial development of a wildland property. In Virginia, the Department of Forestry has taken proactive steps and developed a Geographic Information Systems (GIS) model. This model portrays wildfire risk areas in conjunction with areas of high populations and forest covers. Synthesizing this information and the different spatial relationships that exist allows the Department of Forestry to concentrate on the correct resources needed, provide the right prevention education, and provide emergency response efforts to the places of greatest risk. As with mitigation, there are resources available to help homeowners assess and rank the risk for their individual homes and properties.

Fuel Management

Finding ways to reduce and alter the way vegetative fuels can be used by fires is also an important aspect of WUI fires. Fuel management works to amend the hazard posed by vegetation and structures. Such modifications include reducing the fuels available—either living or dead plants—through prescribed fire or other methods, creating defensible space, and modifying structural features.

<u>Fuel reduction methods can include</u>:

- Prescribed burning is the measured application of fire to help achieve land management goals. In some instances, it can encourage the growth of native plants and enhance habitats.
- Herbicides tend to have longer lasting effects on the vegetation. There are also cases in which, up to a few years, they can't reduce the dead vegetation accumulations.
- Mechanical Fuel Treatments include mowing, disking, roller chopping, and removing vegetation by hand.

<u>Defensible Space</u> can be described as an area of tailored vegetation situated between wildland fuels and structures. With the presence of defensible space, fire intensities can be reduced, and it can make fighting the fire more manageable for firefighters when they arrive to the scene.

Structural Features can be modified in ways such as different landscaping and use of fire-resistant construction materials.

Different landscaping techniques, such as spacing plants carefully and pruning plants regularly, can help reduce and remove excess vegetation that would be readily used as fuel if a fire occurred. Using fire resistant construction materials can also help mitigate the spread of fire upon occurrence—materials like dual or triple pane glass on windows and doors and sprinkler systems.

2.6 Hazardous Fuels Mitigation

Wildfire behavior and severity are dictated by fuel type, weather conditions, and terrain. Because fuel is the only variable of these three that can be practically managed it is the focus of many mitigation efforts. The objectives of fuels management may include reducing surface fire intensity, reducing the likelihood of crown fire initiation, reducing the likelihood of crown fire propagation, and improving forest health. These objectives may be accomplished by reducing surface fuels, limbing branches to raise canopy base height, thinning trees to decrease crown density, and/or retaining larger fire-resistant trees.

By breaking up vertical and horizontal fuel continuity in a strategic manner, fire suppression resources are afforded better opportunities to contain wildfires and community assets will have an increased probability of survival. In addition to the creation of defensible space, fuel breaks may be utilized to this end. These are strategically located areas where fuels have been reduced in a prescribed manner, often along roads. These fuel breaks may be associated with or tapered into larger area treatments. When defensible space, fuel breaks, and area treatments are coordinated, a community and the adjacent natural resources are afforded an enhanced level of protection from wildfire.

Improperly implemented fuel treatments can have negative impacts in terms of ecosystem health and fire behavior. Mowing or prescribed fire improperly applied in grasslands can degrade the health of indigenous species and create openings for invasive species. Some brush species respond to mechanical treatment with vigorous re-sprouting unless combined with additional cuttings, prescribed fire, or chemical treatment. Thinning forest stands in wind prone areas too rapidly can result in subsequent wind damage to the stand. Thinning can also increase the amount of sun and wind exposure on the forest floor, which can increase surface fire intensity if post treatment debris disposal and monitoring are not properly conducted. The overall benefits of properly conducted mitigations treatments are, however, well documented.

2.7 History of Fire

Overview

Fire holds several purposes throughout history ranging from economic and political to ecological. As history has progressed, fire frequencies and regimes have been influenced by social, political, and economic changes, fluctuations in human population densities, and changes in technology. In the late 19th and early 20th century, major transitions were seen in fire regimes in part

by the creation of the US Forest Service and shifts in federal policy from fire suppression to fire management. The current relationship with fire is practicing fire management; fire is now used to achieve land management goals. These fire management policies were a response to unhealthy environmental conditions that were a result from acts of fire suppression.

Human Use of Fire in Prehistory and History

Natural fire regimes, like lightning-caused fires, existed well before the arrival of Native Americans 12,500 years ago. It is believed that the presence of Native Americans caused an increase in fire frequency, as well as expansion of the seasonality of natural fires in ecosystems that they inhabited. General patterns can be seen in the ways that Native Americans utilized fire, but variations showed up by regions due to environmental differences as well as behavioral and demographic differences; though overall, the majority of intentional burns were done with low intensity surface fires. Fire regimes were molded by environmental condition changes, settlement patterns, and human population densities (Guyette and Dey, 2000). As time passed, ecosystem management practices changed – including the use of fire by Prehistoric Native Americans – and led to carrying capacities and human population densities increasing in Southern landscapes.

Social and environmental changes occurring during the historical era created major modifications for fire regimes. While Native Americans continued fire use for farming and hunting, the fires increased, and fire regimes changed as more European settlers came into the territories in response to trade establishments, migration, and conflicts. More changes to fire regimes came in the form of differing land management practices introduced by the Western settlers. Burning practices soon evolved to become a mixture of European burning traditions, Native American burning practices, and elements of experimentation in the new environments. The decline in Native American population and Indian fires during the historic era had a significant impact on vegetation. As time passed, land management practices of European settlers varied from those of the Native Americans. Drastic changes in these fire regimes appeared as settler populations grew in the late 1800s and the beginning of the Industrial Revolution. Fires went from low intensity brush fires to industry-created high intensity fires.

The Period of Fire Suppression and Other Fire Regimes (1890s-1980s)

The fire suppression movement was led by the founder of the Forest Service, Gifford Pinchot. Emerging in the late 1800s, this movement viewed fires as destructive for forests – in part through the environmental damages brought on by industrialization and the accompanying wildfires – and in order to conserve the forests fires were prohibited. In 1944, the campaign for this movement gained an effective symbol for promotion, Smokey Bear. Smokey Bear taught generations of Americans forests were harmed by all kinds of fire. But there was not full support for this movement. Different agencies advocated other methods for land management like light burning or Indian fires; though the forest service experimented with some of these ideas, they later ruled them to still be a threat. Fire regimes were shifted as a result of the movement, more specifically there

were longer fire return intervals – the number of years between two successive fires in a specified area. For example, The Great Smokey Mountains National Park saw fire return intervals increase from 10-40 years during the Euro-American settlement period (1856-1940) to 2000 years during the fire suppression era (1940-1979). With fire occurrences becoming less common the existing composition of Southern landscapes saw great change, like thicker understories developing, species being replaced, or regeneration or disappearance of vegetation species.

Fire Management (1940s-Present)

Land managers, scientists, and policy makers took notice that forests and fields were changing in adverse ways, thus after many decades the fire suppression era was replaced by the fire management era. The fire management era continues through the present, but its reintroduction happened in a piecemeal manner across the South. Fire management is an approach to land management where prescribed fire is utilized to replenish and help preserve healthy ecosystems. The previous fire exclusion had caused problematic accumulation levels of vegetative fuels, as well as undesirable plant species. In 1943, Osceola National Forest was the first federal property that saw a prescribed fire since the fire suppression era. After World War II, prescribed fires became increasingly common. To determine reasonable fire regimes, scientific researchers with federal, state, and private agencies experimented with prescribed burning in a variety of ecosystems. The problems created by the fire exclusion policies are being addressed by land managers through programs that use fire, thinning, and herbicides to manage fuel levels. Millions of acres are burned in the South each year to help restore ecology, reduce hazards, and improve wildlife habitat.

Fire fighters creating a fire break and fire reaching the edge of a roadway during the Goshen Pass Wildfire in April 2017.
Photos: Virginia Department of Forestry

Section 3: COMMUNITY PROFILES

List of Communities Profiled:

Augusta County

Bath County

Highland County

Rockbridge County

Rockingham County

City of Buena Vista

City of Harrisonburg

City of Lexington

City of Staunton

City of Waynesboro

Town of Bridgewater

Town of Broadway

Town of Craigsville

Town of Dayton

Town of Elkton

Town of Glasgow

Town of Goshen

Town of Grottoes

Town of Monterey

Town of Mount Crawford

Town of Timberville

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Augusta County

3.1 Locality Setting

Augusta County, formed from Orange County in 1738 and named for Augusta, Princess of Wales and mother of King George III, is the second largest county in Virginia; encompassing 968 square miles of diverse terrain. There are seven magisterial districts within the County. Staunton and Waynesboro are independent cities, and Craigsville is an incorporated town within the County's boundary.

Augusta County is centrally located in the historic and scenic Shenandoah Valley in west-central Virginia. The City of Staunton is an important educational, retail, commercial, and governmental center; while The City of Waynesboro is a significant commercial and industrial nucleus. Augusta County, Staunton, and Waynesboro share similar characteristics and are economically interrelated.

Augusta County is bounded on the west by the lower elevations of the Allegheny Mountains and on the east by the crest of the Blue Ridge Mountains. The County is surrounded by the Virginia counties of Albemarle, Bath, Highland, Nelson, Rockbridge, and Rockingham, as well as Pendleton County, West Virginia. The headwaters of two major rivers, the James and the Potomac, are located in Augusta County.

Interstates 81 and 64 intersect at the eastern edge of the city limits of Staunton. Augusta County is approximately 85 miles north of Roanoke; 100 miles west of Richmond; 150 miles southwest of Washington, D.C.; 200 miles northwest of the Port of Hampton Roads; and 190 miles north of Greensboro, North Carolina. The Augusta County-Staunton-Waynesboro area is approximately midway between New York and Atlanta.

The County had an estimated population of 74,997 people as of 2016. According to 2015 estimates there were 28,150 occupied housing units within the County. Approximately 22,341 of these units are occupied by owners, with another 5,809 units occupied by renters.

3.2 Climate

Augusta County is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The County has an average annual temperature of 52.3 degrees Fahrenheit. The average high temperatures are 43.3 degrees Fahrenheit in January and 85.1 degrees in July. The average low temperatures are 21.5 degrees in January and 61.6 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the north-west. The growing season is 175 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the County is 36 inches and 26 inches is the average annual snowfall.

3.3 Topography

Augusta County lies within the Valley and Ridge Physiographic Province, which is characterized by long, parallel, narrow, and even crested ridges above intervening, varying sized valleys. The Valley and Ridge Province was developed in a Paleozoic basin where thick sedimentary deposits were extensively folded and thrust faulted. The long axes of these folds determined the Ridge and Valley Alignments. The strike ridges of the province are underlain by sandstones, quartzites, and shales, while less resistant limestones, dolomites, and shales underlay the valleys. Elevations in the valleys range from 1,050 to 1,800 feet asl.

The extreme eastern edge of Augusta County is within the Blue Ridge Physiographic Province, distinguished by sharp mountain peaks. The Blue Ridge is underlain by ancient continental basement rocks that were faulted, uplifted, and deformed during three discrete periods of mountain formation.

Because of the rolling nature of the terrain, steep slopes can be found throughout Augusta County. As much as 55% of the County contains slopes greater than 15% and more than a third of the County has slopes of 25% or greater. The level areas of the County are located in the vicinity of Fishersville, Middlebrook, Spotswood, Stuarts Draft, Swoope, and Weyers Cave.

3.4 Wildlands, Vegetation, and Fuels

Within Augusta County, there are approximately 339,774 acres of forested land. Of that total, approximately 193,470 acres lie within national forests; 9,754 acres belong to the State; 6,098 acres belong to the National Park Service; and 130,458 acres are privately owned. The high quality of natural resources in the Augusta County area is indicated by the large proportion of the County that is held in federal, state, and regional park land. Approximately 33.4 percent of Augusta County is owned by the federal government; the George Washington and Jefferson National Forests covering approximately 195,758 acres and Shenandoah National Park having 12,272 acres in the County. Within the national forest there are two designated wilderness areas that fall inside the County boundary - Ramsey's Draft and Saint Mary's. Both wilderness areas were designated in 1984; with the Ramsey's Draft area consisting of 6,518 total acres and the Saint Mary's area consisting of more than 10,000 acres.

Up until the 1940s the natural vegetation and forested areas of Augusta County were characterized by varieties of oak and American Chestnut trees with smaller pockets of moister forests in coves and ravines. A fungal blight to the American Chestnut tree in the last century caused them to be eliminated as overstory trees; so currently the former forested areas of oak-chestnut forests have been replaced with forests of predominantly oak species. Northern red oaks have replaced the oak-chestnut forests. At the drier, lower elevations forests contain chinquapin and other oaks, black and sugar maples, eastern red buds, and hickory trees. Other trees included in the overstories of various wildland areas include sugar maple, white ash, eastern hemlock, tulip-poplar, red maple, birches, magnolia, and white pines. Because of the differing elevations,

climates, and soils, the variety of vegetation in the woodlands, forest, meadows, and wetlands is quite extensive, and includes spring wildflowers, grasses, shrubs, and wet grassland vegetation. Parts of the County also contain patches of fire-adapted woodlands that contain table-mountain pine, pitch pine, chestnut oak, and bear oak. These patches are currently undergoing alterations due to the recent exclusion or suppression of fires from the landscape. Fuel hazards that exist in the County consist of evergreens, overgrown fields, storm debris, fuel loading caused by unraked leaves, and downed woody materials, such as branches and trees.

Shenandoah National Park is a long, narrow band of land that covers over 190,000 acres, and is situated between the Shenandoah Valley and River and the Virginia Piedmont. The park was fully established in 1935 and spans eight counties, Augusta County being one of them; the park also runs through Warren, Page, Rockingham, Rappahannock, Madison, Green, and Albemarle Counties.

In 1926, Shenandoah National Park got authorization, and nine years passed before it was officially established. Before becoming a national park; much of the area was farmland. Over the years, Virginia slowly acquired the lands through eminent domain. It was then given to the U.S. Federal Government; provided it would be dedicated as a National Park.

Lying across the Blue Ridge Mountains, the park offers many activities for all visitors. The largest attractor is the 105-mile Skyline Drive that provides scenic views of Virginia. There is more to the Shenandoah National Park than just Skyline Drive; with almost 80,000 acres designated as wilderness with the protection of the National Wilderness Preservation System. There are also many trails that serve for horseback riding, camping, bicycling, and hiking to scenic views or waterfalls.

George Washington and Jefferson National Forests are located within three states and Virginia is one of them. The bulk of the forests are located in Virginia, with some overlap in West Virginia and Kentucky. Covering approximately 1.8 million acres along the Appalachian Mountains, the national forests combined, create the largest areas of public land in the eastern portion of the United States. The majority of the forests are remote, and there are over 100,000 acres that have been designated as wilderness areas. Two of these wilderness areas are located within Augusta County – Ramsey's Draft and Saint Mary's Wilderness.

The George Washington National Forest was established in 1918 as the Shenandoah National Forest, and then in 1932 was renamed; the Jefferson National Forest was established in 1936. The two were administratively combined in 1995. George Washington National Forest holds the most acreage between the two with 1,065,389 acres; while Jefferson National Forest encompasses 723,350 acres. Combined the forests also contain over 200,000 acres of old-growth forests.

The national forests offer a wide variety of activities for visitors, including hiking, biking, and hunting. There are hundreds of miles of trails and multiple scenic areas, byways, and wildernesses for these activities to take place.

Ramsey's Draft is a designated wilderness area located in the North River Ranger District of the George Washington and Jefferson National Forests in western Augusta County. The U.S. Forest Service first purchased land in this area in 1913 for the Shenandoah National Forest, which was a precursor to the present-day national forest. Ramsey's Draft has been managed by the U.S. Forest Service as a wilderness area since 1935 and much of it has never been logged. The wilderness area was officially designated under the Virginia Wilderness Act of 1984. Ramsey's Draft covers 6,528 acres and is located between the crests of the Shenandoah Mountain and Bald Ridge. The U.S. Forest Service oversees Ramsey's Draft. The land in Ramsey's Draft is rugged and steep and ranges from 1,600 feet to 4,282 feet at Hardscrabble Knob. The wilderness is named after its primary drainage stream. A "draft" is a local term for a creek. Ramsey's Draft is a tributary of the Calfpasture River, which feeds into the James River and the Chesapeake Bay. Ramsey's Draft Wilderness has a variety of vegetation including over 250 species of vascular plants. This wilderness area is well known for its stands of old-growth Canadian Hemlock, which have been severely damaged by the hemlock wooly adelgid and may not survive. Other trees in Ramsey's Draft include, the Tulip Poplar, Eastern White Pine, Shagbark Hickory, Sugar Maple, Northern Red Oak, and Black Birch. Wildlife in the wilderness area includes black bear, raccoon, squirrel, beaver, wild turkey, and rabbit. Ramsey's Draft is a native brook trout stream. The wilderness area is also a popular nesting grounds for neotropical migrant birds such as songbirds, raptors, and waterfowl.

Saint Mary's Wilderness is a designated wilderness area of the George Washington and Jefferson National Forests in southern Augusta County. From the early 1900s until the 1950s, the Saint Mary's River gorge was mined for manganese ore and iron ore until the mines were abandoned. Saint Mary's was designated as a wilderness area as part of the Virginia Wilderness Act of 1984. The wilderness area consists of 9,835 acres. Saint Mary's elevations range from 1,780 feet to 3,640 feet. As part of the Chesapeake Bay watershed, St. Mary's includes the drainages of Cedar Hollow, Spy Run, and the upper part of Saint Mary's River, which are all tributaries of the South River. Within the wilderness area's boundaries, there are several waterfalls. Saint Mary's is comprised of the southern Appalachian hardwood ecosystem. Oak trees were infested with gypsy moths in the wilderness area in the mid-1990s. Rhododendron and mountain laurel can be found in Saint Mary's as well as native trout.

South River Preserve is the Nature Conservancy's first preserve in the Shenandoah Valley. It is a wetland located on 14 acres bordering the Alcoa Building Products manufacturing plant in Stuarts Draft. This now rare, spring-fed wet prairie was typical in the Shenandoah Valley before European settlers arrived. Prior to 1800, the Shenandoah Valley contained prairies like those in the Midwestern United States and were home to grazing animals like elk and wood bison. These grasslands began to disappear as agriculture was pursued; and man-made and natural fires that renewed the prairies were suppressed. Currently, the preserve is home to birds; such as red-winged blackbirds, Canadian geese, and meadow larks; and wetland animals, such

as the spotted turtle and beavers. The South River Preserve is also home to a rich variety of native plants.

Cowbane Prairie Natural Area Preserve (NAP) is on the western slope of the Blue Ridge Mountains and is owned by the Virginia Department of Conservation and Recreation. This NAP preserves calcareous spring marshes, wet prairies, and mesic prairies that have been constantly disappearing in the Shenandoah Valley through agriculture and industrial development. Two watch-listed freshwater mussel species reside at the Cowbane Prairie NAP. Queen-of-the-Prairie, blue flag Iris, and marsh-speedwell are just three of the eleven rare plants that can be found here. Prescribed burning activities are periodically implemented in the Preserve.

Kennedy Mountain Meadow Preserve is located a few miles south of the South River Preserve, near Sherando. It is a meadow that seasonally floods and contains a 1.5-acre pond. Porous bedrock and soil hold water in spring and fall; but dry up the rest of the year. Augusta and Rockingham Counties are the only places in Virginia with this type of sinkhole pond. Two native plants have adapted to the conditions, the Virginia Sneezeweed and the black-fruited spikerush. Kennedy Mountain Meadow is at the edge of Big Levels, in the Pedlar Ranger District of the George Washington National Forest. This preserve is privately owned and because of its fragile environment, it is not open to the public.

Folly Mills Creek Fen Natural Area Preserve is a privately owned 29-acre preserve located in the floodplain of Folly Mills Creek. A fen is a special type of wetland that includes surface water originating from artesian springs and ground water seepage at the base of a hill. These types of wetlands were more common in the Shenandoah Valley but, either through conversion to other land uses or drainage, they have disappeared. This fen possesses an interesting rare plant community including bog bucbean, shining ladies' tresses, and smooth loosestrife.

Mount Joy Pond Natural Area Preserve, located up against the western side of the Blue Ridge Mountains, is a 274 acre preserve owned by the Virginia Department of Conservation and Recreation, and contains a large natural sinkhole pond that is quite rare in the Shenandoah Valley. The pond and preserve supports one of the world's largest populations of Virginia Sneezeweed, a rare plant.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points.

Surface Water:

The County, due to its elevation and topography, has a rare attribute in that all its surface water originates from watersheds within the County itself. This allows the County to possess a great amount of control over the quality of its surface water resources. Most of Augusta County's surface water comes from the Shenandoah River and James River drainage basins. Major waterways of the Shenandoah River, located in Augusta County, include three north-flowing rivers: the South River, which flows through the eastern portion of the County; the Middle River, which flows through the north-

central portion of the County; and the North River, which travels through the north-west section of the County. The James River drainage basin in the County includes the Calfpasture watershed, the St. Mary's watershed, and the South River (this is a different South River than the one that drains into the Shenandoah River, as it flows south into the Maury River).

Ground Water:
Because of its limestone geology, which causes cavernous formations, the County possesses a good source of ground water for public and private wells. Unfortunately, the supplies of water in these formations are inconsistent throughout Augusta County; so some areas do not have access to adequate ground water. The portion of the County with the greatest potential for groundwater is a narrow belt along the western foot of the Blue Ridge Mountains.

3.6 Fire Department

Augusta County Fire-Rescue
Deerfield FD
Middlebrook FD
Churchville FD
Weyers Cave FD
Verona FD
Stuarts Draft FD
Craigsville FD
Dooms FD
Augusta County FD
Preston L. Yancey FD
Raphine Fire State
Swoope FD
Bridgewater VFD
Clover Hill FD
New Hope FD
Wilson FD
Grottoes FD
Mount Solon FD
Riverheads FD
Wintergreen F&R
Walkers Creek FD

3.7 Values at Risk

Augusta County is comprised of approximately 31,900 housing units; with approximately 28,420 of these occupied by the owners. As of 2016, the median value of homes in Augusta County was approximately $199,700. Homes located in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the County are the critical infrastructure elements and areas of community interest. These include the Lyndhurst area, natural gas and transmission lines, Elliot's Knob communication towers, Norfolk Southern, CSX, and SV rail lines, and other elements of infrastructure. Community interest areas include Campgrounds and Recreation Areas in Crimora, Sherando, Lyndhurst, Mt Solon, Todd Lake, Stoney Creek, Blue Ridge Parkway, Shenandoah National Park, Appalachian Trail, Elkhorn, Camp Shenandoah, Camp May Flather, Wildlife Center of Virginia, Augusta Correctional Center, Confederate Breastworks, Wintergreen, and Swannanoa.

3.8 Woodland Communities

Acorn Lane
Auburn Lane
Barrenridge Road
Bear Den Trail (S.R. 608)
Bear Den Triangle
Big Spy

Braley Pond Road North
Braley Pond Road South
Camp Mayflower Lane
Chinqapin Drive
Clemmer Ridge Lane
Country Estates (Eastside Highway)
Crestwood Drive
Crimora Mines
Crystal Ridge Road
Fishers Lane
Hanley Mountain Highway
Horsehead Road
Horseshoe Circle
Howardsville Turnpike
Hunters Lane
Karman Hill Road
Lake Drive
Leverock Lane
Little River Road
Little Spy
Maple Ridge Lane
Markels Lane
Massey Creek Road
Mill Creek Road
Mullins Lane
Old Mill Road
Paine Run Road
Railroad Avenue
Ravens Roost Drive
Ridgetop Drive
Springer Road
Spy Creek Lane
Stoney Brook Road
Twin Hills Lane
Waldrop Road (Rt. 2210)
Washington Drive
Woodhaven Lane

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Bath County

3.1 Locality Setting

In 1790 Bath County was formed from parts of Augusta, Botetourt, and Greenbrier Counties. The County is made up of 540 sq. miles. There are not any incorporated towns or independent cities. An interesting fact about Bath County is that it was named for the English resort city of Bath, due to its mineral springs.

Bath County lies within the Alleghany Mountains in west-central Virginia. It is surrounded by West Virginia and Highland, Augusta, Rockbridge, and Alleghany Counties. There are not any interstates that cross through the County. Bath County is approximately 55 miles north of Roanoke; 175 miles southwest of Washington, D.C.; and 140 miles west of Richmond.

The County had an estimated population of 4,476 in 2016. According to 2015 estimates there were 2,146 occupied housing units throughout the county. 1,495 units were occupied by owners with another 651 occupied by renters.

3.2 Climate

Bath County is located within Cfa and Cfb climate regions according to the Köppen-Keiger Climate Classification. Cfa is described as a mild temperate climate, fully humid with a hot summer. Cfb is described as a mild temperate climate, fully humid with a warm summer.

The County has an average annual temperature of 51.1 degrees Fahrenheit. The average high temperature of 62.6 degrees Fahrenheit and an average low of 39.6. Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The average annual precipitation for the County is 43.5 inches and 27.6 inches of average annual snowfall.

3.3 Topography

Bath County lies within high, narrow mountain ridges, often with steep slopes; alternating with relatively narrow river valleys. Much of the County has slopes greater than 25 percent which are often unsuitable for cultivation and development. Elevation ranges from 1,100 to over 4,400 feet.

The geology of the County is comprised of sedimentary rocks and is characterized by alternating valleys and ridges from the northeast to the southwest. Mountains are typically capped by hard sandstone while the valleys contain soft shale and soluble limestone. Much of the County sits atop areas of limestone or dolomite, where little if any surface drainage occurs. There are areas of karst topography which often contain many underground caves.

3.4 Wildlands, Vegetation, and Fuels

George Washington and Jefferson National Forests span three states; the bulk of these forests are located in Virginia, with some overlap in West Virginia and Kentucky. Covering approximately 1.8 million acres along the Appalachian Mountains, the

national forests combined create the largest areas of public land in the eastern portion of the United States. The majority of the forest is remote, and there are over 100,000 acres that have been designated as wilderness areas.

The George Washington National Forest was established in 1918, and then in 1932 was renamed; the Jefferson National Forest was established in 1936. The two were administratively combined in 1995. George Washington National Forest holds the most acreage between the two with 1,065,389 acres, while Jefferson National Forest encompasses the remaining 723,350 acres. Combined the forests also contain over 200,000 acres of old-growth forests.

The national forests offer a wide variety of activities for visitors, including hiking, biking, and hunting. There are hundreds of miles of trails and multiple scenic areas, byways, and wildernesses for these activities to take place.

Rough Mountain Wilderness spans 9,300 acres and was established in 1988. It is the 3rd largest wilderness area in Virginia. The elevation ranges from 1,150 feet along the Cowpasture River to its peak on Griffin Knob at 2,842 feet. Due to its steep terrain the only water source is ephemeral streams on the lower slopes, that tend to run dry in the summer months.

T. M. Gathright Wildlife Management Area encompasses 13,428 acres and was one of the earliest Department of Game and Inland Fisheries owned lands. Within the acreage are three major mountains with elevation ranges of 1,400 to 3,600 feet. There are two tracts of land that make up the management area and they are separated by Lake Moomaw. It is located along the West Virginia State Line. The forest is filled with yellow poplar, white pine, and pawpaw where species such as red-bellied and pileated woodpeckers and others can be found.

Douthat State Park encompasses 4,545 acres with a 50-acre lake. It is located within the Allegheny Mountains and opened in 1936 as one of the original six Virginia State Parks. It is also listed on the National Register of Historic Places. There are over 40 miles of wooded trails within the park.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Bath County is located within the Upper James River Basin.

Surface Water:
Located at the southwest corner of the County is Lake Moomaw. Douthat Lake is located within the center of the County in Douthat State Park. There are several rivers located within the County. The Cowpasture River flows along the eastern portion of the County. The Jackson River runs parallel to the Cowpasture river to the west. There are also several creeks that flow throughout the County. The County also has two springs as well as privately owned springs.

Ground Water:
Ground water availability varies due to geologic structure. The County uses ground water as a source via two wells as well as several private wells.

3.6 Fire Department

Bath-Highland Williamsville VFD
Bath-Highland Burnsville VFD
Bolar VFD
Deerfield VFD
Hot Springs VFD
Millboro VFD
Mountain Grove VFD

3.7 Values at Risk

Bath County is comprised of approximately 3,420 housing units; with approximately 2,100 of these occupied by the owners. As of 2016, the median value of homes in Bath County was approximately $146,400. Homes in woodland areas may be at risk in the event of a wildland fire.

Also at risk within the County are the critical infrastructure elements and areas of community interest. These include the Hot Springs area, natural gas and transmission lines, the CSX rail line, and other elements of infrastructure.

3.8 Woodland Communities

Coffee Pot Road
Golf Course Resort
Green Valley
Mill Creek Road
Muddy Run Road
Pinehurst Heights
Route 620 in Warm Springs
State Route 629

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Highland County

3.1 Locality Setting

In 1847 Highland County was formed from Bath and Pendleton Counties. The County is made up of 416 sq. miles. Monterey is the only incorporated town within the County. There are no independent cities.

Highland County is located within the Alleghany Mountains. It is surrounded by West Virginia and Augusta and Bath Counties. There is not an interstate within the County. Highland County is approximately 110 miles north of Roanoke; 175 miles southwest of Washington, D.C.; and 130 miles northwest of Richmond.

The County had an estimated population of 2,216 in 2016. According to 2015 estimates there were 1,071 occupied housing units within the county; 883 units are occupied by owners, with another 188 occupied by renters.

3.2 Climate

Highland County is located within Cfa, Cfb, and Dfb climate regions according to the Köppen-Keiger Climate Classification. Cfa is described as a mild temperate climate, fully humid with a hot summer. Cfb is described as a mild temperate climate, fully humid with a warm summer. Dfb is described as a snow climate, fully humid with a warm summer.

The County has an average annual temperature of 48.8 degrees Fahrenheit. The average high temperatures are 37.1 degrees Fahrenheit in January and 80.1 degrees in July. The average lows are 16 degrees in January and 56.1 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The average annual precipitation for the County is 41.89 inches and 35.4 inches of average snowfall.

3.3 Topography

Highland County is characterized by alternating Ridges and valleys that trend northeast to southwest. Elevations range from 1,625 feet along the Cowpasture River, to 4,545 feet on Allegheny Mountain.

Much of Highland County is underlain by carbonate rocks. This can result in karst features such as caves and sinkholes when the rock is dissolved by slightly acidic rainwater over many years.

3.4 Wildlands, Vegetation, and Fuels

George Washington and Jefferson National Forests spans 3 states; the bulk of the forests are located in Virginia, with some overlap in West Virginia and Kentucky. Covering approximately 1.8 million acres along the Appalachian Mountains, the national forests combined create the largest areas of public land in the eastern portion of the United States. The majority of the forest is remote, and there are over 100,000 acres that have been designated as wilderness areas.

The George Washington National Forest was established in 1918, and then in 1932

was renamed; the Jefferson National Forest was established in 1936. The two were administratively combined in 1995. George Washington National Forest holds the most acreage between the two with 1,065,389 acres, while Jefferson National Forest encompasses the remaining 723,350 acres. Combined the forests also contain over 200,000 acres of old-growth forests.
The national forests offer a wide variety of activities for visitors, including hiking, biking, and hunting. There are hundreds of miles of trails and multiple scenic areas, byways, and wildernesses for these activities to take place.

Highland Wildlife Management Area is regarded as having the highest average elevation of any county east of the Mississippi River. It encompasses a total of 14,283 acres spread across 3 tracts of land and managed by the Department of Game and Inland Fisheries. Upland hardwood forests of oak/hickory and mixed oak stands are the primary timber types found here. There is an 80-acre opening on the Jack Mountain tract that was used for pasture. The elevation ranges from 1,800 to 4,390 feet.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Highland County is located within the Upper James River Basin.

Surface Water:
Back Creek and the Jackson River run in the west/northwest portion of County. The Bullpasture river runs along the eastern portion of the County. The Cowpasture River essentially runs parallel to the Bullpasture river to the east. There are several rivers and creeks that run throughout the County.

Ground Water:
Ground water availability varies due to geologic structure. The County uses two wells as a ground water source. There are several private wells that serve as water sources as well.

3.6 Fire Department

McDowell FC
Highland County VFC
Bath-Highland County VFD

3.7 Values at Risk

Highland County is comprised of approximately 2,000 housing units, with approximately 1,120 of these occupied by the owners. As of 2016, the median value of homes in Highland County was approximately $160,800. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the County are the critical infrastructure elements and areas of community interest.

3.8 Woodland Communities

Route 609
Route 678

Rockbridge County

3.1 Locality Setting

In 1778 Rockbridge County was formed and named after the Natural Bridge of Virginia. The County is made up of 607 sq. One interesting fact is that there is not another county in the US the named "Rockbridge". Buena Vista and Lexington are the independent cities and Glasgow and Goshen are the incorporated towns located within the County boundary.

Rockbridge County is located within the Shenandoah Valley in west-central Virginia. It is mostly surrounded by Augusta, Amherst, Botetourt, and Bath Counties with three other counties bordering it as well. Interstates 81 and 64 intersect at the northeastern edge of the city limits of Lexington. Rockbridge County is approximately 40 miles north of Roanoke; 170 miles southwest of Washington, D.C.; and 120 miles west of Richmond.

The County had an estimated population of 22,392 in 2016. According to 2015 estimates there were 9,319 occupied housing units throughout the county; 6,927 units are occupied by owners with another 2,392 occupied by renters.

3.2 Climate

Rockbridge County is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The County has an average annual temperature of 55 degrees Fahrenheit. The average high temperatures are 45.8 degrees Fahrenheit in January and 86.4 degrees Fahrenheit in July. The average lows are 24.3 degrees in January and 62.8 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 170 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the County is 38.7 inches and 23 inches of average annual snowfall.

3.3 Topography

Rockbridge County is located in the central portion of the Appalachian Mountain Chain. The eastern edge is part of the Blue Ridge Physiographic Province; the central portion is in the Great Valley of Virginia; and the western edge is in the Ridge Province.

The eastern edge is composed of old igneous and metamorphic rocks, which are very hard and resistant to erosion. The central area includes productive farmland underlain by thick sections of limestone and dolostone. The western edge includes ridges and valleys. Rocks in the ridge area are sandstone and quartzites which are resistant to weathering and erosion; while rocks in the valley area are limestone and shale.

Elevations range from around 700 to over 3,500 feet. The highest point within the valley portion of the County is located near the drainage divide between the James and

Shenandoah River Basins at approximately 2,000 feet. The lowest point within the valley portion of the County is located near Glasgow; where the James River flows out of the County at 720 feet.

Rockbridge County is part of one of the largest karst regions in the United States due to the underlain areas of carbonate rocks which are soluble in water. The karst topography is characterized by caves, sinkholes, sinking creeks, and large springs.

3.4 Wildlands, Vegetation, and Fuels

Much of the mountainous sections of the County are covered in forests, of which most are second growth. The predominant forest type is oak-hickory; which accounts from almost 83% of the total forest land. Another significant forest type is oak-pine; which accounts for about 9% of the forest land. In the western part of the county the mountainous forests are comprised of white oak, northern red oak, southern red oak, eastern white pine and pitch pine. In the eastern part of the county you will find scarlet oak, chestnut oak, white oak, pitch pine, spruce pine, blackjack oak, poplar, hickory, and white pine. Within the valley area most forests have been cleared for cultivation and pasture; however, you can find: white oak, northern red oak, hickory, cedar, locust, post oak, walnut, sycamore, willow, ash, basswood, beech, birch, elm, and walnut.

George Washington and Jefferson National Forests span 3 states; the bulk of the forests are located in Virginia, with some overlap in West Virginia and Kentucky. Covering approximately 1.8 million acres along the Appalachian Mountains, the national forests combined create the largest areas of public land in the eastern portion of the United States. The majority of the forest is remote, and there are over 100,000 acres that have been designated as wilderness areas.

The George Washington National Forest was established in 1918, and then in 1932 was renamed; the Jefferson National Forest was established in 1936. The two were administratively combined in 1995. George Washington National Forest holds the most acreage between the two with 1,065,389 acres, while Jefferson National Forest encompasses the remaining 723,350 acres. Combined the forests also contain over 200,000 acres of old-growth forests.

The national forests offer a wide variety of activities for visitors, including hiking, biking, and hunting. There are hundreds of miles of trails and multiple scenic areas, byways, and wildernesses for these activities to take place.

Rich Hole Wilderness is listed as a National Natural Landmark by the National Park Service as “an outstanding example of a cove hardwood forest”. It is Federal land consisting of 1, 326 acres and located within the George Washington National Forest. It is one of 10 National Natural Landmarks located in Virginia. Its name stems from the late 1800s and early 1900s when iron ore was mined from hillsides in the area. There are three cold water streams protected within this wilderness.

Chessie Nature Trail is 7 miles and follows the roadbed of a former Chesapeake and Ohio Railway branch line along the Maury River. The Chesapeake and Ohio Railway abandoned the railroad following

substantial damage caused by Hurricane Camille. Virginia Military Institute now owns and maintains the trail that is open for public use. There are over 43 mammal species living along the trail. Native plant species that are found along the trail include bladdernut trees, may apple, spicebush, and pawpaw as well as several alien plant species.

Goshen and Little North Mountain Wildlife Management Area southeast of Goshen, VA, encompasses 33,697 acres and is managed by the Department of Game and Inland Fisheries. There are two parcels, the Goshen Wildlife Management Area (GWMA) and the Little North Mountain Wildlife Management Area (LNM) that join at the Maury River. LNM lies in Augusta and Rockingham Counties. Elevations within these areas range from 1,326 to 3,400 feet.

Goshen Pass Natural Area Preserve is a 936-acre area comprised of chestnut oak, pine-oak-heath woodland and rocky scrub communities. It is has been owned by DCR since 1954 and in 2002 was dedicated as a State Natural Area Preserve. It borders the northeast bank of the Maury River where it runs through Goshen Pass.

James River Face Wilderness
The 8,903 acre area is located within the Jefferson National Forest. The vegetation is predominately chestnut oak and yellow pine with a heath understory. The Appalachian Trail and other trails run through the wilderness area. Elevations range from 650 to 3,073 feet.

Natural Bridge
Natural Bridge is currently managed as a Virginia State Park and encompasses 1,540 acres. At one time Thomas Jefferson owned the bridge in which he purchased from King George III of England. The Park is located about 15 miles south of the City of Lexington.

Short Hills Wildlife Management Area
The area encompasses 4,322 acres which is located approximately 10 miles southwest of the city of Lexington and is managed by DGIF. 3,482 acres consist of mixed pine/hardwood while the remaining 750 acres are open land. Interestingly this area also has a high percentage of karst topography.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Rockbridge County is located within the Upper James River Basin.

Surface Water:
All of Rockbridge County lies within the James River Drainage Basin. The river extends 10 miles through the County and drains only 9% of the County's area. The Maury River extends approximately 50 miles through the County. The Maury River along with its tributaries drain the remaining 91% of the county. Due to the karst topography of the Region some of the surface drainage in the County occurs as closed drainage areas where water drains directly into a sinkhole (groundwater), rather than directly into a stream.

Ground Water:
In Rockbridge County 20 different aquifers have been identified with varying thickness. The Waynesboro aquifer is located at the foot of the Blue Ridge Mountains and is the

most important aquifer in the County. There are also numerous springs in the counties that are used by farms and older homes.

An estimated 7,400 households obtain their water from wells and springs. The City of Buena Vista and the Town of Glasgow use ground water for their public water supply. The Town of Goshen uses a nearby spring for its public water supply

3.6 Fire Department

Rockbridge County Fire and Rescue
Effinger VFRD
Fairfield VRD
Glasgow VFRD
Goshen VFD
Goshen First Aid
Kerr's Creek VFD
Natural Bridge VFD
Raphine VFD
Rockbridge Baths VFD
South River VFD
Walker's Creek VFD

3.7 Values at Risk

Rockbridge County is comprised of approximately 11,200 housing units; with approximately 9,200 of these occupied by the owners. As of 2016, the median value of homes in Rockbridge County was approximately $193,300. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the County are the critical infrastructure elements and areas of community interest. These include the natural gas and transmission lines, the CSX rail lines, and other elements of infrastructure.

3.8 Woodland Communities

Broad Wing
Chessie Lane
Clan Alpine Way
Colen Hollow
Evergreen Tree
Grey Dove Road
Irish Creek
McDaniels Lane
Red Hill Road
Solitude/Little House
Sterrett Road
Texas Lane

Rockingham County

3.1 Locality Setting

In 1778 Rockingham County was formed from Augusta County. The County is made up of 853 sq. miles, making it the 3rd largest county in Virginia. Harrisonburg is the only independent city. There are 7 incorporated towns located within the County's boundaries: Bridgewater, Broadway, Dayton, Elkton, Grottoes, Mount Crawford, and Timberville.

Rockingham County is located in the Shenandoah Valley in west-central Virginia. It is surrounded by West Virginia and Augusta, Albemarle, Greene, Page, and Shenandoah Counties. Interstate 81 crosses the center of the County. Rockingham County is approximately 40 miles north of Roanoke; 115 miles southwest of Washington, D.C.; and 100 miles northwest of Richmond.

The County had an estimated population of 79,744 in 2016. According to 2015 estimates, there were 29,625 occupied housing units throughout the county; 22,449 units are occupied by owners, and another 7,176 are occupied by renters.

3.2 Climate

Rockingham County is located within Cfa and Cfb climate regions according to the Köppen-Keiger Climate Classification. Cfa is described as a mild temperate climate, fully humid with a hot summer. Cfb is described as a mild temperate climate, fully humid with a warm summer.

The County has an average annual temperature of 52 degrees Fahrenheit. The average high temperatures are 40 degrees Fahrenheit in January and 85 degrees in July. The average lows are 20 degrees in January and 62 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 175 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the County is 36.48 inches and average snowfall is 20.1 inches.

3.3 Topography

Rockingham County is located between two physiographic provinces: Blue Ridge and Ridge and Valley. The Blue Ridge province covers the southeast corner; while the Ridge and Valley province underlies the remainder of the County. Due to the limestone and dolomite characteristics of the Ridge and Valley province; there is a tendency for caves, sinkholes, and solution channels to develop.

The County exhibits gentle to rolling slopes with steep mountain ridges that rise more than 2,000 feet.

3.4 Wildlands, Vegetation, and Fuels

George Washington and Jefferson National Forests span 3 states; the bulk of the forests are located in Virginia, with some overlap in West Virginia and Kentucky. Covering approximately 1.8 million acres along the Appalachian Mountains, the national

forests combined create the largest areas of public land in the eastern portion of the United States. The majority of the forest is remote, and there are over 100,000 acres that have been designated as wilderness areas.

The George Washington National Forest was established in 1918, and then in 1932 was renamed; the Jefferson National Forest was established in 1936. The two were administratively combined in 1995. George Washington National Forest holds the most acreage between the two with 1,065,389 acres, while Jefferson National Forest encompasses the remaining 723,350 acres. Combined the forests also contain over 200,000 acres of old-growth forests. The national forests offer a wide variety of activities for visitors, including hiking, biking, and hunting. There are also hundreds of miles of trails and multiple scenic areas, byways, and wildernesses areas for these activities to take place.

Shenandoah National Park is a long, narrow band of land that covers over 190,000 acres situated between the Shenandoah Valley and River and the Virginia Piedmont. The park was fully established in 1935 and spans eight counties, Rockingham County being one of them. The park also runs through Warren, Page, Augusta, Rappahannock, Madison, Green, and Albemarle Counties. In 1926, Shenandoah National Park was authorized, however nine years passed before it was officially established. Before becoming a national park, much of the area was farmland and over the years Virginia slowly acquired the lands through eminent domain. It was then given to the federal government; with the provision it would be dedicated as a National Park.

Lying across the Blue Ridge Mountains, the park offers many activities for all visitors. The largest attractor is the 105 mile Skyline Drive that offers scenic views of Virginia. There is more to the Shenandoah National Park than just Skyline Drive, with almost 80,000 acres designated as wilderness with the protection of the National Wilderness Preservation System. There are also many trails that serve for horseback riding, camping, bicycling, and hiking to scenic views or waterfalls.

Deep Run Ponds Natural Area Preserve encompasses 688 acres and includes eight sinkhole ponds. It is owned by the Department of Conservation and Recreation and is one of the largest remaining Shenandoah Valley sinkhole pond systems in Virginia. The ponds are found at the base of the Blue Ridge Mountains in both Augusta and Rockingham Counties.

Paul State Forest encompasses 173 acres with an elevation of 1,420 feet and has a variety of hardwood species. The forest is surrounded by farmland and is located northeast of Ottobine, VA. There are many birds that find their home within the forest including red-bellied, downy, and hairy woodpeckers.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Rockingham County is located within the Upper Shenandoah River Basin.

Surface Water:
Located within Rockingham county are several rivers and creeks. The North River

which flows along the south portion of the County. The Dry river runs along the east and south portions of the County. The South Fork Shenandoah River flows through the east portion of the County and the North Fork Shenandoah River flows through the center of the County.

Ground Water:
Because of its limestone geology, which supports cavernous formations, the County has a good source of ground water for public and private wells. Unfortunately, the supply of water in these formations is inconsistent throughout Rockingham County so some areas do not have access to adequate ground water. The portion of the County with the greatest potential for groundwater is a narrow belt along the western foot of the Blue Ridge Mountains.

3.6 Fire Department

Rockingham County Fire and Rescue
Bergton VFC
Bridgewater VFC
Broadway VFC
Clover Hill VFC
Elkton VFC
Grottoes VFC
Hose Company #4
McGaheysville VFD
Port Road Station
Singers Glenn VFC
Timberville VFC

3.7 Values at Risk

Rockingham County is comprised of approximately 34,500 housing units, with approximately 29,800 of these occupied by the owners. As of 2016, the median value of homes in Rockingham County was approximately $200,900. Homes in woodland areas may be at risk in the event of a wildland fire.

Also at risk within the County are the critical infrastructure elements and areas of community interest. These include the natural gas and transmission lines, the Norfolk Southern and SV rail lines, and other elements of infrastructure.

3.8 Woodland Communities

Big Run Estates
Briery Branch
Cedar Hill Estates
Donaldson
Fox Hill Drive
Gum Run
Hensley Hollow
Huckleberry Mountain
Lenora
Massanutten
Mountain Top
Mountain Valley
Rawley Springs
Second Mountain
Shady Acres
Sparkling Springs
Sundance Forest
Sundance Mountain
Sunvalley-upper and lower
Tillman Road
Turner Run
Union Springs
Walnut Hill Estates
West Brice
Whipporwill

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City of Buena Vista

3.1 Locality Setting

In 1892 the City of Buena Vista became an incorporated city. Buena Vista is 7 sq. miles, located within the Shenandoah Valley in west-central Virginia, and is physically located within Rockbridge County. Buena Vista is approximately 55 miles north of Roanoke; 200 miles southwest of Washington, D.C.; and 130 miles west of Richmond.

The City had an estimated population of 6,452 in 2016. According to 2015 estimates there were 2,737 occupied housing units throughout the City. 1,605 units are occupied by owners with another 1,132 occupied by renters.

3.2 Climate

Buena Vista is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The City has an average annual temperature of 55.9 degrees Fahrenheit. The average high temperatures are 45 degrees Fahrenheit in January and 89.5 degrees in July. The average lows are 21.1 degrees in January and 62.7 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 170 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the City is 38.7 inches and 13.7 inches of average annual snowfall.

3.3 Topography

The City of Buena Vista has varying degrees of topography. The central part of the City has flat/gently sloping areas leading towards the Maury River while the northern and southern ends of the City have hilly terrain.

3.4 Wildlands, Vegetation, and Fuels

Chessie Nature Trail is located just outside the City boundary and is 7 miles long following the roadbed of a former Chesapeake and Ohio Railway branch line along the Maury River. The Chesapeake and Ohio Railway abandoned the railroad following substantial damage caused by Hurricane Camille. Virginia Military Institute now owns and maintains the trail that is open for public use. There are over 43 mammal species living along the trail. Native plant species that are found along the trail include bladdernut trees, may apple, spicebush, and pawpaw to name a few as well as several alien plant species.

Glen Maury Park is a 315-acre park that has wooded trails and two campgrounds. Located in the park of historical significance is Glen Maury, a brick home between 1829 and 1832 that is listed on the National Register of Historic Places.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Buena Vista is located within the Upper James River Basin.

Surface Water:
The Maury River cuts through the western portion of the City. There are also several creeks that flow off the mountain through Buena Vista towards the Maury River.

Ground Water:
Ground water availability varies due to geologic structure. The City uses three wells to provide water to the City. There are other wells that have been drilled, but only three are in use.

3.6 Fire Department

Buena Vista VFD

3.7 Values at Risk

Buena Vista is comprised of approximately 2,900 housing units, with approximately 2,700 of these occupied by the owners. As of 2016, the median value of homes in Buena Vista was approximately $112,400. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the City are the critical infrastructure elements and areas of community interest.

City of Harrisonburg

3.1 Locality Setting

In 1780 the City of Harrisonburg was founded and in 1916 it became an incorporated city. Harrisonburg is 18 sq. miles.

Harrisonburg is located within the Shenandoah Valley in west-central Virginia and is physically located within Rockingham County Interstate 81 crosses the center of the City. Harrisonburg is approximately 110 miles north of Roanoke; 130 miles southwest of Washington, D.C.; and 100 miles northwest of Richmond.

The County had an estimated population of 53,078 in 2016. According to 2015 estimates there were 16,409 occupied housing units throughout the City. 5,926 units are occupied by owners with another 10,483 occupied by renters.

3.2 Climate

Harrisonburg is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The City has an average annual temperature of 52 degrees Fahrenheit. The average high temperatures are 40 degrees Fahrenheit in January and 85 degrees in July. The average lows are 20 degrees in January and 62 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 175 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the City is 36.48 inches and average snowfall is 20.1 inches.

3.3 Topography

The City of Harrisonburg is located within the valley portion of the Ridge and Valley geologic province and has a rolling topography with varying slopes from 0 to greater than 25%. The city is underlain by sedimentary rocks of limestone, dolomite, and shale. Due to the presence of limestone and dolomite, there is a tendency for caves, solution channels, and sink holes to develop as acid rainwater dissolves the rock over time.

3.4 Wildlands, Vegetation, and Fuels

Edith J. Carrier Arboretum encompasses 125 acres as part of James Madison University. 33 acres are naturalized botanical gardens while the remaining 92 acres are forest. It is an oak-hickory forest located within an urban growth and development area.

Bluestone Trail is a 1-mile path that connects between James Madison University, Port Republic Road and Hillside Ave, Purcell Park (and surrounding neighborhood), Stone Spring Road (surrounding businesses).

Hillandale Park is located on Hillandale Ave. The park spans 74 acres and includes a 1.3-mile walking trail. There are several mountain bike trails located throughout the park.

Kiwanis Park spans 3.8 acres and is located on Franklin Street.

Liberty Park is located on North Liberty Street.

Morrison Park is 6 acres and located on North Willow Street. It borders Waterman Elementary School.

Purcell Park is 67 acres and located on Monument Ave. There are 1.5 miles of walking trails.

Ralph Sampson Park is located on East Washington Street and covers 31 acres.

Riven Rock Park is 27 acres and includes trails.

Westover Park covers 48 acres.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. The City is drained primarily by two streams: Blacks Run and a branch of Cooks Creek. Harrisonburg is located within the Upper Shenandoah River Basin.

Surface Water:
Cooks Creek and Blacks run both cross through the City. Lake Shenandoah is located southeast of the City.

Ground Water:
Ground water availability varies due to geologic structure. While the town does not use ground water as a source it does not mean that it could not be explored in the future.

3.6 Fire Department

Harrisonburg FD

3.7 Values at Risk

Harrisonburg is comprised of approximately 18,000 housing units, with approximately 16,600 of these occupied by the owners. As of 2016, the median value of homes in Harrisonburg was approximately $197,400. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the City are the critical infrastructure elements and areas of community interest. These include natural gas and transmission lines, the Norfolk Southern rail line and other elements of infrastructure.

City of Lexington

3.1 Locality Setting

In 1778 the City of Lexington was incorporated as a town and in 1966 was chartered as a city. Lexington is 2 sq. miles.

Lexington is located within the Shenandoah Valley in west-central Virginia and is physically located within Rockbridge County Interstate 81 and 64 intersect north of the City. Lexington is approximately 55 miles north of Roanoke; 195 miles southwest of Washington, D.C.; and 140 miles west of Richmond.

The City had an estimated population of 7,045 in 2016. According to 2015 estimates there were 1,638 occupied housing units throughout the City. 941 units are occupied by owners with another 697 occupied by renters.

3.2 Climate

Lexington is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The City has an average annual temperature of 54.8 degrees Fahrenheit. The average high temperatures are 46 degrees Fahrenheit in January and 87 degrees in July. The average lows are 22 degrees in January and 63 degrees in July.

Prevailing winds are generally out of the southwest. During colder months, the winds often originate out of the northwest. The growing season is 170 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the City is 40.52 inches and 14 inches of average annual snowfall.

3.3 Topography

The City of Lexington lies within the Great Valley portion of the Valley and Ridge Physiographic Province. The City is characterized by rolling hills and valleys.

Elevations within the city range from 890 feet along the Maury River to 1,185 feet on the western edge. Most of the City has moderate slopes, but a few areas have slopes exceeding 25%. These areas are susceptible to erosion.

The City is part of a large karst region characterized by caves, sinkholes and large springs. This is due to the underlain rock being limestone dolomite which dissolves as water makes its way into the rock.

3.4 Wildlands, Vegetation, and Fuels

Chessie Nature Trail is 7 miles and follows the roadbed of a former Chesapeake and Ohio Railway branch line along the Maury River. The Chesapeake and Ohio Railway abandoned the railroad following substantial damage caused by Hurricane Camille. Virginia Military Institute now owns and maintains the trail that is open for public use. There are over 43 mammal species living along the trail. Native plant species that are found along the trail include bladdernut trees, may apple,

spicebush, and pawpaw to name a few as well as several alien plant species.

Jordan's Point Park this park is an island in the middle of the Maury River and located at Stono Ln.

Fairwinds Park has a playground and is located at 225 Mcclung Pl.

Hopkins Green has a covered area and is located at 22 W. Nelson St.

Lime Kiln Bridge Park has a playground and is just off the Chessie Trail. It is located at Lime Kiln Rd. and Mclaughlin St.

M. Leroy Richardson Park has two playgrounds and a walking trail. It is located at 307 Diamond St.

Taylor Street Park has a playground and is located at 100 Taylor St.

Woods Creek Park is located along woods creek at Jordan St. and Overhill Dr.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Lexington is located within the Upper James River Basin.

Surface Water:
There is one major river and a creek along with its tributaries. The Maury River borders the City to the north. The City is drained by Woods Creek, which runs along the western portion of the City, and its tributaries.
Ground Water:

Ground water availability varies due to geologic structure. The City is served by two wells, but they are not located within the City.

3.6 Fire Department

Lexington FD

3.7 Values at Risk

Lexington is comprised of approximately 2,100 housing units, with approximately 1,800 of these occupied by the owners. As of 2016, the median value of homes in Lexington was approximately $230,500. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the City are the critical infrastructure elements and areas of community interest.

City of Staunton

3.1 Locality Setting

In 1747 the City of Staunton was founded and in 1871 it became an incorporated city. Staunton is 19 sq. miles.

Staunton is located within the Shenandoah Valley in west-central Virginia and is physically located within Augusta County Interstate 81 and 64 intersect southeast of the City. Staunton is approximately 85 miles north of Roanoke; 160 miles southwest of Washington, D.C.; and 105 miles northwest of Richmond.

The City had an estimated population of 24,363 in 2016. According to 2015 estimates there were 10,387 occupied housing units throughout the City. 5,900 units are occupied by owners with another 4,487 occupied by renters.

3.2 Climate

Staunton is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The City has an average annual temperature of 53.5 degrees Fahrenheit. The average high temperatures are 42 degrees Fahrenheit in January and 84 degrees in July. The normal lows are 23 degrees in January and 63 degrees in July.

Prevailing winds are generally out of the southwest. During colder months, the winds often originate out of the northwest. The growing season is 175 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the City is 39.14 inches and 23 inches of average snowfall.

3.3 Topography

The City of Staunton has steep hills as well as a rolling valley floor. There are two distinct hills within the City that contain the highest elevations reaching 1,940 and 1,850 feet. The lowest elevations are found along Lewis creek ranging from 1,300 to 1,400 feet.

The slopes in the City are typically 5% to 12% but there are areas greater than 20% and less than 5%. Staunton is located within a karst area in which sinkholes and caverns are features.

3.4 Wildlands, Vegetation, and Fuels

Gypsy Hill Park is located on Churchville Avenue and encompasses 214 acres.

Betsy Bell and Mary Gray Wilderness Park is 70 acres. The road to the peak of the park is a steep gravel road recommended for four-wheel drive vehicles.

Landes Park is a one-acre area.

Montgomery Hall Park is located on Montgomery Ave and encompasses 148 acres.

Woodrow Park encompasses 5 acres and is located in the Sears Hill District of Staunton.

Reservoir Hill Park encompasses 4 acres and is located along N. Jefferson St.

Men's Green Thumb Park encompasses approximately 2 acres and includes a fountain.

Knowles Park a small parcel of land across from Gypsy Hill Park on Churchville Avenue.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Staunton is located within the Upper Shenandoah River Basin.

Surface Water:
Lewis Creek runs through the center of the City. Christian's Creek runs southeast of the City and the Middle River runs north and northeast of Staunton.

Ground Water:
Ground water availability varies due to geologic structure. While the City does not use ground water as a source, it does not mean that in the future it could not be explored as a possibility.

3.6 Fire Department

Staunton FD

3.7 Values at Risk

Staunton is comprised of approximately 11,800 housing units, with approximately 10,300 of these occupied by the owners. As of 2016, the median value of homes in Staunton was approximately $163,000. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the City are the critical infrastructure elements and areas of community interest. These include natural gas and transmission lines, CSX and SV rail lines, and other elements of infrastructure.

City of Waynesboro

3.1 Locality Setting

In 1801 the City of Waynesboro was established and in 1948 it became an incorporated city. Waynesboro is 15 sq. miles.

Waynesboro is located within the Shenandoah Valley in west-central Virginia and is physically located within Augusta County. Interstate 64 crosses the southern edge of the City. Waynesboro is approximately 95 miles north of Roanoke; 165 miles southwest of Washington, D.C.; and 95 miles northwest of Richmond.

The City had an estimated population of 21,887 in 2016. According to 2015 estimates there were 9,031 occupied housing units throughout the City. 5,215 units are occupied by owners with another 3,816 occupied by renters.

3.2 Climate

Waynesboro is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The City has an average annual temperature of 53 degrees Fahrenheit. The average high temperatures are 44 degrees in January and 85 degrees in July. The average lows are 22 degrees in January and 62 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 175 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the City is 44.42 inches.

3.3 Topography

The City of Waynesboro lies primarily within the Valley and Ridge Province with its eastern border on the edge of the Blue Ridge Province. The City is characterized by rolling, hilly land with some mountainous terrain.

Elevations within the City range from 1,200 feet near the South River to 2,800 feet in the southern and eastern edges of the City near the mountains.

The mountain slopes are underlain by sandstone, quartzite, and phylite beds while the valley consists of limestone and dolomite bedrock.

3.4 Wildlands, Vegetation, and Fuels

Ridgeview Park is an 85-acre area in which the South River meanders through. There are several trails that can be found within the park. It offers both open spaces as well as forested areas.

Coyner Springs Park encompasses 145 acres and is located off Lyndhurst Rd. The park is home to numerous wildlife and several nature trails.

Constitution Park is located on Race Avenue. It is home to the Waynesboro

Arboretum and the location of Virginia's first Urban Trout Fishery.

North Park is a 14-acre park located off Bridge Ave. The park is bordered by the South River.

Basic Park is 18 acres and is bordered on its western boundary by the South River. It is accessible from Genicom Dr.

Shenandoah National Park is within close proximity to the City of Waynesboro. It is a long, narrow band of land that covers over 190,000 acres and is situated between the Shenandoah Valley and River and the Virginia Piedmont. The park was fully established in 1935 and spans eight counties, Augusta County being one of them; the park also runs through Warren, Page, Rockingham, Rappahannock, Madison, Green, and Albemarle Counties.
In 1926, Shenandoah National Park got authorization, and nine years passed before it was officially established. Before becoming a national park, much of the area was farmland. Over the years, Virginia slowly acquired the lands through eminent domain. It was then given to the U.S. Federal Government; provided it would be dedicated as a National Park.

Lying across the Blue Ridge Mountains, the park offers many activities for all visitors. The largest attractor is the 105-mile Skyline Drive that provides scenic views of Virginia. There is more to the Shenandoah National Park than just Skyline Drive; with almost 80,000 acres designated as wilderness with the protection of the National Wilderness Preservation System. There are also many trails that serve for horseback riding, camping, bicycling, and hiking to scenic views or waterfalls.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Waynesboro is located within the Upper Shenandoah River Basin.

Surface Water:
Waynesboro has one spring on the east side of Town. Also, the South River flows through the center of Town.

Ground Water:
Ground water availability varies due to geologic structure. The town has ground water as a source via 2 wells.

3.6 Fire Department

Waynesboro FD

3.7 Values at Risk

Waynesboro is comprised of approximately 9,900 housing units, with approximately 9,000 of these occupied by the owners. As of 2016, the median value of homes in Waynesboro was approximately $158,800. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the City are the critical infrastructure elements and areas of community interest. These include natural gas and transmission lines, the Norfolk Southern and CSX rail lines, and other elements of infrastructure.

Town of Bridgewater

3.1 Locality Setting

In 1835 the Town of Bridgewater was chartered as a town. Bridgewater is 2.5 sq. miles.

Bridgewater is located within the Shenandoah Valley in west-central Virginia and is physically located within Rockingham County. Interstate 81 runs to the east of the Town. Bridgewater is approximately 105 miles north of Roanoke; 135 miles southwest of Washington, D.C.; and 125 miles northwest of Richmond.

The Town had an estimated population of 6,048 in 2016. According to 2015 estimates there were 2,026 occupied housing units throughout the Town. 1,162 units are occupied by owners with another 864 occupied by renters.

3.2 Climate

Bridgewater is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The Town has an average annual temperature of 52 degrees Fahrenheit. The average high temperatures are 40 degrees Fahrenheit in January and 85 degrees in July. The average lows are 20 degrees in January and 62 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 175 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the Town is 36.48 inches and average snowfall is 20.1 inches.

3.3 Topography

Elevations within the Town of Bridgewater range from 1,160 feet along the North River to 1,300 feet in the Breezewood Terrace area.

Most of the Town is characterized with gently rolling slopes of less than 15%, while slopes of greater than 15% can be found along the North River and on the ridge line in Town.

3.4 Wildlands, Vegetation, and Fuels

The Town of Bridgewater has planted more than 2,000 trees since 1990. Along the banks of the North and Dry Rivers are mature trees and woodlands. Smaller woodland areas can be found amongst Mount Crawford Ave. and College Woods Dr.

Cooks Creek Arboretum encompasses 8 acres and as the trees mature will become a natural preserve. It is located on Weeping Willow Ln.

Harrison Park is a 15-acre park and located on Grove Street.

Oakdale Community Park is a 36-acre park and the largest in Bridgewater. It is located on Mt. Crawford Ave.

Wildwood Park
The park encompasses 10 acres and is located on Bank St. It borders the North River and has wooded areas. It is located at 606 W. Bank St.

Bridgeview Park
The area encompasses about 2.5 acres along the North River with trees and fitness areas. It is located at 220 W. Bank St.

Bird Sanctuary
The Bird Sanctuary is a small area of .75 acres and has trees and shrubs available as shelter for the birds. It is located at 211 W. Riverside Dr.

Seven Bridges
This park is about 2 acres and overlooks the river. It is located at 201 S. Grove St.

Edgebriar Park
This pocket park is .24 acres and located along the North River. It is located at 101 E. Riverside Dr.

Millview Park
The area is 4.73 acres and in the development stage. It is located at 4155 Dry River Rd.

3.5 Water Resources

Water resources within the Town consist of both surface and ground water sources. Bridgewater is located within the Upper Shenandoah River Basin.

Surface Water:
The North River that flows on the east/southeast side of Town is a surface water source for Bridgewater.

Ground Water:
Ground water availability varies due to geologic structure. The Town does have ground water as a water source by use of a well.

3.6 Fire Department

Bridgewater VFD

3.7 Values at Risk

Bridgewater is comprised of approximately 2,070 housing units, with approximately 2,050 of these occupied by the owners. As of 2016, the median value of homes in Bridgewater was approximately $209,200. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the Town are the critical infrastructure elements and areas of community interest.

Town of Broadway

3.1 Locality Setting

In 1880 the Town of Broadway was incorporated. Broadway is 2.4 sq. miles.

Broadway is located within the Shenandoah Valley in west-central Virginia and is physically located within Rockingham County. Interstate 81 runs to the east of the Town. Broadway is approximately 125 miles north of Roanoke; 115 miles southwest of Washington, D.C.; and 130 miles northwest of Richmond.

The Town had an estimated population of 3,860 in 2016. According to 2015 estimates there were 1,569 occupied housing units throughout the Town. 1,173 units are occupied by owners with another 396 occupied by renters.

3.2 Climate

Broadway is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The Town has an average annual temperature of 53 degrees Fahrenheit. The average high temperatures are 42 degrees in January and 85 degrees in July. The average lows are 20 degrees in January and 63 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 165 days long, from late-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the Town is 35.4 inches and 21.6 inches of annual average snowfall.

3.3 Topography

The Town of Broadway lies within the Great Valley portion of the Valley and Ridge Physiographic Province. The Town is paralleled by mountains to the east and west. It is characterized by rolling hills and valleys.

Elevations within the Town range from 1,010 to 1,250. The Town has slopes that range from 0-45%.

Broadway is part of a large karst region characterized by caves, sinkholes and large springs. This is due to the underlain rock being limestone dolomite which dissolves as water makes its way into the rock.

3.4 Wildlands, Vegetation, and Fuels

Heritage Park is located on Turner Ave. right off Route 42. This park has a small shelter available.

Broadway Community Park is located at the end of Turner Ave. along Route 617. This park has two small shelters and a large shelter available.

3.5 Water Resources

Water resources within the Town consist of both surface and ground water sources. Broadway is located within the Upper Shenandoah River Basin.

Surface Water:
The Town has three bodies of surface water: Linville Creek (flowing through town), The North Fork of the Shenandoah River (the north border of Town), and Daphna Creek (flowing through the Southern part of Town).

Ground Water:
Ground water availability varies due to geologic structure. The Town does have one ground water source as of 2015.

3.6 Fire Department

Broadway FD

3.7 Values at Risk

Broadway is comprised of approximately 1,515 housing units, with approximately 1,500 of these occupied by the owners. As of 2016, the median value of homes in Broadway was approximately $205,400. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the Town are the critical infrastructure elements and areas of community interest. These include natural gas and transmission lines, Norfolk Southern rail line, and other elements of infrastructure.

Town of Craigsville

3.1 Locality Setting

In 1959 the Town of Craigsville was incorporated. Craigsville is 2 sq. miles.

The Town is located within the Shenandoah Valley in west-central Virginia and is physically located within Augusta County. Craigsville is approximately 85 miles north of Roanoke; 175 miles southwest of Washington, D.C.; and 130 miles west of Richmond.

The Town had an estimated population of 935 was 2016. According to 2015 estimates there were 458 occupied housing units throughout the Town. 274 units are occupied by owners with another 184 occupied by renters.

3.2 Climate

Craigsville is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The Town has an average annual temperature of 52.3 degrees Fahrenheit. The average high temperatures are 43.3 degrees Fahrenheit in January and 85.1 degrees in July, the average lows are 21.5 degrees in January and 61.6 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the north-west. The growing season is 175 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the Town is 36 inches and 26 inches of average annual snowfall.

3.3 Topography

Craigsville is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The Town has an average annual temperature of 52.3 degrees Fahrenheit. The average high temperatures are 43.3 degrees Fahrenheit in January and 85.1 degrees in July, the average lows are 21.5 degrees in January and 61.6 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the north-west. The growing season is 175 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the Town is 36 inches and 26 inches of average annual snowfall. The average annual humidity for Craigsville is 73.94%, with the peak humidity occurring in May at 88.4%.

3.4 Wildlands, Vegetation, and Fuels

George Washington and Jefferson National Forests is within close proximity to Craigsville. Virginia is one of three states that encompass the George Washington and Jefferson National Forests; the bulk of the forests are located in Virginia, with

some overlap in West Virginia and Kentucky. Covering approximately 1.8 million acres along the Appalachian Mountains, the national forests combined create the largest area of public land in the eastern portion of the United States. The majority of the forest is remote, and there are over 100,000 acres that have been designated as wilderness areas.

The George Washington National Forest was established in 1918, and then in 1932 was renamed; the Jefferson National Forest was established in 1936. The two were administratively combined in 1995. George Washington National Forest holds the most acreage between the two with 1,065,389 acres, while Jefferson National Forest encompasses the remaining 723,350 acres. Combined the forests also contain over 200,000 acres of old-growth forests.
The national forests offer a wide variety of activities for visitors, including hiking, biking, and hunting. There are hundreds of miles of trails and multiple scenic areas, byways, and wildernesses for these activities to take place.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. The Town is located within the Upper Shenandoah River Basin.

Surface Water:
The Town has two springs available for use as source water. The Little Calfpasture River flows just south of Town.

Ground Water:
Ground water availability varies due to geologic structure. Craigsville also makes use of ground water as a source via 4 wells.

3.6 Fire Department

Craigsville VFD

3.7 Values at Risk

Craigsville is comprised of approximately 500 housing units, with approximately 445 of these occupied by the owners. As of 2010, the median value of homes in Craigsville was approximately $201,100. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the Town are the critical infrastructure elements and areas of community interest. These include natural gas and transmission lines, the CSX rail line, and other elements of infrastructure.

Town of Dayton

3.1 Locality Setting

In 1852 the Town of Dayton was incorporated. Dayton is 0.75 sq. miles.

Dayton is located within the Shenandoah Valley in west-central Virginia and is physically located within Rockingham County. Dayton is approximately 110 miles north of Roanoke; 135 miles southwest of Washington, D.C.; and 120 miles northwest of Richmond.

The Town had an estimated population of 1,609 in 2016. According to 2015 estimates there were 653 occupied housing units throughout the Town. 465 units are occupied by owners with another 188 occupied by renters.

3.2 Climate

Dayton is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The Town has an average annual temperature of 53.5 degrees Fahrenheit. Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 175 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the Town is 36.48 inches and average snowfall is 20.1 inches.

3.3 Topography

Dayton is characterized by gently rolling slopes of less than 15%. There is approximately 2% of the Town with slopes between 15-25%.

The Town of Dayton lies within the Great Valley portion of the Valley and Ridge Physiographic Province. The Town is paralleled by mountains to the east and west.

Dayton is part of a large karst region characterized by caves, sinkholes and large springs. This is due to the underlain rock being limestone dolomite which dissolves as water makes its way into the rock.

3.4 Wildlands, Vegetation, and Fuels

College Street Pavilion is located at 360 College Street.

Cooks Creek Park is located at 230 Bowman Road.

Sunset Park is located at 145 Sunset Drive.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Dayton is located within the Upper Shenandoah River Basin.

Surface Water:
Dayton has a spring source located north of Town as well as Cook's Creek which runs along the north and east Town border.

Ground Water:
Ground water availability varies due to geologic structure. The Town has a ground water source via two wells.

3.6 Fire Department

None

3.7 Values at Risk

Dayton is comprised of approximately 690 housing units, with approximately 640 of these occupied by the owners. As of 2016, the median value of homes in Dayton was approximately $225,000. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the Town are the critical infrastructure elements and areas of community interest.

Town of Elkton

3.1 Locality Setting

In 1908 the Town of Elkton was founded. Elkton is 1.4 sq. miles.

Elkton is located within the Shenandoah Valley in west-central Virginia and is physically located within Rockingham County. Elkton is approximately 120 miles north of Roanoke; 120 miles southwest of Washington, D.C.; and 100 miles northwest of Richmond.

The Town had an estimated population of 2,850 in 2016. According to 2015 estimates there were 1,278 occupied housing units throughout the Town. 875 units are occupied by owners with another 403 occupied by renters.

3.2 Climate

Elkton is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The Town has an average annual temperature of 54 degrees Fahrenheit. The average daytime temperature is 80 degrees in the summer and 42 degrees in the winter. Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 166 days long, from late-April to early October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation if 45 inches.

3.3 Topography

The Town of Elkton is relatively flat and has low elevations ranging from 920 feet along the Shenandoah River to 1,168 feet at Elkwood. Slopes within the Town range from less than 8% west of Route 340 and greater than 25% in the newly annexed area to the east.

The Town of Elkton lies within the Great Valley portion of the Valley and Ridge Physiographic Province. The Town is paralleled by mountains to the east and west.

Elkton is part of a large karst region characterized by caves, sinkholes and large springs. This is due to the underlain rock being limestone dolomite which dissolves as water makes its way into the rock.

3.4 Wildlands, Vegetation, and Fuels

Shenandoah National Park is within close proximity to Elkton. The park is a long, narrow band of land that covers over 190,000 acres and is situated between the Shenandoah Valley and River and the Virginia Piedmont. The park was fully established in 1935 and spans eight counties, Rockingham County being one of them; the park also runs through Warren, Page, Augusta, Rappahannock, Madison, Green, and Albemarle Counties.

In 1926, Shenandoah National Park got authorization, and nine years passed before it was officially established. Before

becoming a national park, much of the area was farmland; and over the years Virginia slowly acquired the lands through eminent domain. It was then given to the U.S. Federal Government; provided it would be dedicated as a National Park.

Lying across the Blue Ridge Mountains, the park offers many activities for all visitors. The largest attractor is the 105-mile Skyline Drive that offers scenic views of Virginia. There is more to the Shenandoah National Park than just Skyline Drive, with almost 80,000 acres designated as wilderness with the protection of the National Wilderness Preservation System. There are also many trails that serve for horseback riding, camping, bicycling, and hiking to scenic views or waterfalls.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Elkton is located within the Upper Shenandoah River Basin.

Surface Water:
Elkton has one spring located east of town as well as the South Fork Shenandoah River that runs through the west side of Town.

Ground Water:
Ground water availability varies due to geologic structure. Elkton does have a ground water source via one well.

3.6 Fire Department

Elkton VFC

3.7 Values at Risk

Elkton is comprised of approximately 1,360 housing units, with approximately 1,200 of these occupied by the owners. As of 2016, the median value of homes in Elkton was approximately $180,000. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the Town are the critical infrastructure elements and areas of community interest. These include natural gas and transmission lines, the Norfolk Southern rail line, and other elements of infrastructure.

Town of Glasgow

3.1 Locality Setting

In 1892 the Town of Glasgow was established. Glasgow is 1.53 sq. miles.

Glasgow is located within the Shenandoah Valley in west-central Virginia and is physically located within Rockbridge County. Glasgow is approximately 45 miles north of Roanoke; 195 miles southwest of Washington, D.C.; and 135 miles west of Richmond.

The Town had an estimated population of 1,116 in 2016. According to 2015 estimates there were 537 occupied housing units throughout the Town. 327 units are occupied by owners with another 210 occupied by renters.

3.2 Climate

Glasgow is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The Town has an average annual temperature of 55 degrees Fahrenheit. The average high temperature is 39.4 degrees Fahrenheit in January and 87.2 degrees in July. The average low is 19.9 degrees in January and 62.9 degrees in July.

Prevailing winds are generally out of the southwest. During colder months, the winds often originate from the northwest. The growing season is 168 days long, from late-April to early-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the Town is 49.26 inches and 18.7 inches of average annual snowfall.

3.3 Topography

The Town of Glasgow has a ridgeline that passes through the center of Town where water flows to either the Maury or James River watershed. The Maury River flows into the James River. The elevation ranges from 710 to 900 feet.

The town is fairly flat at the base of the Blue Ridge Mountains, but has slopes approaching 25% along the western boundary of Town.

3.4 Wildlands, Vegetation, and Fuels

George Washington and Jefferson National Forests is within close proximity to Glasgow. Virginia is one of three states that encompass the George Washington and Jefferson National Forests; the bulk of the forests are located in Virginia, with some overlap in West Virginia and Kentucky. Covering approximately 1.8 million acres along the Appalachian Mountains, the national forests combined create the largest areas of public land in the eastern portion of the United States. The majority of the forest is remote, and there are over 100,000 acres that have been designated as wilderness areas.

The George Washington National Forest was established in 1918, and then in 1932 was renamed; the Jefferson National Forest was established in 1936. The two were

administratively combined in 1995. George Washington National Forest holds the most acreage between the two with 1,065,389 acres, while Jefferson National Forest encompasses the remaining 723,350 acres. Combined the forests also contain over 200,000 acres of old-growth forests.
The national forests offer a wide variety of activities for visitors, including hiking, biking, and hunting. There are hundreds of miles of trails and multiple scenic areas, byways, and wildernesses for these activities to take place.

William S. Knick Ballfield the park has sports fields/courts and two pavilions.

Centennial Park this park is located at the corner of McCulloch Street and Blue Ridge Road. There are benches located at the park.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Glasgow is located within the Upper James River Basin.

Surface Water:
The Town is located at the confluence of the James and Maury Rivers. The Maury borders the Town to the east and the James borders the Town to the south.

Ground Water:
Ground water availability varies due to geologic structure. The Town is served by three wells.

3.6 Fire Department

Glasgow VFD

3.7 Values at Risk

Glasgow is comprised of approximately 545 housing units, with approximately 485 of these occupied by the owners. As of 2016, the median value of homes in Glasgow was approximately $95,500. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the Town are the critical infrastructure elements and areas of community interest.

Town of Goshen

3.1 Locality Setting

In 1884 the Town of Goshen was incorporated. Goshen is 1.7 sq. miles.

Goshen is located within the Shenandoah Valley in west-central Virginia and is physically located within Rockbridge County. Goshen is approximately 75 miles north of Roanoke; 185 miles southwest of Washington, D.C.; and 140 miles west of Richmond.

The Town had an estimated population of 354 in 2016. According to 2015 estimates there were 167 occupied housing units throughout the Town. 126 units are occupied by owners with another 41 occupied by renters.

3.2 Climate

Goshen is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The Town has an average daily temperature of 36 degrees Fahrenheit in January and 75 degrees Fahrenheit in July. Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 168 days long, from late-April to early-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the Town is 40 inches.

3.3 Topography

The Town of Goshen is in the Alleghany Mountains Province which is characterized by a succession of northeast trending ridges and valleys. The rocks in this area are younger than the Great Valley and tend to be sandstones and quartzite which are several hundred feet thick.

The elevation of the town ranges from 1,400 to 1,500 feet. Floodplains of waterways within the Town cover 1/5 of its total area.

3.4 Wildlands, Vegetation, and Fuels

George Washington and Jefferson National Forests is within close proximity to Goshen. Virginia is one of three states that encompass the George Washington and Jefferson National Forests; the bulk of the forests are located in Virginia, with some overlap in West Virginia and Kentucky. Covering approximately 1.8 million acres along the Appalachian Mountains, the national forests combined create the largest areas of public land in the eastern portion of the United States. The majority of the forest is remote, and there are over 100,000 acres that have been designated as wilderness areas.

The George Washington National Forest was established in 1918, and then in 1932 was renamed; the Jefferson National Forest was established in 1936. The two were administratively combined in 1995. George Washington National Forest holds the most acreage between the two with 1,065,389 acres, while Jefferson National Forest encompasses the remaining 723,350 acres. Combined the forests also contain over

200,000 acres of old-growth forests. The national forests offer a wide variety of activities for visitors, including hiking, biking, and hunting. There are hundreds of miles of trails and multiple scenic areas, byways, and wildernesses for these activities to take place.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Goshen is located within the Upper James River Basin.

Surface Water:
The Town of Goshen is located at the confluence of the Mill Creek and Calfpasture River. Mill Creek runs through the center of Town and the Calfpasture River runs along the northeast and southeast border. Lake Merriweather is in close proximity to the east.

Ground Water:
Ground water availability varies due to geologic structure. The Town does have one spring source located within the boundary.

3.6 Fire Department

Goshen VFC

3.7 Values at Risk

Goshen is comprised of approximately 215 housing units, with approximately 165 of these occupied by the owners. As of 2016, the median value of homes in Goshen was approximately $96,300. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the County are the critical infrastructure elements and areas of community interest. These include natural gas and transmission lines, the CSX rail line, and other elements of infrastructure.

Town of Grottoes

3.1 Locality Setting

In 1892 the Town of Shendun was incorporated and in 1912 the town's name was changed to Grottoes. Grottoes is 2 sq. miles.

Grottoes is located within the Shenandoah Valley in west-central Virginia and is physically located within Rockingham County. Grottoes is approximately 105 miles north of Roanoke; 135 miles southwest of Washington, D.C.; and 115 miles northwest of Richmond.

The Town had an estimated population of 2,799 in 2016. According to 2015 estimates there were 1,090 occupied housing units throughout the Town. 773 units are occupied by owners with another 317 occupied by renters.

3.2 Climate

Grottoes is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The Town has an average annual temperature of 53 degrees Fahrenheit. The average daytime-summer temperature is 80 degrees Fahrenheit with nighttime lows averaging around 50 degrees Fahrenheit.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate out of the northwest.

The growing season is 166 days long, from late-April to early-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the Town is 34 inches and 29 inches of average annual snowfall.

3.3 Topography

The Town of Grottoes is characterized by rolling hills within a valley beside the South Fork of the Shenandoah River. Slopes within the Town range from 0-25%. The elevation ranges from 1,090 feet near the Shenandoah River to 1,180 feet.

The physiographic province surrounding the Town is the Valley-Ridge province that lies between the Blue Ridge Province to the east and the Appalachian Province to the west.

3.4 Wildlands, Vegetation, and Fuels

Shenandoah National Park is within close proximity to Grottoes. The park is a long, narrow band of land that covers over 190,000 acres and is situated between the Shenandoah Valley and River and the Virginia Piedmont. The park was fully established in 1935 and spans eight counties, Rockingham County being one of them; the park also runs through Warren, Page, Augusta, Rappahannock, Madison, Green, and Albemarle Counties.
In 1926, Shenandoah National Park got authorization, and nine years passed before it was officially established. Before becoming a national park, much of the area was farmland; and over the years Virginia slowly acquired the lands through eminent domain. It was then given to the U.S.

Federal Government; provided it would be dedicated as a National Park.

Lying across the Blue Ridge Mountains, the park offers many activities for all visitors. The largest attractor is the 105-mile Skyline Drive that offers scenic views of Virginia. There is more to the Shenandoah National Park than just Skyline Drive, with almost 80,000 acres designated as wilderness with the protection of the National Wilderness Preservation System. There are also many trails that serve for horseback riding, camping, bicycling, and hiking to scenic views or waterfalls.

Grand Caverns Park includes limestone caverns that were discovered in 1804 and that are designated a National Natural Landmark by the National Park Service. The park also has a variety of forested walking and biking trails.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Grottoes is located within the Upper Shenandoah River Basin.

Surface Water:
The Town is bordered to the west by the South River.

Ground Water:
Ground water availability varies due to geologic structure. Grottoes uses ground water as a source via 3 wells.

3.6 Fire Department

Grottoes VFRD

3.7 Values at Risk

Grottoes is comprised of approximately 1,190 housing units, with approximately 1,115 of these occupied by the owners. As of 2016, the median value of homes in Grottoes was approximately $169,200. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the Town are the critical infrastructure elements and areas of community interest. These include natural gas and transmission lines, the Norfolk Southern rail line, and other elements of infrastructure.

Town of Monterey

3.1 Locality Setting

In 1880 the Town of Monterey was incorporated. Monterey is 0.3 sq. miles.

Monterey is located within the Shenandoah Valley in west-central Virginia and is physically located within Highland County. Monterey is approximately 110 miles north of Roanoke; 190 miles southwest of Washington, D.C.; and 155 miles west of Richmond.

The Town had an estimated population of 136 in 2016. According to 2015 estimates there were 83 occupied housing units throughout the Town. 63 units are occupied by owners with another 20 occupied by renters.

3.2 Climate

Monterey is located within the Cfb climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a warm summer.

The Town has an average annual temperature of 48 degrees Fahrenheit. The average high temperature is 37 degrees Fahrenheit in January and 80 degrees in July. The average low is 17 degrees in January and 56 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 165 days long, from late-April to early-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation is 43.72 inches.

3.3 Topography

Monterey is situated within the Allegheny Mountains in which the area is characterized with alternating ridges and valleys.

3.4 Wildlands, Vegetation, and Fuels

George Washington and Jefferson National Forests surrounds Monterey. Virginia is one of three states that encompass the George Washington and Jefferson National Forests; the bulk of the forests are located in Virginia, with some overlap in West Virginia and Kentucky. Covering approximately 1.8 million acres along the Appalachian Mountains, the national forests combined create the largest areas of public land in the eastern portion of the United States. The majority of the forest is remote, and there are over 100,000 acres that have been designated as wilderness areas.

The George Washington National Forest was established in 1918, and then in 1932 was renamed; the Jefferson National Forest was established in 1936. The two were administratively combined in 1995. George Washington National Forest holds the most acreage between the two with 1,065,389 acres, while Jefferson National Forest encompasses the remaining 723,350 acres. Combined the forests also contain over 200,000 acres of old-growth forests. The national forests offer a wide variety of activities for visitors, including hiking,

biking, and hunting. There are hundreds of miles of trails and multiple scenic areas, byways, and wildernesses for these activities to take place.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Monterey is located within the Upper James River Basin.

Surface Water:
West Strait Creek runs through the northern portion of Town. There are other creeks within close proximity.

Ground Water:
Ground water availability varies due to geologic structure. The Town is served by three wells.

3.6 Fire Department

Highland County VFD

3.7 Values at Risk

Monterey is comprised of approximately 120 housing units, with approximately 80 of these occupied by the owners. As of 2016, the median value of homes in Monterey was approximately $157,100. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the Town are the critical infrastructure elements and areas of community interest.

Town of Mount Crawford

3.1 Locality Setting

In 1825 the Town of Mount Crawford was established. Mount Crawford is 0.5 sq. miles.

Mount Crawford is located within the Shenandoah Valley in west-central Virginia and is physically located within Rockingham County. Mount Crawford is approximately 105 miles north of Roanoke; 135 miles southwest of Washington, D.C.; and 125 miles northwest of Richmond.

The Town had an estimated population of 452 in 2016. According to 2015 estimates there were 191 occupied housing units throughout the Town. 135 units are occupied by owners with another 56 occupied by renters.

3.2 Climate

Mount Crawford is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The Town has an average annual temperature of 52 degrees Fahrenheit. The average high temperature is 40 degrees Fahrenheit in January and 85 degrees in July. The average low is 20 degrees in January and 62 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 175 days long, from mid-April to mid-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the Town is 36.48 inches and average snowfall is 20.1 inches.

3.3 Topography

Mount Crawford is characterized by rolling hills within a valley. The Town is near the banks of the North River and Cooks Creek. The elevation ranges from 1,170 feet at the junction of the North River and Cooks Creek to 1,205 feet near the corporate limits north of Town.

The physiographic province surrounding the Town is the Valley-Ridge province that lies between the Blue Ridge Province to the east and the Appalachian Province to the west.

3.4 Wildlands, Vegetation, and Fuels

None

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Mount Crawford is located within the Upper Shenandoah River Basin.

Surface Water:
Mount Crawford is nearly surrounded by the North River. It is bordered to the east, south, and west by the North River.

Ground Water:
Ground water availability varies due to geologic structure.

3.6 Fire Department

Rockingham County Fire and Rescue

3.7 Values at Risk

Mount Crawford is comprised of approximately 210 housing units, with approximately 180 of these occupied by the owners. As of 2016, the median value of homes in Mount Crawford was approximately $222,700. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the Town are the critical infrastructure elements and areas of community interest.

Town of Timberville

3.1 Locality Setting

In 1894 the Town of Timberville was chartered. Timberville is 0.86 sq. miles.

Timberville is located within the Shenandoah Valley in north-west Virginia and is physically located within Rockingham County. Timberville is approximately 130 miles north of Roanoke; 120 miles southwest of Washington, D.C.; and 135 miles northwest of Richmond.

The Town had an estimated population of 2,640 in 2016. According to 2015 estimates there were 1,094 occupied housing units throughout the Town. 604 units are occupied by owners with another 490 occupied by renters.

3.2 Climate

Timberville is located within the Cfa climate region according to the Köppen-Keiger Climate Classification. It is described as a mild temperate climate, fully humid with a hot summer.

The Town has an average annual temperature of 54.4 degrees Fahrenheit. The average high temperature is 43 degrees Fahrenheit in January and 87 degrees in July. The average low is 22 degrees in January and 63 degrees in July.

Prevailing winds are generally out of the southwest. During the colder months, the winds often originate from the northwest. The growing season is 165 days long, from late-April to early-October. This is long enough to allow proper maturity for a large variety of crops. The average annual precipitation for the Town is 35.2 inches.

3.3 Topography

Timberville is characterized by rolling hills with mountains to the east and west. The elevation ranges from 980 to 1,120 feet. The slopes can range from 0-45 degrees.

The physiographic province surrounding the Town is the Valley-Ridge province that lies between the Blue Ridge Province to the east and the Appalachian Province to the west.

3.4 Wildlands, Vegetation, and Fuels

Plains District Memorial Park encompasses 12 acres with a few sports fields/ courts, a pool, and three picnic shelters. The North Fork Shenandoah River is the boundary for the park.

Timber Hills Park is located within the Timber Hills Subdivision for their residents.

3.5 Water Resources

Water resources within the Region consist of numerous bodies of ground and surface water, hydrants, and other access points. Timberville is located within the Upper Shenandoah River Basin.

Surface Water:
The North Fork Shenandoah River runs through the center of Town.

Ground Water:
Ground water availability varies due to geologic structure. The Town uses ground water as a source via two wells as well as a spring source located northwest of Town.

3.6 Fire Department

Timberville VFD

3.7 Values at Risk

Timberville is comprised of approximately 1,135 housing units, with approximately 1,015 of these occupied by the owners. As of 2016, the median value of homes in Timberville was approximately $147,300. Homes in woodland areas may be at risk in the event of a wildland fire.

Also, at risk within the Town are the critical infrastructure elements and areas of community interest. These include natural gas and transmission lines, Norfolk Southern rail line, and other elements of infrastructure.

Section 4: WILDFIRE HAZARD AND RISK ASSESSMENT

4.1 Assessment Approach

The assessment is a tool to examine wildfire vulnerability and for developing an understanding of potential loss of life, property, and natural resources due to wildfire. It is also an implementation strategy for future efforts. The Wildfire Hazard and Risk Assessment focuses on assessing the risk, the hazard, and the values to delineate the Wildland Urban Interface (WUI). **Risks** are defined as those uses, human activities, or natural causes that have the potential to cause wildfire ignition. **Hazards** are defined as fuels and topography of an area. Examining hazards helps determine the potential for a large-scale fire to result from ignition. **Values** are also known as "potential for loss" and consist of identifying those elements of natural or developed areas where destruction by wildfire is unacceptable. Some values are common among all communities such as loss of life, residential structures, commercial development, or natural resources. Some values may be specific and unique to a community and include cultural, historical, and/or recreational assets. Through an assessment of risk, hazard, and values, the jurisdictions in the Region have the information needed to utilize planning, preparedness, response, and mitigation resources more effectively.

4.2 Risks

As previously mentioned, risks are defined as those uses, human activities, or natural causes that have the potential to cause wildfire ignition. There are two major factors that influence the risk levels of in the Region, its increase in population, which has included development in the Wildland Urban Interface, as well as the large amount of public lands. Increased population brings with it increased potential for wildfire ignition from human activity and development including, but certainly not limited to, structural fires, natural gas and power lines, vehicles and equipment, permitted burning, arson, fireworks, children playing with matches or lighters, and discharge of firearms. With large tracts of public wildlands, that include the George Washington and Jefferson National Forests and the Shenandoah National Park, wildfire occurrence increases due to natural causes such as lightning or debris caused by high winds, tornadoes, or winter storms to human-caused risks such as cigarette smoking or camp fires. Because of its combination of increasing population and large amount of wild spaces, communities in the Region are at risk for wildfires.

While the woodland areas throughout the Region provide beautiful landscapes upon which many people have settled and built homes, they also represent a major danger in the form of wildfires. The landscape of the Valley, with its sloping hills and steady winds, is a major contributor to the threat of forest fires. While their incidence and intensity are not of the same severity as it is in the western United States, these eastern forest fires still pose a major threat to the safety of people and property in the Region.

4.2.1 Recent Wildfires

On **February 10, 2008**, 354 wildfires occurred in the State of Virginia, the most of any day on record. Five of these fires occurred in Augusta County. These fires claimed close to 55 acres of Augusta woodlands.

In **March of 2008**, the St. Mary's Wildfire made regional headlines for the vast plumes of smoke that could be seen up to 50 miles away. Caused by campers, the fire burned a total of 4,505 acres of land. High winds and dry conditions fueled the fire. Rough terrain strained firefighter's efforts in containing the fire. By the time it was controlled, it had caused $70,000 (2008 dollars) worth of property damage.

In **April of 2012**, separate wildfires in Shenandoah, Alleghany, Page, Craig, and Rockbridge Counties burned for several days as nearly 700 firefighters from 29 states were called in to help control the fires. In all, the fires burned 39,000 acres over a period of ten days, making the combined 'Easter Complex Fire' one of the worst in State history.

In **March of 2016,** a forest fire on Cellar Mountain located within Saint Mary's Wilderness in Augusta County, VA (East of Raphine and west of the Blue Ridge Parkway) burned over 700 acres. A team of 75 firefighters and support personnel were called on to fight this fire.

In **April of 2016,** the Rocky Mount forest fire burned over 10,000 acres (2nd largest) in Shenandoah National Park (SNP). The name of the fire was due to the location within the park that it started—Rocky Mount, which is just south of Elkton, VA. More than 350 firefighting and support personnel were assigned to the fire from 33 states. Since the creation of SNP in 1935 there had not been a fire so the area was overwhelmed with dead and down wood, deep duff, and overgrowth.

In **April of 2017,** a brush fire in Goshen Pass burned 3,100 acres. The steep terrain created difficult conditions for fighting the fire. Arson was the suspected cause of the fire.

In **May 2018**, the Tye River Fire in the George Washington and Jefferson National Forests, was caused by a spark from a vehicle fire near Vesuvius in Rockbridge County. The fire spread into Augusta County. Over 1,700 acres burned as a result of this fire.

4.3 Hazards

Determining the degree of difficulty in suppressing a fire once it has been ignited occurs by accessing the hazards. Areas of fire behavior that are the most important in determining the level of hazards and fire intensity for an area include **topography**, **fuels**, and **weather**.

4.3.1 Topography

Slope is defined as an upward or downward slant of the terrain. Fire traveling up a slope will move faster and have longer flames than fire traveling on flat terrain. Most of the Central Shenandoah Region lies within the Valley and Ridge Physiographic Province, which is characterized by long, parallel, narrow, and even-crested ridges above intervening, varying sized valleys. The eastern part of the region is located in

the Blue Ridge Physiographic Province which is known for its sharp mountain peaks. Because of the varying degrees of slope throughout the Region, there is the enhanced potential for development of wildfires.

4.3.2 Fuel

Plant material, living or dead, that can be ignited by a fire is known as fuel. There are four main categories of fuels; ground fuels, surface fuels, ladder fuels, and canopy fuels. Starting with ground fuels, these fuel types layer the forest starting within the soil up to the crowns of trees that form the overstory. Foliage, pine needle litter, vines, shrubs, deciduous and evergreen trees, dead tree limbs, etc. are all fuels that can ignite causing wildfires. In the Central Shenandoah Region, evergreens, downed woody materials such as branches and trees, storm debris, and overgrown fields are consistent fuel hazards. Because of the large volume of forested land and fuel hazards that exist in the Region, there is the enhanced potential for development of wildfires.

4.3.3 Weather

Interaction of weather elements can control fire behavior. These weather elements exist in an area that starts at the earth's surface and rises to a level five to ten miles above in the atmosphere. Elements such as temperature, humidity, atmospheric stability, winds, clouds, precipitation, and storms, such as thunderstorms and tornadoes, can affect the development and frequency of wildfire occurrence. Severe weather, including thunderstorms, straight-lined winds, tornadoes, and tropical systems, have occurred throughout the Region's history. Warm summers and long growing seasons allow for vegetation to flourish in fields and forested areas creating a high volume of fuel for wildfires. Periods of limited rainfall and drought conditions also occur periodically in the Region. There are also periods throughout the year when the humidity level drops to levels low enough that wildfire risk is extremely high. Because of the climate and variable weather conditions, there is the enhanced potential for development of wildfires throughout the Region.

4.4 Values

Natural or developed areas where destruction by wildfire is unacceptable are known as Values. Loss of life, first responder safety, residential structures, and natural resources are considered values for the Central Shenandoah Regional Wildfire Protection Plan. These values were at the center of both fuel reduction and structural ignitability reduction measures included in this Plan.

4.5 The Wildland Urban Interface

Delineation of Wildland Urban Interface (WUI) areas in the Region occurred throughout the planning process. It involved discussions with the Steering Committee, public input, and the analysis of data. Types of data used in the WUI analysis included population in wildland areas and woodland home communities, structural and housing density, and land cover. In the appendices of the Plan, are maps that detail the Wildland Urban Interface areas throughout the Central Shenandoah Region.

Table 4.1: Wildfire Statistics by Fire Year 1995-2001

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

Source: Virginia Department of Forestry

Table 4.2: Wildfire Summary 1995 - 2001

County	1995 Acres	1996 Acres	1997 Acres	1998 Acres	1999 Acres	2000 Acres	2001 Acres	Acres Total
Augusta County	61.3	6.2	2.5	482.3	113.2	214.5	355.8	1235.8
Bath County	17	3	0	17.3	53	23	93	206.3
Highland County	29	2	2	35	35.3	0.3	5	108.6
Rockbridge County	4.9	0.3	481.1	4.6	100.3	2	31	624.2
Rockingham County	166.7	8.3	16.1	24.4	151.6	10	147	524.1
Total	**278.9**	**19.8**	**501.7**	**563.6**	**453.4**	**249.8**	**631.8**	**2699**

Source: Virginia Department of Forestry

Table 4.3: Wildfire Causes 1995 - 2001

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

Figure 4.1 CSPDC Wildfire Vulnerability

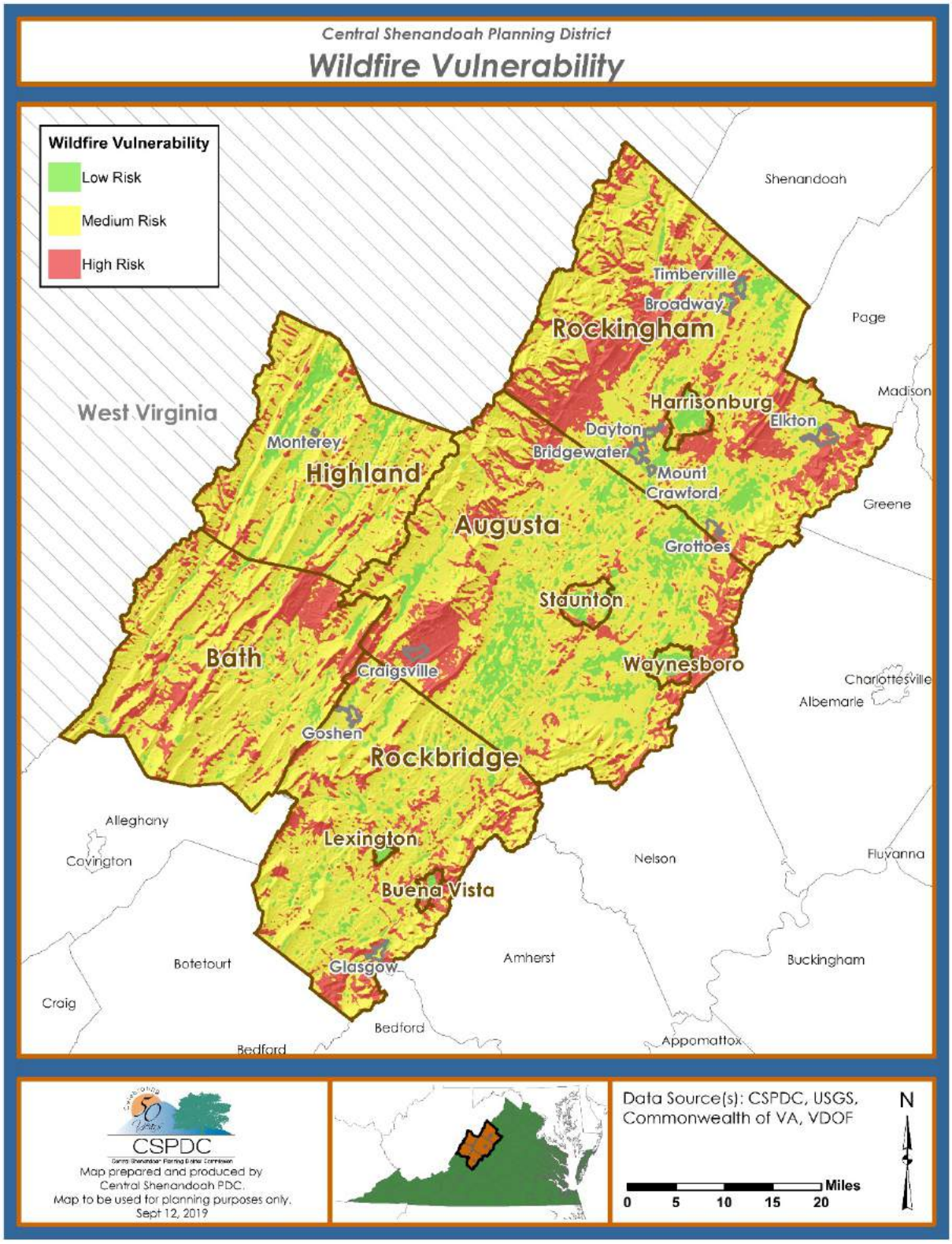
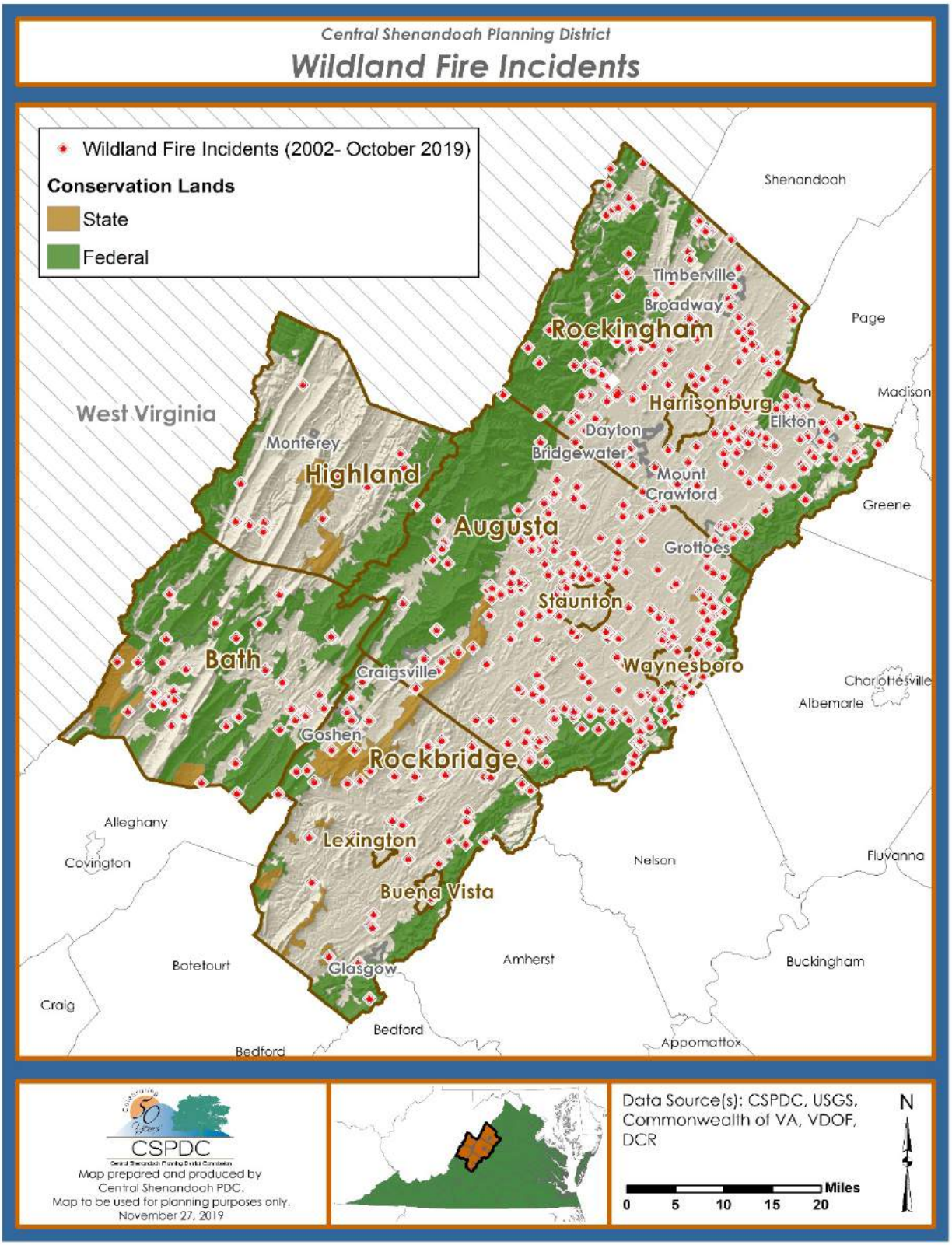


Figure 4.2 CSPDC Wildland Fire Incidents



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Section 5: WILDFIRE MITIGATION PLAN

5.1 Wildfire Mitigation Key Concepts

Mitigation *is defined as any sustained action that reduces or eliminates long term risk to people and property from natural hazards and their effects.*

In taking future steps towards wildfire resistance in the Wildland Urban Interface areas in the Central Shenandoah Region, understanding wildfire's behavior is important. The mitigation strategies and action plan included in this section are focused around the following key concepts:

Effects of Fuels on Woodland Areas

- Fire usually burns uphill and more intensely on hillsides. Increased flame length of fires burning upslope can directly expose structures to flames.
- Light fuels include grasses, shrubs, tree leaves, or needles; they ignite easily and burn rapidly. Light fuels affect the rate of spread of an advancing fire. These are the primary fuels that carry fires and ignite homes in many wildfire situations.
- Heavy fuels include large tree branches, downed logs, and buildings. They require more heat energy to ignite but burn longer and produce more heat once ignited.
- Ladder fuels include shrubs and small trees of intermediate height and act as ladders carrying the flames from the forest surface up to the tops of trees.

Fuel Reduction

"Defensible Space" and "Firescaping" reduce fuels in woodland areas. Higher wildfire hazard levels demand greater distance between structure and vegetation.

- "Defensible Space" is created by:
  - Removal of flammable vegetation such as trees and brush.
  - Reduction of available fuel by pruning tree limbs, removing dead leaves and wood from shrubs, and cutting dead grass.
  - Replacement of hazardous vegetation with less flammable species that are planted in irrigated, maintained flower beds.
  - Altering plant arrangement when necessary and maintaining low plant height.
- Ladder fuel risk can be mitigated by vertical separation of vegetation layers. Separation can be achieved by pruning the tops of bushes and removing lower tree branches.
- "Firescaping" is landscaping to create defensible space. Landscaping may be a primary factor in deciding whether a structure survives a wildfire. "Firescaping" has the goal to create an environment surrounding structures that is not likely to burn in any but the most extreme conditions.

Through "Firescaping", "Defensible Space" concepts are integrated into the objectives of landscaping which include aesthetics, erosion management, entertainment, and environmental and wildlife habitat considerations.

Structural Ignitability

Structures exposed to wildland fires can ignite by **radiation, convection, or fire brands**. **Radiation** is ignition caused by radiating heat to a structure and depends on intensity and duration of the flame front. **Convection** causes the ignition of a structure when a flame comes in direct contact with the structure. **Firebrands** cause ignition when pieces of burning material detach from a fire by strong convection drafts in the burning zone. They can be carried more than a mile. Heavy firebrand showers can be caused in the Wildfire Urban Interface by severe wildfires.

How Fire Affects A Structure:

- **Roof** - slope makes them vulnerable to radiation and convection but are more susceptible to firebrands. (A major cause of home loss in wildland areas is woodshake roofs).
- **Walls** - most susceptible to radiation and convection.
- **Windows** - exposure to heat can cause windows to fracture and collapse leaving an opening for flames or firebrands to ignite structure's interior. Tempered glass can withstand higher temperatures.
- **Eaves and Overhangs** - are very vulnerable to convective exposures. Fuels should be eliminated from contact with eaves. Eaves and overhangs should be boxed or enclosed with nonflammable materials**.**
- **Vents** - openings should be screened to prevent firebrands from entering a structure.
- **Exterior doors** - should be solid wood or metal.
- **Exterior siding materials** - should be fire-resistive.
- **Decks** - should be enclosed underneath and made of composite plastic and wood materials which are fire-resistive. Wood decks that are open underneath, particularly on slopes, are heat traps.

5.2 Wildfire Mitigation Methods Primer

Categories of Mitigation:

1. Mitigation and Defensible Space
2. Planning and Preparedness
3. Fire Safety and Response

Mitigation and Defensible Space Measures:

- Perform a Firewise assessment of your home.
- Maintain a defensible space around the home. The goal is to maintain a green lawn for 30' around your home – a short, green lawn will not carry fire. If new homes are still being built in your area, talk to the developer and local zoning officials about building standards.
- In your home's defensible space:
  - Remove your firewood pile.
  - Remove conifer shrubs, especially if your home is in a high-risk area.
  - Clear deadwood, dense flammable vegetation, and leaf accumulation.
  - Replace conifer and evergreen shrubs with low-flammable plants.

  - Plant nothing within 3-5’ of the structure, or directly beneath windows or next to foundation vents.
  - Increase moisture content of vegetation.
- Beyond the 30’ home defensible space, examine the woods 100’ beyond your home. Reducing fuels in this area will reduce the intensity of an approaching wildfire.
- Use rock and stone landscaping materials next to buildings.
- Use mulches to conserve moisture and reduce weed growth. Mulch can be organic or inorganic. Do not use pine bark, thick layers of pine needles, or other mulches that can readily carry fire.
- Clean your roof and gutters of leaf clutter and pine needles (best done in October). During a wildland fire, leaves on the roof and/or in the gutters could be ignited by flying embers.
- Put a hose (at least 100’ long) on a rack and attach it to an outside faucet.
- Trim all tree branches if they overhang your house, and trim all tree branches from within 20’ of all chimneys. Also, remove dead or overhanging branches. During the windy conditions that exist during a wildland fire, flames, sparks, and firebrands could travel from the tree to the roof of the structure.
- If there are any branches close to power lines on your property, ask the power company to clear them.
- Remove “ladder fuels”. Prune tree limbs so the lowest is between 6’-10’ from the ground. Fire burning through tall, dry grass could ignite these limbs and climb to the top of the tree with relative ease.
- Remove tall, dry grasses. Tall, dry grasses provide a path for a fire that can lead directly to a house.
- Review your homeowner’s insurance policy for adequate coverage. Consult your insurance agent about costs of rebuilding and repairs in your area.
- Install metal screens on all attics, foundation, and other openings on your home to prevent accumulation of leaves and needles.
- Enclose foundations of homes, outbuildings, trailers, decks, and overhangs with solid flame-resistant sheeting to keep spark from igniting materials underneath.
- Install a metal shield between your home and an attached wood fence.
- When building a deck or patio, use concrete, flagstone, or rock instead of wood. These materials do not burn and do not collect flammable debris like the space between planks in wooden decking.
- Use non-flammable metal when constructing a trellis and cover with vegetation that contains high-moisture and is fire-resistant.
- Where appropriate on steeper ground, use retaining walls to reduce the steepness of the slope. This in turn reduces the rate of fire spread. Retaining walls also act as physical barriers to fire spread and help deflect heat from the fire upwards and away from structures. On steep slopes, consider building steps and walkways around structures. This makes access

easier for home maintenance, and it also serves as a physical barrier to fire spread and increase firefighters' speed and safety as they work.

- Thin and prune conifer trees for 30' to 100' around your home. Prune bushes and shrubs regularly. Remove excess growth, as well as dead leaves and branches, to decrease their flammability and the threat they could pose during a wildland fire.
- Remove enough evergreen trees in the 100' perimeter of the house, so their branches are at least 10' apart. Prune the lower branches of the remaining evergreens up to 6-10', but no more than 1/3 of the total live crown.
- Purchase and use a NOAA weather alert radio. Many types of emergencies are announced through this service.
- Replace vinyl gutters and downspouts with non-flammable, metal gutters and downspouts.
- Install a spark arrester or heavy wire screen with opening less than 1/2" on wood burning fireplaces and chimneys.
- When updating your home, consider less flammable materials such as brick, stone, and metal for roofing and siding.
- Treat flammable materials like wood roofs, decks, and siding with fire retardant chemicals.
- Enclose decks to prevent accumulation of leaves, needles, and debris. Include a metal screen with a 1/8" mesh opening to prevent sparks from getting under the deck.
- Replace your roof with fire-resistant materials such as Class A shingles.
- Install a roof irrigation system to protect your home's roof.
- Install an independent water supply from a sprinkler system with a non-electric (e.g. propane) powered pump capable of running unattended for 24 hours.
- Replace wood or vinyl siding with non-flammable material.
- Replace single-pane glass windows and plastic skylights with tempered, double-pane glass.
- Radiant heat from a large wildfire can ignite sheer curtains inside of homes through large glass windows. Consider closeable shutters for large windows.
- Box in eaves, fascias, and soffits with aluminum or steel materials with metal screens to prevent entry of sparks.
- Relocate propane tanks inside the defensible space but at least 10' from the house. Have non-flammable ground cover such as gravel around them for 10'.
- Have electric service lines to your house placed underground.

Planning and Preparedness Measures:

- Create a disaster plan with your family:
  - Plan and discuss escape plans
  - Post local emergency telephone numbers in a visible place
  - Have a plan for your pets
  - Practice family fire drills
- Get involved with your community's disaster mitigation plans.

- Purchase and use a NOAA weather alert radio. Many types of emergencies are announced through this service.
- Check your generator and/or hose to be sure it is in good repair. Refuel garden equipment carefully. Yard equipment needs annual maintenance and proper fueling. Make sure motorized garden equipment, such as lawnmowers and chainsaws, have approved and functioning spark arrestors. Hoses develop leaks and deteriorate with age and exposure. During wildland fire season, fuel your lawn mower properly, away from dry, flammable grasses.
- Wildfire approaching checklist:
  - Call for help. Use a cell phone if your electrical power has been interrupted.
  - Close all entrances, windows, and other openings. This includes doors, garage doors, windows, vents, and any other entrances to your residence or garage. Close shutters, heavy drapes, Venetian blinds, or other window coverings. This action is recommended to prevent sparks from blowing inside your house and igniting there.
  - Have tools and water accessible. Have a shovel, rake, and long water hose accessible. Fill buckets and other bulk containers with water.
  - Dress to protect yourself. Wear cotton/woolen clothing including long pants, a long-sleeved shirt, gloves, and a handkerchief to protect your face.
  - Wet down the roof. If your roof is combustible, wet it down with a hose. Place the ladder you use for this task on the side of the roof opposite the fire.
  - Turn off residential fuel. If you use natural gas or butane, turn it off at the tank or the meter.
  - Prepare the automobiles; back as many vehicles as possible into the garage and then close the garage door. In the event you evacuate, close the garage door behind you as you leave. If you do not have a garage or if the garage is full, park vehicles so they are heading in the direction of the evacuation route.
  - Evacuate the family. If evacuation becomes necessary, take your family.

Fire Safety and Response Measures:

- Clear the view of your house number so it can be easily seen from the street. Install big, highly visible house numbers (at least 4" tall) on your home, as well as at the entrance of the driveway onto the street. Use non-flammable materials and posts.
- Improve driveways to accommodate fire trucks:
  - Remove trees along the driveway to make it 12' wide – if your driveway is longer than 150' the driveway should be 20' wide – and prune branches overhanging the driveway to have a 14' overhead clearance.
  - Build a gravel turn around area near your house big enough to allow a fire truck to turn around.
  - Modify driveway gates to accommodate fire trucks. They should be at least 10' wide and set

back at least 30' from the road. If locked use a key box approved by your local fire department or use a chain loop with the lock that can be cut in an emergency.

  - Improve your driveway by straightening sharp curves and filling in sharp dips that would hinder a fire truck.
  - Improve driveway culverts and bridges to accommodate the weight of a fire truck.

- Make sure you have smoke detectors on each floor of your home and check them each fall to make sure they work.
- Install and check existing fire extinguishers in the home – install fire extinguishers in places like the kitchen or garage. Are they still charged? Are they easy to get to in an emergency? Does everyone in the family know · where they are and how to use them?
- Talk to your children about not starting fires or playing with matches.
- Compost leaves in the fall, don't burn them.
- If you burn your brush piles or grass in the Spring get a burning permit.
- Always have a shovel on hand and hook up the garden hose before you start the fire.
- Never burn if the smoke and flames are blowing towards your home (or your neighbor's home).
- Make sure recreational fires are made in a fire-safe pit or container and completely extinguished before leaving. Before lighting any outdoor fire, check for local restrictions and permit requirements. Avoid lighting fires when high winds, high temperatures, and low humidity are present or predicted.
- Do not dispose of ashes until they are cold to the touch.
- Store gasoline, oily rags, and other flammable materials in approved safety cans. Keep those safety cans in a fire-resistant metal or brick building or your garage.
- Hold a neighborhood meeting to talk about fire safety. Invite your local fire chief. Have coffee and doughnuts for neighbors.
- Join your neighbors in having an additional access road into your neighborhood. Share the costs.

5.3 Mitigation Strategies

1. Education and Outreach

1.1 Educate citizens in the region that live in the Wildland Urban Interface (WUI) and other vulnerable citizens about wildfire mitigation techniques, fire-resistive construction and landscaping methods, and defensible space to protect their homes and properties and reduce wildfire risk.

1.2 Educate citizens and community groups on wildfire preparedness and mitigation activities. Highlight best practices such as:

  - Pre-planning evacuation routes out of woodland areas.
  - First-responder access to property.
  - Fire-resistant landscaping.

- Safely burning debris and brush.
- Adequate streets with suitable turnarounds for use by firefighting equipment.
- Highly visible and reflective posted address on homes or driveways.
- Propane tanks that are at least 75 feet from structures.
- Fire resistant siding and roofing materials.
- Chimneys and stove pipes that have caps and spark arrestors.
- Maintaining a thirty-foot clearance around homes and other structures.

1.3 Educate local government staff and elected officials on the benefits of wildfire mitigation.

1.4 Educate developers and contractors on the benefits of wildfire mitigation.

2. Reducing Hazardous Fuels

2.1 For citizens in the region that live in the Wildland Urban Interface (WUI) provide training on hazardous fuel reduction including creation of defensible space around structures, thinning trees to reduce canopy cover, and removal of deadwood and other debris.

2.2 Coordinate meetings between the localities in the Region, and State and Federal agencies to discuss fuel reduction on public lands that adjoin local property.

3. Reducing Structural Ignitability

3.1 For citizens in the region that live in the Wildland Urban Interface (WUI) provide training on landscaping and structural ignitability strategies, and highlight best management practices including:

3.2 Train and maintain a core group of Community Emergency Response Team (CERT) and other volunteers able to conduct wildfire vulnerability assessments to assist residents in making their properties and homes more wildfire-resistant.

3.4 Provide training opportunities to local government staff that encourage wildfire-preventative planning, zoning, and code-enforcement activities that promote the responsible use of and development in wildland areas.

4. Emergency Management

4.1 Review, update, and revise the Central Shenandoah Regional Wildfire Protection Plan on a regular basis. Review, update, and revise the wildfire information in the Central Shenandoah Hazards Mitigation Plan on a regular basis.

4.2 Promote wildfire training that is being offered to firefighters and EMTs in topics including; scene safety and size-up; emergency equipment access; and wildfire mitigation strategies and recommendations for homeowners.

4.4 Support implementation of State, Federal, and Non-profit citizen wildfire

reduction programs such as Firewise, and Fire Adapted Communities.

4.5 Increase community preparedness and mobilization abilities through programs such as the Community Emergency Response Team (CERT) program to increase resources available to first responders during their wildfire response efforts.

4.6 Include wildfire preparedness and mitigation information in local Emergency Operation Plans as appropriate.

4.7 Coordinate information management through an event by sharing wildfire information through local Public Information Officers and the Central Virginia Public Information Network.

5.4 Action Plan

The purpose of the Action Plan is to guide future mitigation implementation in the Region. The Mitigation Action Plan was created based input from the Steering Committee and the public through the All Hazards Survey. Proposed actions are centered around the four major components of the Mitigation Strategies; 1. Education and outreach, 2. Reducing hazardous fuels, 3. Reducing structural ignitability, and 4. Emergency management. In this section are the actions recommended in this inaugural version of the Central Shenandoah Regional Wildfire Protection Plan. All recommendations are contingent upon available human capital and financial resources in order to be implemented.

Education and Outreach

1. Begin community outreach to residents, particularly those in the Wildland Urban Interface (WUI) on topics that include fire-resistive construction and landscaping methods, defensible space, fire safety, and wildfire preparedness. Assistance with this action could be provided by Fire and Rescue staff and volunteers, Community Emergency Response Team (CERT) members, and volunteers of the region's disaster mitigation education program, Shenandoah Valley Project Impact.

2. Hold an initial wildfire mitigation educational opportunity for local government staff and elected officials. Assistance with this action can be provided by Fire and Rescue staff and volunteers and staff of the Central Shenandoah Planning District Commission (CSPDC).

3. Explore and prioritize woodland communities in the Region's WUI that may be receptive to becoming "Firewise Communities". Assistance with this action can be provided by a partnership between the Virginia Department of Forestry and Fire and Rescue staff of the local governments in the Region.

4. Create a brief Education Plan to outline what types of educational and outreach materials will be used and when these efforts will be focused in order to effectively use the limited resources that the Region has available.

Reducing Hazardous Fuels

1. Train residents throughout the Region on hazardous fuel reduction, defensible space, reduction of canopy cover, and debris removal. Assistance with this action can be provided by Fire and Rescue staff and volunteers, Community Emergency Response Team (CERT) members, and volunteers of Shenandoah Valley Project Impact, the regional disaster mitigation education program.

2. On public lands throughout the Region, create an inventory of potential fuel breaks on public lands. This activity could be done at the local or regional level using staff or possibly interns.

3. Meet with federal and state agency representatives on an annual basis to discuss a variety of wildfire issues including fuel reduction on public lands that adjoin local public and private lands. The CSPDC could coordinate this meeting that could be attended by local Fire and Rescue staff.

Reducing Structural Ignitability

1. Include structural ignitability reduction strategies in an education and outreach program for residents living in the WUI. Also during this program, highlight communities that have implemented wildfire mitigation best practices. Assistance with this action could be provided by Fire and Rescue staff and volunteers, Community Emergency Response Team (CERT) members, and volunteers of Shenandoah Valley Project Impact, the regional disaster mitigation educational program.

2. Utilize Community Emergency Response Team (CERT) members and other volunteers to perform wildfire vulnerability assessments for interested homeowners living in woodland areas of the Region. CERT members and other interested volunteers will be provided the necessary training to conduct these assessments. This action will be completed by the CERT Coordinator and local Fire and Rescue staff.

3. Examine existing planning, zoning, and code-enforcement activities throughout the Region. Create an inventory of wildfire protection and mitigation opportunities. Explore the feasibility of implementing any new measures to increase wildfire protection. Assistance with this activity could be provided by local Community Development Departments and Fire and Rescue staff during the course of their normal day-to-day activities and coordinated by CSPDC staff if needed.

Emergency Management

1. Encourage local government Fire and Rescue personnel and volunteers to attend available wildfire training. Implementation of this action would involve Fire and Rescue staff and volunteers and relevant state and federal agencies.

2. Inventory emergency communication equipment and towers located in wildland areas. Explore possible grant funding opportunities and implement potential mitigation projects to reduce damage by wildfires. Assistance with the inventory could be provided by Fire

and Rescue staff and volunteers. CSPDC staff could assist local governments with grant writing tasks.

3. Confirm existing partnerships and cultivate new partnerships with other local, state, and federal agencies that deal with wildfire issues, as well as the private sector who can assist with educational activities, implementation of mitigation and preventative measures, and wildfire suppression activities. Local Fire and Rescue staff and Emergency Managers, as well as State and Federal staff can participate in this action. Any necessary coordination at the regional level could be completed by the CSPDC staff.

Section 6: EMERGENCY MANAGEMENT OPERATIONS

Due to the large areas of wildlands and Wildland Urban Interface in the Central Shenandoah Region, implementing effective wildfire management focused on safety and risk awareness is essential and creates the following results:

- Reduction in injuries and deaths to firefighters and the public.
- Shared-jurisdictional response that is effective and efficient.
- Pre-fire, multi-jurisdictional planning.

6.1 Wildfire Suppression

Wildfires have many more considerations than structural fires because of their ability to constantly change due to varying environmental conditions. Different firefighting techniques, equipment, and training are required for wildfire suppression. Resources and natural wilderness are protected through crews suppressing flames, creating firelines, and extinguishing flames and areas of heat.

The creation of safety zones, establishment of escape routes, and verification of communications are some of the initial steps taken once crews arrive on scene. This preparation creates opportunity for the firefighters to engage with the fire, as well as have the option to retreat in case the fire cannot be contained.

There are many techniques and tactics utilized when fighting wildfires. Many factors should be considered before deciding on a method of suppression, including; fire intensity, fuel type, fire size, rate of spread, resource availability, access, and maneuverability.

After assessing the situation, a decision can be made about the tactics and techniques that will be utilized. Direct attack takes the approach of working directly on the fire edge with the objective of constructing a fireline around all fire intended to be suppressed. Treatments are applied directly to the fire in the form of wetting, smothering, or chemically drenching the fire or physical separation of the burning fuel from unburned fuel. Indirect attack is a large-fire tactic that includes the use of preparatory suppression tactics occurring from a distance. In using the indirect approach there is a larger element of planning, but there is also an increased chance of more acreage burning, seeing as control lines and barriers are set up further away from the flames. Mop-up occurs after flames have passed; even though the flames have passed there is still the chance that smoldering heavy fuels have continued to burn. At this time, it is extremely important that the burn area exterior is cooled to prevent re-ignition. Rehabilitation helps reduce the damages that happen post-fire. Some of the firefighting techniques used could have caused damage to the soil, and a remedy to this could be re-planting vegetation.

6.2 Wildfire Response Capability

Wildfire suppression often takes a multi-jurisdictional approach. The location of the wildfire determines which agency will assume the lead. Federal, state, and local governments work cooperatively, providing assistance to suppress wildfires that arise.

Federal Government Wildfire Response

The *Federal Wildland Fire Management Policy* created in 1995, provides guidance for federal wildfire response. The foundational principles for this policy are:

1. Firefighter and public safety is the first priority in every fire management activity.
2. The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the planning process.
3. Fire Management Plans, programs, and activities support land and resource management plans and their implementation.
4. Sound risk management is a foundation for all fire management activities.
5. Fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives.
6. Fire Management Plans and activities are based upon the best available science.
7. Fire Management Plans and activities incorporate public health and environmental quality considerations.
8. Federal, State, tribal, local, interagency, and international coordination and cooperation are essential.
9. Standardization of policies and procedures among federal wildland fire management agencies is an ongoing objective.

There are 5 federal land agencies that manage wildland fire: **National Park Service, Bureau of Land Management, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, and U.S. Forest Service**. These 5 agencies provide a representative to the National Wildfire Coordination Group (NWCG) who functions to provide leadership and establish, implement, maintain, and communicate policy, standards, guidelines and qualifications for wildland fire program management and support the National Incident Management System. Response to a wildfire will be coordinated with all affected agencies/cooperators regardless of the jurisdiction at the ignition point.

The **U.S. Forest Service** responds to all wildfires detected on National Forests and Grasslands. The U.S. Forest Service response to all human-caused wildfires is suppression. In certain location, when conditions are right, the agency response may be to manage a wildfire to reduce fuels and restore ecosystems that benefit from fire. When wildfires occur under the jurisdiction of other federal agencies, state, and local agencies, the U.S. Forest Service provides firefighters, aircraft, and equipment to assist.

Shenandoah National Park (SNP) is the National Park asset located in the Central Shenandoah Region. Between 1926 – 2016,

there were 893 fires in the SNP. The larges fire was in 2000 and the second largest, the Rocky Mountain Fire, was in 2016. The Park maintains a stand-alone Fire Management Program. Not all national parks do this. The goal of SNP's fire management program is to maintain and restore the forested ecosystem. Fire can be a resource management tool as well as a threat. SNP's philosophy is to utilize planned and unplanned events to protect but not every fire will be put out but instead may be confined and contained if the fire could be beneficial to the ecosystem. The Park's Fire Management Program also offers hazardous fuels reduction training and supports fire suppression efforts when needed in Virginia and Maryland.

State Government Wildfire Response

Wildfire prevention and response is a primary component of the mission of the **Virginia Department of Forestry (VDOF)**. Wildfire mitigation is a critical activity at VDOF. VDOF has worked with woodland communities to join the Firewise program and implements many hazard mitigation projects each year. The Virginia Dry Hydrant Program is also provided through VDOF. A dry hydrant is a non-pressurized pipe system permanently installed in existing lakes, ponds and streams that provides a suction supply of water to a fire department tank truck. In FY19, 25 new hydrants were installed, and 13 existing hydrants were repaired by VDOF. The Virginia Department of Forestry develops partnerships with local fire departments, non-governmental organizations, and other institutions to increase the State's resiliency to wildfires. By providing staff training and grants to local fire departments, VDOF is helping to establish a resilient response network.

Local Government Wildfire Response

Local fire agencies in the Central Shenandoah Region are valuable assets in managing Wildland Urban Interface(WUI) fire risk. The three essential resources that local career and volunteer departments possess to assist in wildfire resiliency include; Fire Response/Suppression Equipment and Personal Protective Equipment (PPE), Personnel trained in wildland fire fighting, and public outreach staff who can spread awareness about community risk reduction.

- *Equipment and PPE:*
  - Fire agencies in the Region have hybrid or dual-purpose apparatus that are used in rural areas but are also useful for fighting fires in wildlands and the WUI.
  - PPE is also available at local agencies that can be used for fighting wildland and WUI fires. Appropriate respiratory gear and fire shelters are specific PPE that is needed by firefighters to safely combat wildfires that may not always be available at every local agency.
- Training:
  - Mutual Aid Cooperative Agreements allow local fire agencies to participate in joint training activities within the Region and at the State level. Joint training allows for resources to be used effectively.

- "Wildfire Chainsaw Operation" is useful training for local firefighters to be able to assist in a multi-jurisdictional wildfire response.
- Wildland firefighting requires different physical demands than structural fire suppression so physical fitness training at the local level to meet these demands is an extremely helpful safety tool.

- Public Outreach:
  - Local fire agencies in the Region have active fire prevention awareness education programs. Including wildfire mitigation information with traditional fire prevention educational activities can increase awareness about wildfires as well as, the Wildland Urban Interface.
  - Property inspections are an effective educational tool in teaching homeowners about their potential wildfire risk and mitigation strategies that will lessen their vulnerability. Augusta County and the Cities of Staunton and Waynesboro have provided wildfire mitigation inspection training through the Firewise program to their Staunton-Augusta-Waynesboro Community Emergency Response Team (S-A-W CERT) members. CERT members are now able to provide inspections and mitigation education to interested property owners particularly with woodland homes or homes in the WUI.

Rocky Mountain Fire in Shenandoah National Park in April 2016.
Fire at Night – Photo, Bob Adamek
Smokey Bear Hotshots Wildfire Fighting Team from New Mexico – Photo, Rita Baysinger, NPS

Section 7: MONITORING AND EVALUATION

Plan monitoring helps determine whether plans and goals identified in this Plan are applicable for current circumstances and being met overtime, as well as tracking the implementation of activities mentioned. The plan will be modified to reflect the changing conditions that arise through project implementation or natural occurrences happening in the Region. Having the monitoring strategy keeps the Plan a current and effective resource for the local jurisdictions in the Region.

The Steering Committee will act as the body responsible for the review, monitoring, and update of the Regional Wildfire Protection Plan. This group will meet annually and includes representatives from local, state, and federal government, other relevant organizations, and citizen stakeholders. The Steering Committee is currently staffed by the Central Shenandoah Planning District Commission.

Through the Steering Committee, the Plan will be reviewed on an annual basis and updated when and where needed. Each committee member will be asked to review the Plan. Revisions will be made to the Plan by the CSPDC staff. Goals to be accomplished through an annual review include; evaluating progress toward meeting goals, setting priorities, and updating goals and maps. In addition, any local, state, or federal regulations that change or impact the Plan will be revised. Regional locality staff will also determine if any substantial changes need to be included in the Plan.

Because the Central Shenandoah Regional Wildfire Protection Plan is a companion planning document to the Central Shenandoah Hazard Mitigation Plan (CSHMP), in addition to annual review, the Plan will undergo a comprehensive review every five years, during the update process of the CSHMP, as well.

Public participation was an integral part of the development of this Plan and will continue through the course of its existence. Activities to involve the public will occur when appropriate and resources are available.

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Section 8: GLOSSARY

Absolute Humidity: total amount of water vapor in the air.

Accelerant: material (usually a flammable liquid) used to initiate or increase the spread of fire.

Acceptable Fire Risk: the potential fire loss a community is willing to accept rather than provide resources to reduce such losses.

Acre: one acre is approximately 209 feet by 209 feet or 43,560 square feet.

Advancing Fire: that portion of the fire with rapid fire spread with higher fire intensity which is normally burning with the wind and/or up slope.

Aerial Fuels: Standing and supported live and dead combustible materials not in direct contact with the ground and consisting mainly of foliage, twigs, branches, stems, cones, bark, and vines.

Alligatoring: char patterns formed on paint or burned wood remains, usually in the shape of blisters.

Arson Fire: a fire that is intentional and wrongfully set to burn one's own or someone else's property.

Aspect: the predominant direction of the slope of the land.

Attack A Fire: limit the spread of fire by any appropriate means.

Backburn/Backfire: a fire set along the inner edge of a fireline to consume the fuel in the path of a wildfire or change the direction force of the fire's convection column.

Backing Fire: 1. fire spreading or ignited to spread, into (against) the wind or downslope 2. that portion of the fire with slower rates of fire spread and lower intensity normally moving into the wind and/or down slope.

Bambi Bucket®: a collapsible bucket slung below a helicopter. Used to dip water from a variety of sources for fire suppression.

Basal Area: the cross-sectional area of a single tree stem, including the bark, measured at breast height (4.5 feet above ground). Often expressed as BA/Acre.

Berm: a ridge of soil and debris along the outside edge of a fireline, resulting from line construction.

Blow Down: an area of previously standing timber which has been blown over by strong winds or storms.

Bone Yard: 1. a mop up term. To "bone yard" a fire means to systematically work the entire area, scraping embers off remaining fuel, feeling for heat with the hands, and piling unburned materials in areas cleared to mineral soil. 2. an area cleared to mineral soil for piling unburned fuels.

Bole: the trunk of a tree. Equals one board foot.

Brush: a collective term that refers to stands of vegetation dominated by shrubby, woody plants, or low growing trees.

Brush Fire: a fire burning in vegetation that is predominantly shrubs, brush, and shrub growth.

Burn Patterns: the characteristic configuration of char left by a fire. In wildland fires, burn patterns are influenced by topography, wind direction, length of exposure, and type of fuel.

Burning Period: the part of each 24-hour period when fires spread most rapidly; typically from 10:00 a.m. to sundown.

Burnover: an event in which a fire moves through a location or overtakes personnel or equipment where there is no opportunity to utilize escape routes and safety zones, often resulting in personal injury or equipment damage.

Candle: a standing tree with a broken top which often continues to burn after the main firefront has passed. Candles usually send up a fountain of sparks and burning embers which may travel some distance and be of concern if near the unburnt side of a control line.

Candling: the burning of the foliage of a single tree or a small group of trees, from the bottom up.

Canopy: the stratum containing the crowns of the tallest vegetation present (living or dead), usually above 20 feet.

Char: remains of burned materials.

Cold Line: fireline that has been controlled. The fire has been mopped up for a safe distance inside the line and can be considered safe to leave unattended.

Combustion: the rapid oxidation of fuel in which heat and usually flame are produced.

Conduction: heat transfer through a material from a region of higher temperature to a region of lower temperature.

Conflagration: a raging, destructive fire. Often used to connote such a fire with a moving front as distinguished from a fire storm.

Conifer: a cone-bearing tree.

Convection: the transfer of heat by the movement of a gas or liquid.

Cord: a stack of firewood that measures 4 x 4 by 8 feet or 128 cubic feet.

Creeping Fire: fire burning with a low flame and spreading slowly.

Crown: the uppermost branches and foliage of a tree.

Crown Fire: a fire that advances from top to top of trees or shrubs more or less independent of a surface fire.

Crown Out: a fire that rises from ground into the tree crowns and advances from treetop to treetop.

Dead Man Zone: unburnt areas around edges of brush fire.

Dead Out: when a fire is completely out, with no smoldering or burning areas.

Deciduous: shedding or losing leaves annually; the opposite of evergreen. Trees such as maple, ash, cherry, and aspen are deciduous.

Defensible Space: an area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire towards the structure.

Diameter At Breast Height (dbh): the measurement of tree diameter at a point 4 ½ feet above ground level. Usually expressed in inches.

Dominant Trees: trees that extend above surrounding individuals and capture sunlight from above and around the crown.

Dripline: a tree's dripline is the same as the dripline on a house; it is where the rain drips off the limbs at the outer edge of the crown.

Dry Hydrant: permanent devices with fire engine threads attached to expedite drafting operations in locations where there are water sources suitable for use in fire suppression.

Duff: the later of decomposing organic materials lying below the litter layer of freshly fallen twigs, needles, and leaves immediately above the mineral soil.

Emission: a release of combustion gases and aerosols into the atmosphere.

Envelopment: direct attack with multiple anchor points, that allows for multiple points of attack. Generally used as an engine tactic in the Wildland Urban Interface.

Escape Fire: a fire, which has exceeded or is expected to exceed initial attack capabilities or prescription.

Even-aged: forest stand composed of trees of a single age class.

Even-aged stand: a stand in which the age difference between the oldest and youngest trees is minimal, usually no greater than 10 to 20 years.

Faller: a person who fells trees. Also called sawyer, and cutter.

Fingers Of A Fire: the long, narrow extensions of a fire projecting from the main body.

Fire: rapid oxidation, usually with the evolution of heat and light; heat fuel, oxygen, and interaction of the three.

Fire Behavior: the manner in which a fire reacts to the influences of fuel, weather, and topography.

Fire Bug: arsonist, especially a repetitive firesetter.

Fire Climate: composite pattern of weather elements over time that affect fire behavior in a given region.

Fire Concentration (Complex) – generally a situation in which numerous fires are burning in a locality.

Fire Front: the part of a fire within which continuous flaming combustion is taking place.

Fire Intensity: commonly referred to as fire line intensity, this is the amount of heat energy that is generated by burning materials.

Fire Retardant: any substance except plain water that by chemical or physical action reduces flammability of fuels or slows their rate of combustion.

Fire Storm: violent convection caused by a large continuous area of intense fire. Often characterized by destructively violent surface indrafts, near and beyond the perimeter, and sometimes by tornado-like whirls.

Fire Weather: weather conditions which influence fire ignition, behavior, and suppression.

Fire Whirl: a tornado-like vortex that forms from the stretching of vorticity due to the interaction of air flowing towards and upwards in a fire.

Firebrands: Any source of heat, natural or human made, capable of igniting wildland fuels; flaming or glowing fuel particles that can be carried naturally by wind, convection currents, or by gravity into unburned fuels.

Fireline: the part of a control line that is scraped or dug to mineral soil. Also called fire trail. More generally, working a fire is called being "on the fireline." May also refer to a "wet line" where water has been used to create a burn boundary in light fuels such as grass.
Firebreak: a natural or constructed barrier used to stop or check fires that may occur, or to provide a control line from which to work.

Flame: a mass of gas undergoing rapid combustion, generally accompanied by evolution of sensible heat and incandescence.

Flanks Of A Fire: the parts of a fire's spread perimeter that grow to the sides then run roughly parallel to the main direction of spread. Separated flank heads are extremely dangerous in steep terrain.

Flash Fuels: highly combustible fire fuels such as grass, leaves, draped pine needles, fern, tree moss, and some kinds of slash, which ignite readily and are consumed rapidly when dry.

Forest Residue: accumulation in the forest of living or dead (mostly woody) material that is added to and rearranged by human activities such as harvest, cultural operations, and land clearing.

Fuel: any combustible material, especially petroleum-based products and wildland fuels.

Fuel Loading: the oven-dry weight of fuel per unit area.

Fume: an airborne irritating, noxious or toxic smoke, vapor, or any combination of these produced by a volatile substance or a chemical reaction.

Grass Fire: any fire in which the predominant fuel is grass or glasslike.

Greenbelt: landscaped and regularly maintained fuel/fire break, usually put to some additional use. (e.g., golf course, park, playground).

Greenfield: land, including farmland and open spaces, that has not been previously developed.

Ground Fire: fire that consumes the organic material beneath the surface litter ground, such as peat fire.

Hazard: any real or potential condition that can cause injury or death of personnel, or damage to, or loss of equipment or property.

Hazard Reduction: precautionary controlled and managed fire lit during cooler and/or wetter weather in order to reduce the available fuel load.

Head Of A Fire: the most rapidly spreading portion of a fire's perimeter, usually to the leeward or up slope; may have multiple heads if there are separated flanking fires.

Holding Actions: all actions taken to stop the spread of fire.

Holdover Fire: a fire that remains dormant for a considerable time. Also called a sleeper fire.

Hot Spot: a particularly active part of a fire.

Hotshot Crew: intensively trained fire crew used primarily in hand line construction, and organized primarily to travel long distances from fire to fire as needed rather than serving only one geographic location.

Humus: layer of decomposed organic matter on the forest floor beneath the fermentation layer and directly above the soil. It is that part of the duff in which decomposition has rendered vegetation unrecognizable and mixing of soil and organic matter is underway.

Incendiary Device: contrivance designed and used to start a fire.

Inhibitor: any agent which retards a chemical reaction.

Into The Black: moving from outside the fire front to inside the burned area, which is sometimes the safest place to be in a flare-up, i.e., behind the fire, if possible to traverse the flames.

Kindling Point: lowest temperature at which sustained combustion can be initiated for a specified substance. Also called ignition temperature.

Knock Down: to reduce the flame or heat on the more vigorously burning parts of a fire edge, usually by cooling with dirt, water or another retardant.

Ladder Fuels: vegetative materials with vertical continuity that allows fire to burn for the ground level up to the branches and crowns of trees.

Let-burn Policy: administrative decision to defer fire suppression, perhaps because of wilderness and long-term forest conservation considerations.

Liana: long stemmed woody vines that are rooted in the soil at ground level and use trees, as well as other means of vertical support, to climb up to the canopy to get access to well-lit areas of the forest.

Lightning Fire: wildfire caused directly or indirectly by lightning.

Limbing: removing branches from a felled or standing tree or brush.

Live Fuel Moisture Content: ratio of the amount of water to the amount of dry plant material in living plants.

Litter (forest litter): surface buildup of leaves and twigs.

Lop and Scatter: a hand method of removing the upward-extending branches from tops of felled trees to keep slash low to the ground, to increase rate of decomposition, lower fire hazard, or as a pretreatment prior to burning.

Mass Fire: a fire resulting from many simultaneous ignitions that generates a high level of energy output.

Mineral Soil: soil layers below the predominantly organic horizons; soil with little combustible material. Mineral soil is the same as topsoil.

Mitigation: those activities implemented prior to, during, or after an incident which are designed to reduce or eliminate risks to persons or property that lessen the actual or potential effects or consequences of an incident.

Mop-up: extinguishing or removing burning material near control lines, felling snags, and trenching logs to prevent rolling after an area has burned, to make a fire safe, or to reduce residual smoke.

Multiple Points Of Origin: two or more separate points of fire origins at a fire scene; strong indication of arson.

Mutual Aid: cross-jurisdictional assistance with emergency services by pre-arranged agreement.

National Fire Danger Rating System (NFDRS): a uniform fire danger rating system that focuses on the environmental factors that control the moisture content of fuels.

National Fire Protection Association (NFPA): a private, non-profit organization dedicated to reducing fire hazards and improving fire service.

National Fire Protection Association Standards (NFPA): standards of the National Fire Protection Association are frequently adopted by insurance agencies such as the National Board of Fire Underwriters as a basis for their regulations and used as a guide for municipal, state, or provincial laws, ordinances, and regulations.

National Response Plan: a plan that integrates federal government domestic prevention, preparedness, response, and recovery plans into one all-discipline, all-hazard plan.

National Wildfire Coordinating Group (NWCG): a group formed under the direction of the Secretaries of the Interior and Agriculture to improve the coordination and effectiveness of wildland fire activities and provide a forum to discuss, recommend appropriate action, or resolve issues and problems of substantive nature.

Natural Hazard: source of harm or difficulty created by a meteorological, environmental, or geological event.

Open Burning: burning of any fuel outdoors without the use of mechanical combustion enhancements.

Organic Soil: any soil horizon containing at least 30% organic matter.

Orographic: pertaining to or caused by mountains.

Overstocked: the situation in which trees are so closely spaced that they compete for resources and do not reach full growth potential.

Overstory: the level of forest canopy that includes the crowns of dominant, co-dominant, and intermediate trees.

Overtopped: the situation in which a tree cannot sufficiently extend its crown into the overstory and receive direct sunlight. Overtopped trees that lack shade tolerance lose vigor and die.

Palmer Drought Severity Index (PDI): techniques for measuring impact of soil moisture changes on vegetation, for predicting fire danger and fire behavior.

Passive Crown Fire: a fire in the crowns of trees in which trees or groups of trees torch, ignited by the passing front of the fire.

Perennial Grasses: an extremely volatile fuel, after curing, in May, June, July, which can lead to large, fast fires that may reach larger fuels.

Plow Line: fuel line constructed by a fire plow, usually drawn by a tractor or other motorized equipment.

Plume: a convection column generated by combustion of wildland fuel.

Precipitation: any or all forms of water particles, liquid or solid, that fall from the atmosphere and reach the ground.

Preparedness: activities that lead to a safe, efficient, and cost-effective fire management program in support of land and resource management objectives through appropriate planning and coordination.

Prescribed Fire: any fire intentionally ignited by management actions in accordance with applicable laws, policies, and regulations to meet specific objectives.

Pretreat: the use of water, foam, or retardant along a control line in advance of the fire.

Prevention: activities directed at reducing the incidence of fires, including public education, law enforcement, personal contact, and reduction of fuel hazards (fuels management).

Pruning: the act of removing branches from a living tree to improve tree beauty, increase future lumber value, remove ladder fuels, and remove disease infested limbs.

QUINT: a ladder truck with a fire pump. Tank size is generally 250 gallons to 750 gallons. Pump sizes can vary from 1200 GPM to 2,000 GPM. 314

Radiation: propagation of energy in free space by virtue of joint, undulatory variations in the electric or magnetic fields in space.

Readiness: condition or degree of being completely ready to cope with a potential fire situation.

Recovery: the increase in fuel moisture as a result of increased relative humidity, usually occurring overnight.

Red-flag Day: weather conditions creating a critical fire hazard, may require closing the forest to non-emergency activities in order to minimize the risk of accidental wildland fires.

Regeneration: the process by which a forest is reseeded and renewed. Advanced regeneration refers to regeneration that is established before the existing forest stand is removed.

Rehabilitation: efforts undertaken within three years of a wildland fire to repair or improve fire damaged lands.

Rekindle: reignition due to latent heat, sparks, or embers due to presence of smoke or steam.

Remote Automated Weather Station (RAWS): a weather station that transmits weather observations vi GOES satellite to the wildland fire management information system.

Release: to remove overtopping trees that compete with understory or suppressed trees.

Residual Stand: the trees remaining intact following any thinning operation.

Resiliency: the ability to prepare and plan for, absorb, respond, recover from, and more successfully adapt to adverse events.

Response: activities that address the short-term, direct effect on an incident, including immediate actions to save lives, protect property, and meet basic human needs.

Restoration: the continuation of rehabilitation beyond the initial three years of the repair or replacement of major facilities damaged by the fire.

Risk: a measure of the probability and consequence of uncertain future events.

Risk Assessment: 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.

Safety Zone: an area cleared of flammable material used for escape in the event the line is outflanked or in case a spot fire causes fuels outside the control line to render the line unsafe.

Salvage Cut: the removal of dead, damaged, or diseased trees to recover maximum value prior to deterioration.

Sapling: a tree at least 4 1/2 feet tall and up to 4 inches in diameter.

Sawlog: a log large enough to be sawed economically on a sawmill. Sawlogs are usually at least 8 feet long and 6 inches in diameter at the small end of the tree.

SCAT: Short, Chassis Attack Truck. This apparatus is designed for both structural and wildland fire fighting. A SCAT can have a tank capacity of 200 gallons to 750 gallons of water and pump size can be from 150 GPM to 450+ GPM. A SCAT generally operates with a minimum crew of two persons.

Seed Tree: a mature tree left uncut to provide seed for regeneration of a harvested stand.

Set: 1. an individual incendiary fire. 2. the point of origins of an incendiary fire.

Size-up: initial assessment of fire including (among other things) fuel load, fire weather, topography, fire behavior, hazards and exposures of valuable properties. Quickly detects need for additional resources and sets operational priorities.

Slash: branches and other woody material left on a site after forest management activities.

Slopover: fire spreading outside the boundaries of a control line.

Smoke: small particles of carbon, tarry and water vapor resulting from the incomplete combustion of carbonaceous materials such as wood, coal.

Smoldering: a fire burning without flame and barely spreading.

Snag: a dead tree that is still standing. Snags provide important food and cover for a wide variety of wildlife species.

Soot: carbon dust formed by incomplete combustion.

Spotting: behavior of a fire producing sparks or embers that are carried by the wind and which start new fires (spot fires) beyond the zone of direct ignition by the main fire.

Structure Fire: Fire originating in and burning any part or all, of any building, shelter, or other structure.

Structural Ignition Zone: The area around a specific structure and associated accessory structures, including all vegetation that contains potential ignition sources and fuels.

Stocking: is a measure of the occupancy of available growing space, and is a function of the number of trees and their size relative to the ideal stand.

Stand: a contiguous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit.

Stand Density: A quantitative measure of stem crowding within a stocked area.

Suppressed: trees with crowns entirely below the general level of the crown cover, receiving no direct light either from above or from the sides.

Suppression: a wildfire response strategy to "put the fire out" as efficiently and effectively as possible while providing for firefighter and public safety.

Surface Fire: fire that burns loose debris on the surface, which include dead branches, blowdown timber, leaves, and low vegetation, as contrasted with crown fire.

Surface Fuel: fuels lying on or near the surface of the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low stature living plants.

Thinning: removal of poorest formed, damaged, suppressed, and crowded trees in a stand to improve growth and form of remaining trees.

Threat Fire: any uncontrolled fire near to or heading toward an area under organized fire protection.

Timber Stand Improvement (tsi): any practice that increases the value or rate of value growth in a stand of potential sawtimber trees. Pruning and thinning are considered tsi.

Tinder: burnable organic material (duff, peat, rotten wood, etc.) with a high surface to volume ratio.

Torching: not to be confused with crowning, is when a single or small group of trees "torch" or go up in flames. Torching and group torching are more of a nuisance whereas crown fire is of much greater concern.

Turn The Corner: contain a fire along a flank of the fire and begin containing it across the head.

Type: refers to resource capability. A Type 1 resource provides a greater overall capability due to power, size, capacity, etc., than would be found in a Type 2 resource. Resource typing provides managers with additional information in selecting the best resource for the task.

> **Type 1 engine:** a Type 1 engine is a structure engine which carries a minimum 300 gallons of water, minimum pump flow requirements are 1000 gpm, at 150 psi.
>
> **Type 3 wildland engine:** carries a minimum of 500 gallons of water, 150 gallons per minute (gpm) minimum pump flow, at a rated pressure of 150 (psi). A Type 3 engine carries 1000 feet of 2 ½" hose, 500 feet of 1 ½" hose, and a crew of 3 persons.
>
> **Type 6 wildland engine:** carries a minimum of 150 gallons of water, 50 gallons per minute (gpm) minimum pump flow, at a rated pressure of 100 (psi). A Type 6 engine carries 300 feet of 1 ½" hose, 300 feet of 1' hose, and a crew of 2 persons and has a gross vehicle weight (GVWR) of 19,500 pounds.

Underburn: a fire that consumes surface fuels but not the overstory canopy.

Understory: the level of forest vegetation beneath the canopy.

Uneven-aged: forest stand composed of intermingling of trees that differ markedly in age. Three or more age classes of trees represented.

Volunteer Fire Department (VFD): a fire Department company or a response unit, the members of which are not paid.

Water Tender: any ground vehicle capable of transporting specified quantities of water.

Wet Line: temporary control line using water or other fire-retardant liquid to prevent a low-intensity fire from spreading in surface fuels or to knock down a more intense fire.

Wetting Rain: a widespread rain that over an extended period of time significantly reduces fire danger.

Widowmaker: any branch or treetop that is poorly or no longer attached to a tree, but still tangled overhead.

Wildfire: an unplanned or unwanted fire requiring suppression action; an uncontrolled fire, usually spreading through vegetative fuels but often threatening structures.

Wildfire Hazard: the combination of the likelihood of a fire occurring and the intensity of the fire. Also refers to the wildland or built fuels present in a given area, or the combustibility of a given fuel type or fuel complex in general.

Wildfire Risk: the wildfire hazard plus the addition of the factors that contribute to susceptibility, or the impact of a wildfire on highly valued resources and assets.

Wildland: an area in which development is essentially nonexistent, except for roads, railroads, powerlines, and similar transportation facilities. Structures, if any, are widely scattered.

Wildland Fire: any non-structure fire that occurs in vegetation or natural fuels. Wildland fire includes prescribed fire and wildfire.

Wildland Urban Interface (WUI): any developed area where conditions affecting the combustibility of natural and cultivated vegetation (wildland fuels) and structures or infrastructure (built fuels) allow for the ignition and spread of fire through these combined fuels.

Wind-driven Wildland Fire: a wildland fire that is controlled by a strong consistent wind.

Windrow Burning: burning slash that has been piled into long continuous rows.

Windfall: tree knocked over or broken off by wind, increasing fuel loading and hampers building fireline.

Windfirm: trees able to withstand strong winds and resist windthrow, open grown trees tend to grow slower and develop deep root systems whereas some species grow within a stand which acts as a buffer, thinning in this second type needs to be completed in stages to allow remaining trees to increase their windfirmness.

Section 9: WILDLAND URBAN INTERFACE (WUI) MAPS

9.1 Wildland Urban Interface Definition

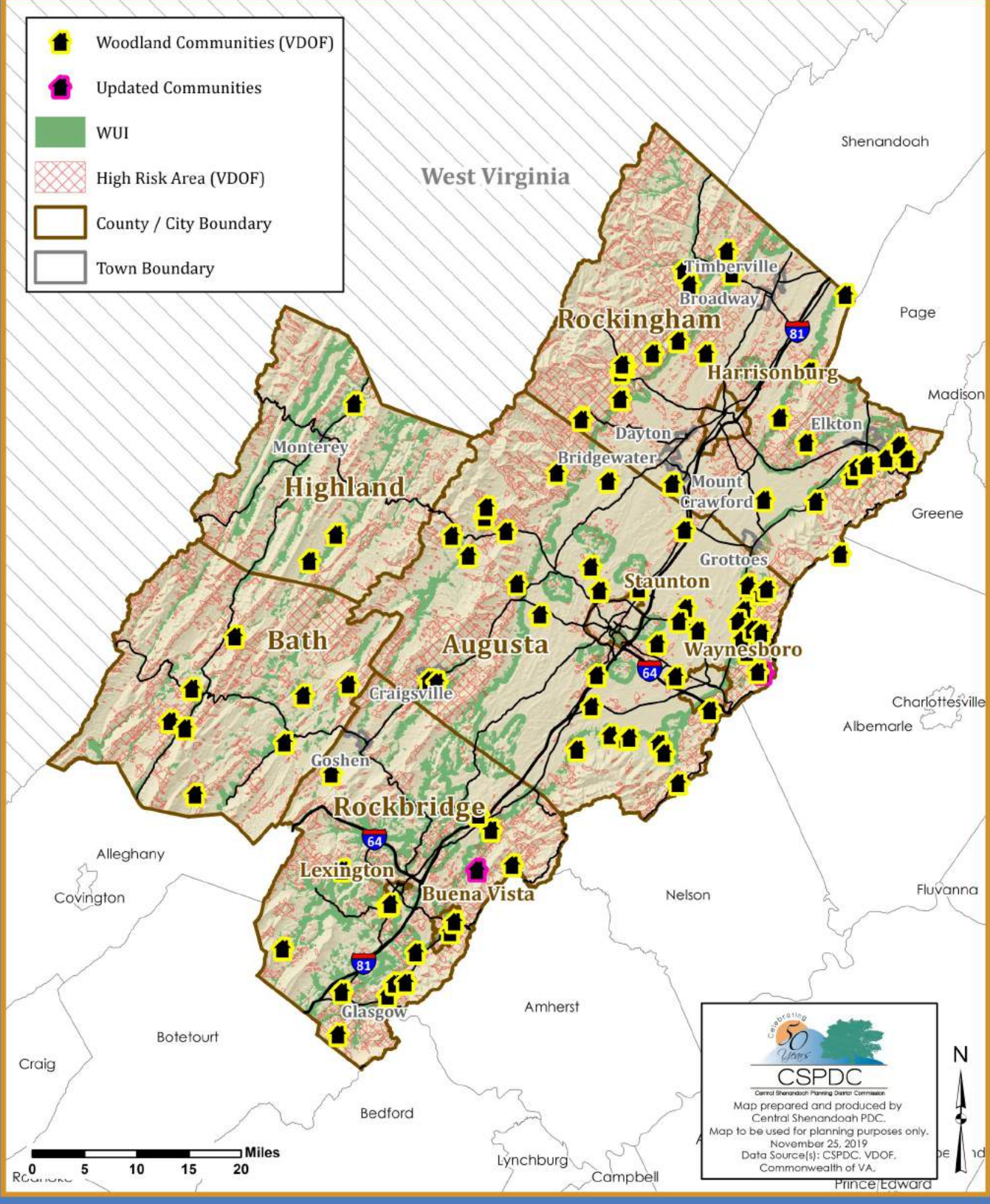
The Wildland Urban Interface (WUI) is a defensible area from which to suppress fires or defend communities; and/or where houses and other structures meet or intermingle with wildland vegetation; and/or where wildfire poses the biggest risk to human lives and structures.

9.2 Defining The WUI

The following maps show the Wildland Urban Interface areas that were created through this planning process. WUIs were identified through multiple data sources. Data analyzed included woodland home communities, homes and dwellings in forested areas, structural and housing density, and forested land cover. Input from the public, local government staff, and Steering Committee members was also considered in defining the WUI areas throughout the Region. The designated Wildland Urban Interface areas in this document are for informational and planning purposes only.

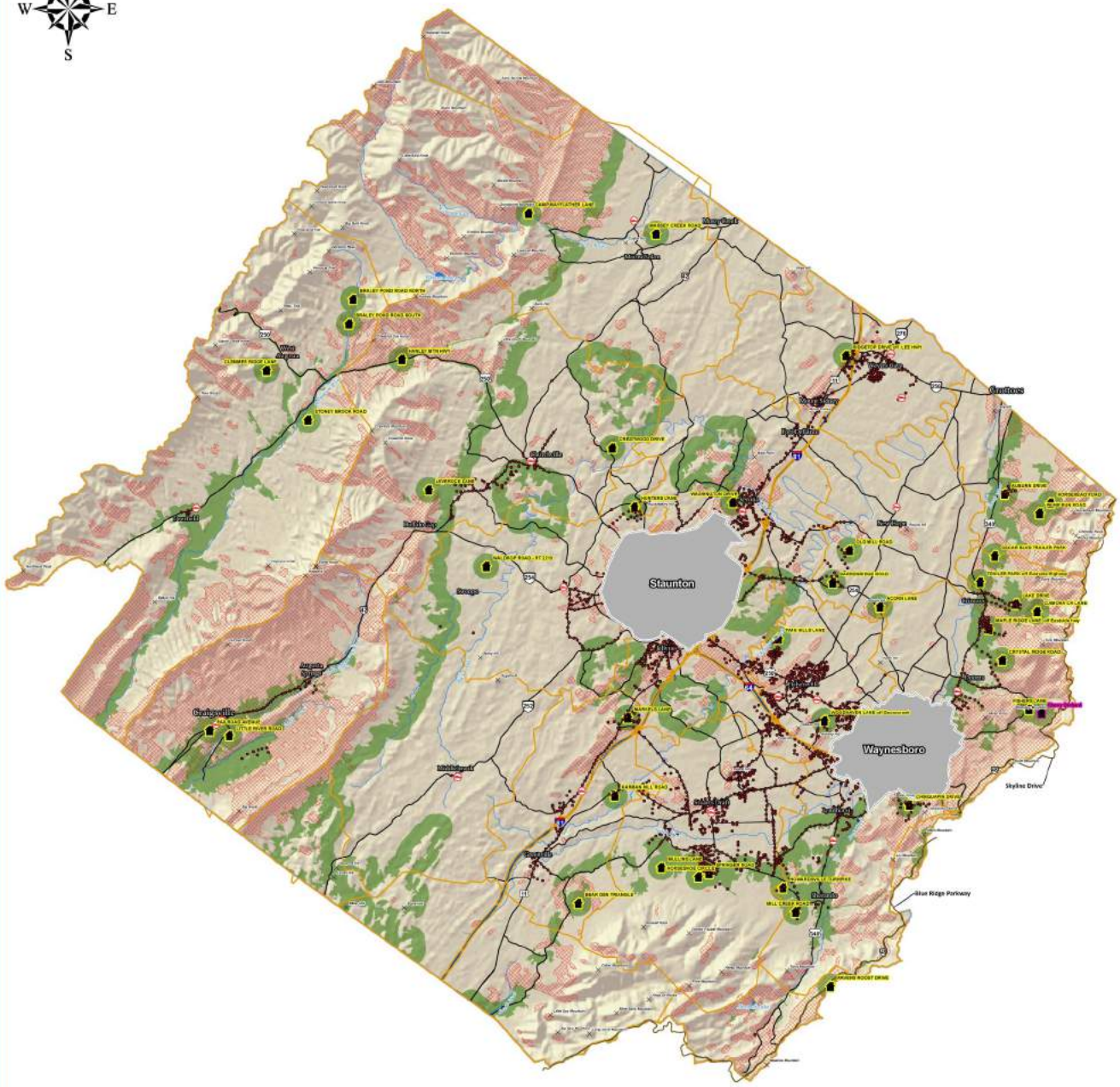
9.3 WUI Maps

CSPDC Wildland-Urban Interface (WUI)



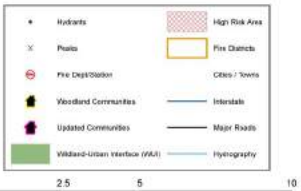
Augusta County Community Wildfire Protection Plan (CWPP)

Wildfire Planning Composite Map



CSPDC

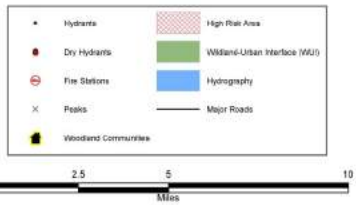
Central Shenandoah Planning District Commission



Data Source(s): Commonwealth of Virginia, Census, VDOT, FEMA, VDEM, VDOF, USGS, CSPDC, Augusta County

Bath County Community Wildfire Protection Plan (CWPP)

Wildfire Planning Composite Map



Data Source(s): Commonwealth of Virginia, U.S. Census, FEMA, VDEM, VDOF, USGS, CSPDC, Bath County

Celebrating 45+ Years

CSPDC

Central Shenandoah Planning District Commission

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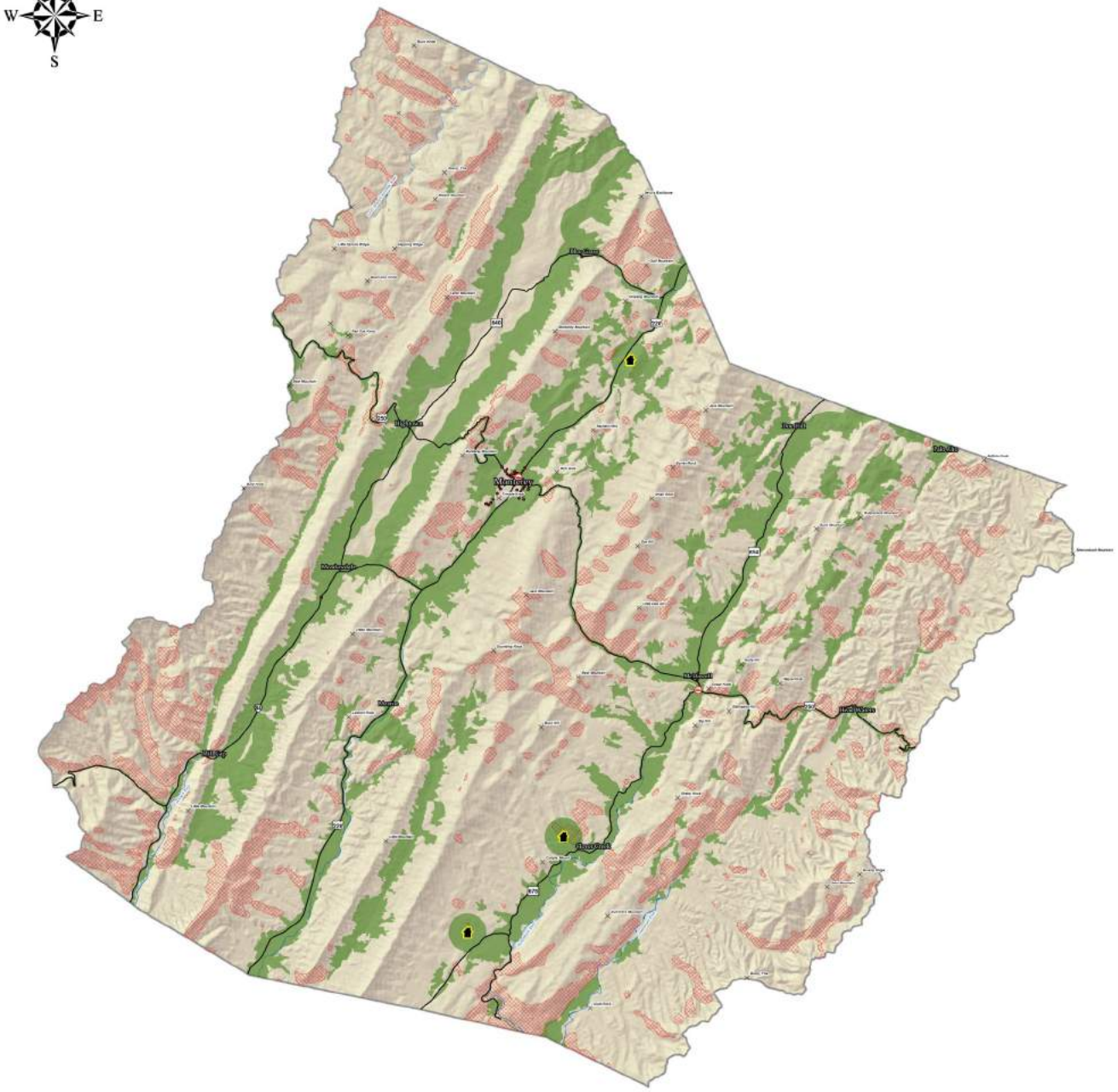
March 15, 2017

Highland County Community Wildfire Protection Plan (CWPP)

Wildfire Planning Composite Map



CSPDC
Central Shenandoah Planning District Commission

- Hydrants
- FireStations
- Woodland Communities
- Peaks
- Major Roads
- Wildland-Urban Interface (WUI)
- High Risk Area
- Hydrography

0 2 4 8
Miles

Data Source(s): Commonwealth of Virginia, U.S. Census, FEMA, VDEM, VDOF, USGS, CSPDC, Highland County

County of Rockbridge Community Wildfire Protection Plan (CWPP)

Wildfire Planning Composite Map

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CSPDC

Central Shenandoah Planning District Commission

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April 25, 2018

- Hydrants
- Peaks
- Fire Dept./Station
- Woodland Communities
- Updated Communities
- Wildland-Urban Interface (WUI)
- High Risk Area
- Fire Districts
- Cities
- Hydrography
- Interstate
- Major Roads

0 2.5 5 10

Miles

Data Source(s): Commonwealth of Virginia, U.S. Census, FEMA, VDEM, VDOF, USGS, CSPDC, County of Rockbridge

Rockingham County Community Wildfire Protection Plan (CWPP)

Wildfire Planning Composite Map

CSPDC
Central Shenandoah Planning District Commission

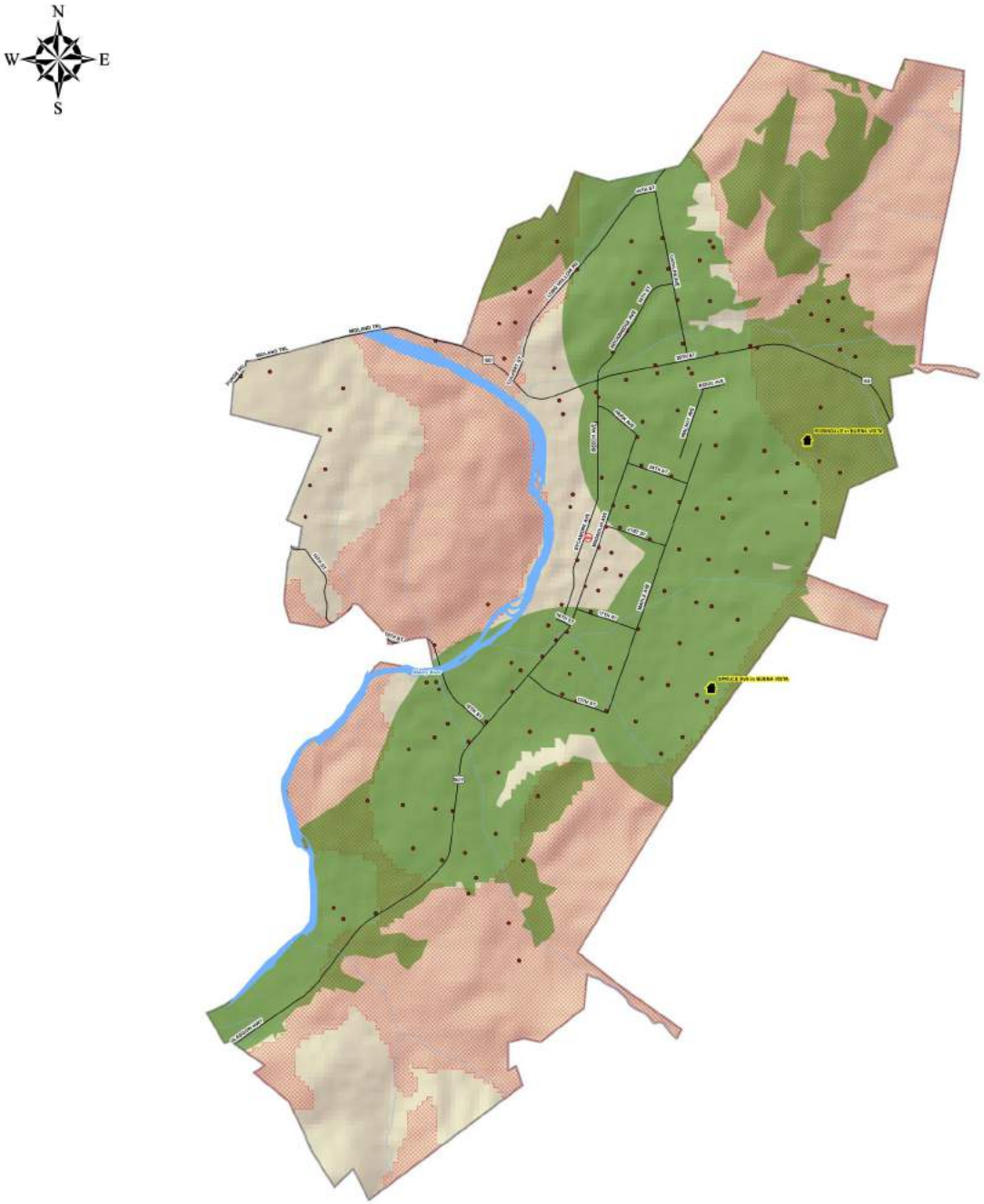
- Hydrants
- Dry Hydrants
- Peaks
- Fire Departments
- Woodland Communities
- Wildland-Urban Interface (WUI)
- High Risk Area
- Fire Districts
- Augusta County
- Interstate
- Major Roads
- Hydrography

0 3 6 12
Miles

Data Source(s): Commonwealth of Virginia, U.S. Census, FEMA, VDEM, VDOF, USGS, CSPDC, Rockingham County

City of Buena Vista Community Wildfire Protection Plan (CWPP)

Wildfire Planning Composite Map



Hydrants
Fire Station
Woodland Communities
Major Roads
Wildland-Urban Interface (WUI)
High Risk Area
Hydrography

0 0.25 0.5 1
Miles

Data Source(s): Commonwealth of Virginia, U.S. Census, FEMA, VDEM, VDOF, USGS, CSPDC, City of Buena Vista

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CSPDC
Central Shenandoah Planning District Commission

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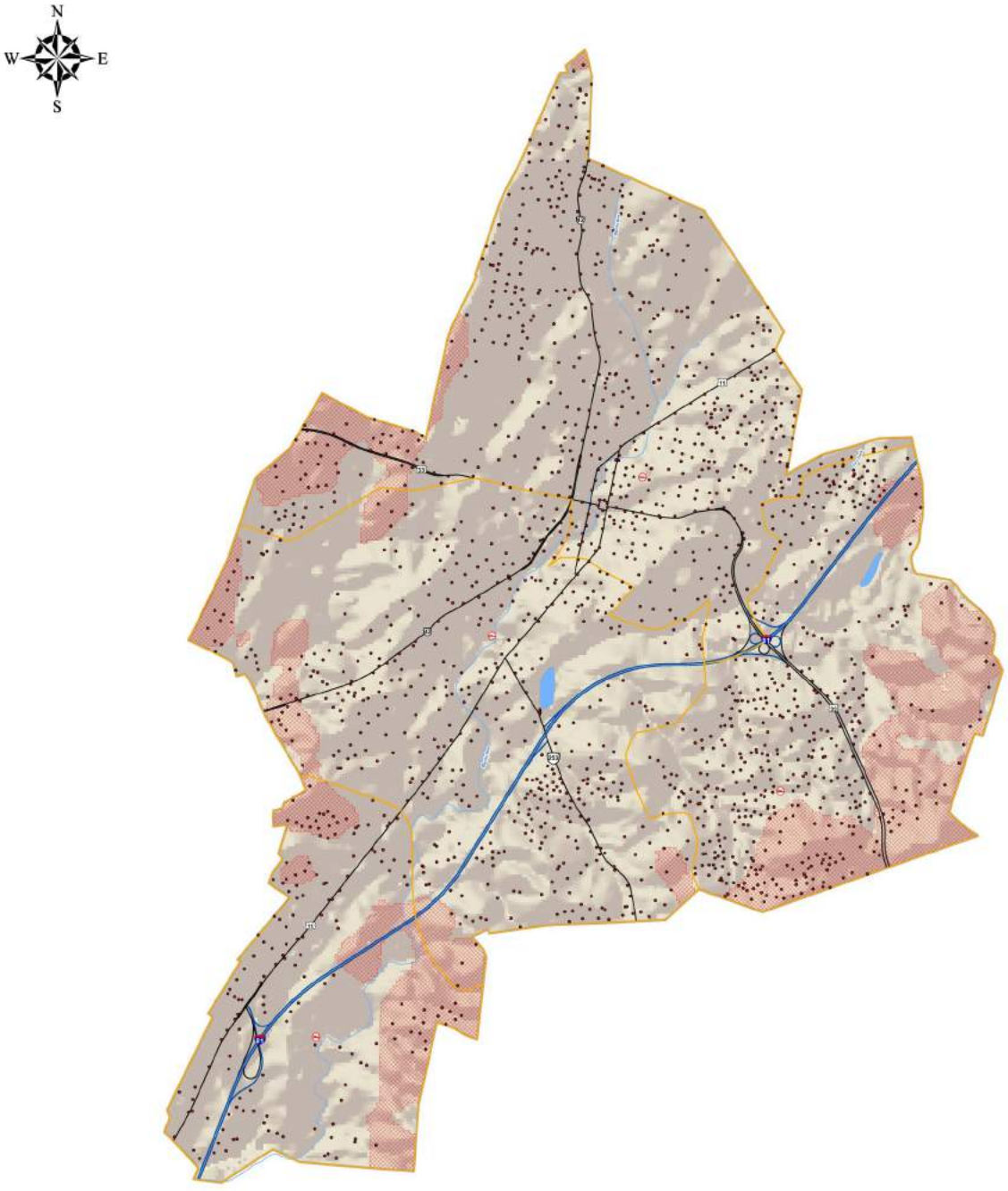
City of Harrisonburg Community Wildfire Protection Plan (CWPP)

Wildfire Planning Composite Map



Hydrants
Fire Districts
Fire Stations
High Risk Area
Interstate
Hydrography
Major Roads

0 0.75 1.5 Miles

Data Source(s): Commonwealth of Virginia, U.S. Census, FEMA, VDEM, VDOF, USGS, CSPDC, City of Harrisonburg

Celebrating 45+ Years

CSPDC

Central Shenandoah Planning District Commission

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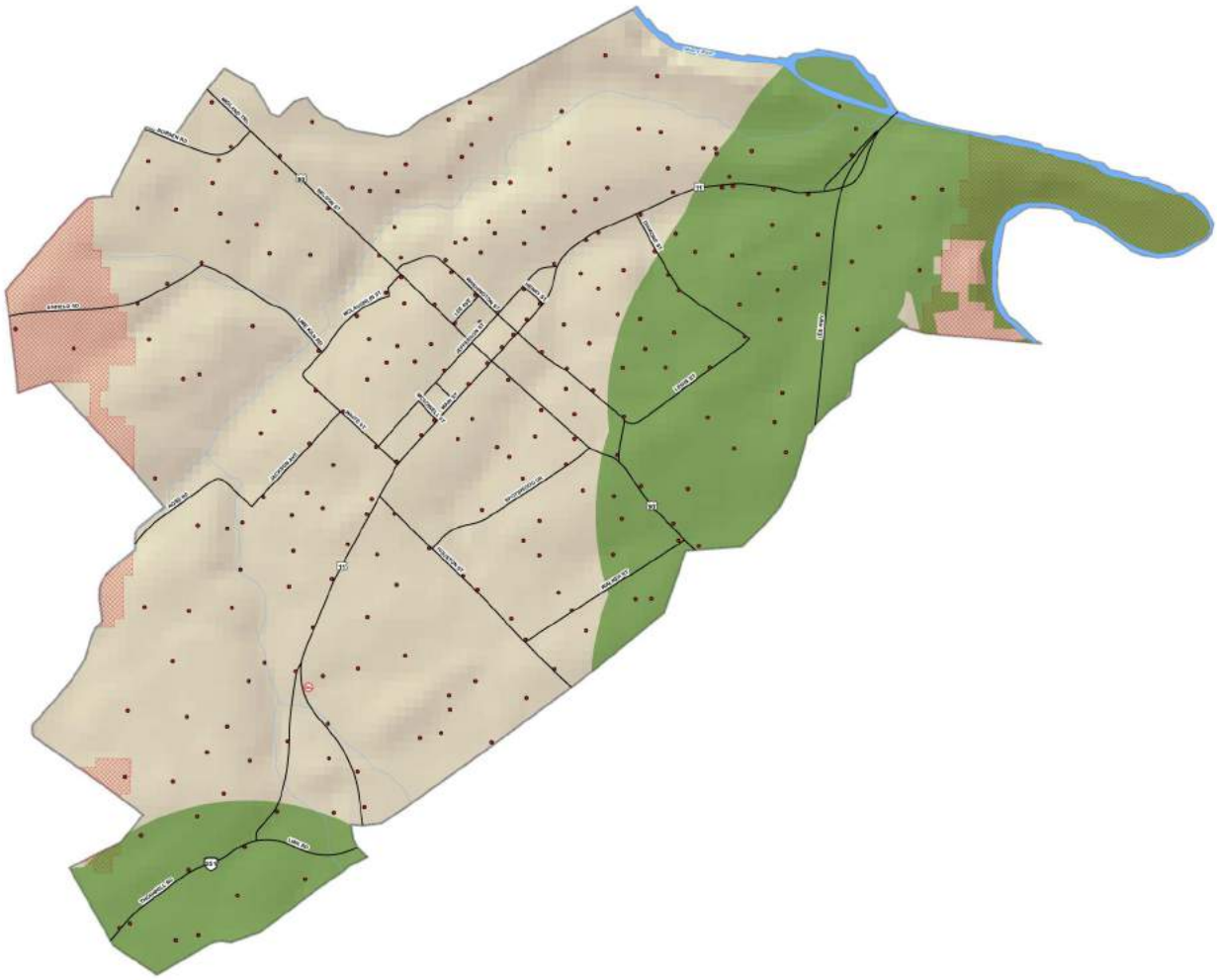
March 15, 2017

City of Lexington Community Wildfire Protection Plan (CWPP)

Wildfire Planning Composite Map



Celebrating 45+ Years

CSPDC

Central Shenandoah Planning District Commission

- Hydrants
- Fire Stations
- Major Roads
- Wildland-Urban Interface (WUI)
- High Risk Area
- Hydrography

0 0.125 0.25 0.5

Miles

Data Source(s): Commonwealth of Virginia, U.S. Census, FEMA, VDEM, VDOF, USGS, CSPDC, City of Lexington

City Of Staunton Community Wildfire Protection Plan (CWPP)

Wildfire Planning Composite Map

Celebrating 45 Years

CSPDC

Central Shenandoah Planning District Commission

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April 10, 2017

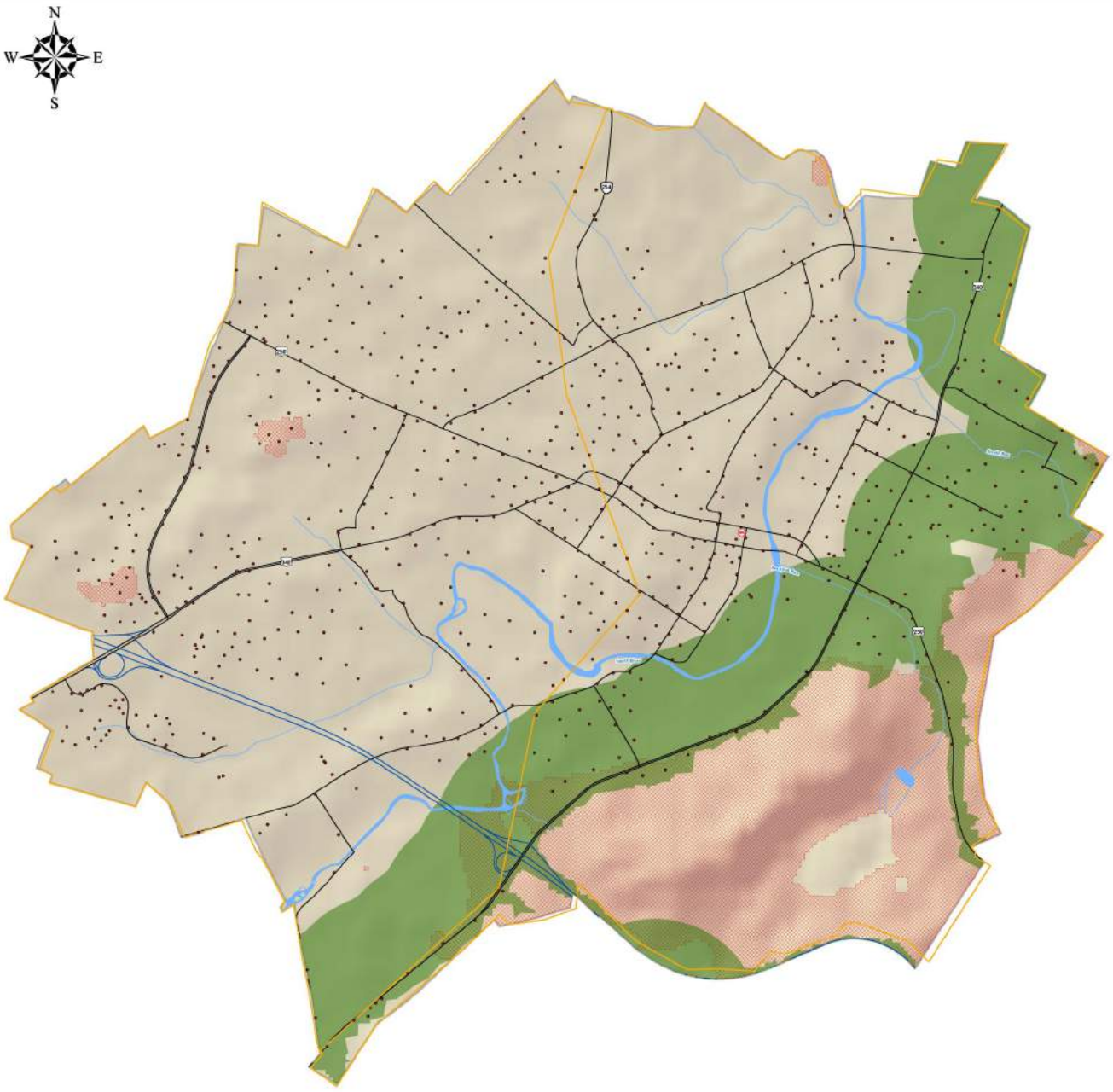
- Hydrants
- Fire Stations
- Peaks
- Interstate
- Major Roads
- Hydrography
- Fire Districts
- Wildland-Urban Interface (WUI)
- High Risk Area

0 0.375 0.75 1.5
Miles

Data Source(s): Commonwealth of Virginia, U.S. Census, FEMA, VDEM, VDOF, USGS, CSPDC, City of Staunton

City Of Waynesboro Community Wildfire Protection Plan (CWPP)

Wildfire Planning Composite Map



Hydrants	Hydrography
Fire Stations	Fire Districts
Interstate	Wildland-Urban Interface (WUI)
Major Roads	High Risk Area

0 0.375 0.75 1.5

Miles

Data Source(s): Commonwealth of Virginia, U.S. Census, FEMA, VDEM, VDOF, USGS, CSPDC, City of Waynesboro

Waynesboro VIRGINIA

Celebrating 45+ Years

CSPDC

Central Shenandoah Planning District Commission

This map was prepared and produced at the Central Shenandoah Planning District Commission and is to be used for planning purposes only.

March 15, 2017

Section 10: APPENDICES

Appendix 1 Additional Wildfire Mitigation Resources

Firewise USA®
www.firewise.org

The Firewise Program is a national educational program, administered by the National Fire Protection Association (NFPA), that encourages enhanced fire safety in the Wildland Urban Interface (WUI) by providing resources and guidance in the principles of prevention, mitigation, and preparedness targeted to local communities and individuals. The program encourages local solutions for safety by involving homeowners in taking individual responsibility for preparing their homes from the risk of wildfire. Firewise USA® is a voluntary program that provides a framework to help neighbors get organized, find direction, and take action to increase the ignition resistance of their homes and community. There are more than 1,500 recognized Firewise USA® sites in the United States.

Fire Adapted Communities®
www.fireadapted.org

A fire adapted community is a human community consisting of informed and prepared citizens, collaboratively planning and taking action to safely coexist with wildland fire. Fire Adapted Communities is not a program, rather it is a continual process with no defined endpoint. There is no entity that certifies that any given community is fire adapted. Every community's fire adaption journey is different. The Fire Adapted Communities Coalition is committed to helping people and communities in the wildland urban interface adapt to living with wildfire and reduce their risk for damage, without compromising firefighter or civilian safety.

Ready, Set, Go!
www.wildlandfirersg.org

The Ready, Set, Go! (RSG) Program seeks to empower fire departments to engage the residents they serve in wildland fire community risk reduction. The RSG Program provides tools and resources for fire departments to use as they help residents gain an understanding of their wildland fire risk and what they can do to reduce that risk. The RSG program is managed by the International Association of Fire Chiefs.

Appendix 2 Natural Hazards Public Survey

Central Shenandoah Regional Wildfire Protection Plan
Natural Hazards Survey Report

Summary

In order to receive public input on wildfires and other natural hazards as part of the planning process for the the Central Shenandoah Regional Wildfire Protection Plan, from April 2018 until October 2019, the CSPDC conducted a survey of the citizens of the twenty-one jurisdictions in the Region. The purpose of this survey was to receive public input regarding perceptions about natural hazards experienced by individuals in the Central Shenandoah Region, their knowledge regarding mitigation techniques, and their willingness to implement mitigation measures.

Distribution of the survey was purposely widespread throughout the Region. Individuals had the option to complete the survey on-line, as a paper copy, or by telephone interview. A press release explaining the survey and how citizens could obtain a copy was distributed in a mass e-mail to contacts throughout the Region and to various media outlets such as newspapers and local television stations.

Five hundred and fifty-seven (557) people completed the survey. The majority of completed surveys were from Augusta County, 156; the City of Staunton, 65; and Rockingham County, 54 based on the responses of the 478 people who answered the question regarding where they live.

Results

- The survey asked respondents which natural disasters they had experienced. The top four natural disasters were; winter storms (82%), windstorms (49%), hurricanes/tropical storms (48%), and floods (44%). With the survey done for the last update of the Plan, windstorms were not included as a top category. This change may be the result of the 2012 Derecho and several smaller, localized windstorms we have had since the last update.

- Respondents were asked to state their concerns about natural hazards affecting the Shenandoah Valley. The largest percentages for each disaster fell in the middle of the rating scale in the *Concerned* category: with the largest being household fire (35%), windstorm/derecho (32%), winter storm (32%), drought (31%), and hurricanes (30%). The *Very Concerned* or *Extremely Concerned* categories did not receive a majority for any hazard. In the survey for the 2013 update, respondents were *Very Concerned* about winter storms/ blizzards (35%) and ice storms (33%). Hurricanes (31%), drought (32%), and floods (30%) had respondents *Concerned* in their response to that survey.

- The survey listed several mitigation activities and asked respondents which of these they had completed. Answers for this survey are in **bold.** Answers from the previous survey are in *italics*. Completed activities included:

    - Installed smoke detectors. **(90%)** *(88%)*
    - Attended meetings or received information about natural disasters or emergency preparedness. **(67%)** *(54%)*
    - Trained in First Aid or CPR in the last year. **(49%)** *(53%)*
    - Prepared a disaster supply kit. **(46%)** *(37%)*
    - Developed a household emergency plan. **(50%)** *(34%)*
    - Implemented fire-resistance or floodproofing techniques. **(27%)** *(19%)*
    - Purchased flood insurance. **(7%)** *(8%)*

- Less than 20% of respondents are *Very Concerned* or *Extremely Concerned* about an occurrence of a natural hazard on their property.

- When asked how much money would respondents be willing to spend to better protect their family and homes from natural disasters; forty-seven percent (47%) said they would spend up to one thousand dollars ($1,000), twenty-five percent (25%) said they would spend up to five thousand dollars ($5,000), and seven percent (7%) would spend five thousand dollars ($5,000) or above.

- The survey listed several types of modifications people have made or would make to protect their home from natural disasters. The three most popular modifications were:

    - Eighty-seven percent (87%) of respondents would keep gutters clean.
    - Sixty-nine percent (69%) of respondents would keep culverts, ditches, and gutters free of debris to allow the free flow of potential floodwaters.
    - Sixty-six percent (66%) of respondents would dispose of stove, grill, and fireplace ashes properly.

- Respondents were asked what incentives would motivate them to take additional steps to better protect their family and homes from a natural disaster. The three incentives that received the most responses were:

    - Seventy-three percent (73%) of respondents said an insurance discount would be a motivating factor.

    - Fifty percent of respondents (50%) said a tax break or incentive would be a motivating factor.

- Forty-seven percent (47%) of respondents said a federal or state grant would be a motivating factor.

Conclusions

What conclusions can be drawn by examining the responses of the five hundred and fifty-seven (557) individuals that completed the survey?

- The most common natural disasters that respondents have experienced are the ones that have happened most frequently. Windstorms/Derechos are new to this list.

- The disasters respondents expressed the most concern about are the ones that occur the most frequently. Windstorms/Derechos are new to this list. House fires are more of a concern than in the past.

- Mitigation and preparedness information is being distributed and received by citizens throughout the Central Shenandoah Region.

- Since the last HMP update more respondents are doing the three most essential tasks needed to prepare for emergencies and disasters; creating a family plan, assembling a disaster supply kit, and receiving information about hazards preparedness.

- Fire safety education in the Central Shenandoah Valley continues to be extremely effective as illustrated by 90% of respondents having installed smoke detectors. This has stayed consistent since the previous update of the HMP.

- Yard work and home maintenance activities that reduce combustible debris and assist with the proper drainage of stormwater are simple mitigation methods a majority of respondents are willing to undertake to prevent damage to their property.

- Not more than one thousand dollars ($1,000.00) is the amount of financial resources that the majority of respondents are willing to spend to protect their families and properties from natural hazards. This trend has not changed since the previous HMP.

- Financial incentives whether through insurance discounts, tax breaks, or grants are the most motivating factors to respondents in order to implement steps to protect their homes and families. The most motivating factor is now insurance discounts compared to the last HMP where tax breaks were the most popular incentive.

In conclusion, while the Central Shenandoah Valley continues to make strides in its progress towards disaster-resistance and resilience there is still much work to be done.

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