ATKINS

Buncombe Madison

Regional Hazard Mitigation Plan

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SECTION 1
INTRODUCTION

This section provides a general introduction to the Buncombe Madison Regional Hazard Mitigation Plan. It consists of the following five subsections:

- 1.1 Background
- 1.2 Purpose
- 1.3 Scope
- 1.4 Authority
- 1.5 Summary of Plan Contents

1.1 BACKGROUND

Natural hazards, such as winter storms, floods, and landslides, are a part of the world around us. Their occurrence is natural and inevitable, and there is little we can do to control their force and intensity. We must consider these hazards to be legitimate and significant threats to human life, safety, and property.

The Buncombe Madison Region is located in the western part of North Carolina and includes the two counties and the municipalities within the counties. This area is vulnerable to a wide range of natural hazards such as landslides, winter storms, severe thunderstorms, and floods. These hazards threaten the life and safety of residents in the Buncombe Madison Region and have the potential to damage or destroy both public and private property, disrupt the local economy, and impact the overall quality of life of individuals who live, work, and vacation in the region.

While the threat from hazardous events may never be fully eliminated, there is much we can do to lessen their potential impact upon our community and our citizens. By minimizing the impact of hazards upon our built environment, we can prevent such events from resulting in disasters. The concept and practice of reducing risks to people and property from known hazards is generally referred to as *hazard mitigation*.

FEMA Definition of Hazard Mitigation:
"Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards."

Hazard mitigation techniques include both structural measures (such as strengthening or protecting buildings and infrastructure from the destructive forces of potential hazards) and non-structural measures (such as the adoption of sound land use policies and the creation of public awareness programs). It is widely accepted that the most effective mitigation measures are implemented at the local government level, where decisions on the regulation and control of development are ultimately made. A comprehensive mitigation approach addresses hazard vulnerabilities that exist today and in the foreseeable future. Therefore, it is essential that projected patterns of future development are

evaluated and considered in terms of how that growth will increase or decrease a community's overall hazard vulnerability.

A key component in the formulation of a comprehensive approach to hazard mitigation is to develop, adopt, and update a local hazard mitigation plan as needed. A hazard mitigation plan establishes the broad community vision and guiding principles for reducing hazard risk, and further proposes specific mitigation actions to eliminate or reduce identified vulnerabilities.

Both of the counties and their municipal jurisdictions have an existing hazard mitigation plan that has evolved over the years, as described in Section 2: *Planning Process*. This regional plan draws from both of the County plans to document the region's sustained efforts to incorporate hazard mitigation principles and practices into routine government activities and functions. At its core, the Plan recommends specific actions to minimize hazard vulnerability and protect residents from losses to those hazards that pose the greatest risk. These mitigation actions go beyond simply recommending structural solutions to reduce existing vulnerability, such as elevation, retrofitting, and acquisition projects. Local policies on community growth and development, incentives for natural resource protection, and public awareness and outreach activities are examples of other actions considered to reduce the Buncombe Madison Region's vulnerability to identified hazards. The Plan remains a living document, with implementation and evaluation procedures established to help achieve meaningful objectives and successful outcomes over time.

1.1.1 The Disaster Mitigation Act and the Flood Insurance Reform Act

In an effort to reduce the Nation's mounting natural disaster losses, the U.S. Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) in order to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Section 322 of DMA 2000 emphasizes the need for state, local and Tribal government entities to closely coordinate on mitigation planning activities and makes the development of a hazard mitigation plan a specific eligibility requirement for any local or Tribal government applying for federal mitigation grant funds. These funds include the Hazard Mitigation Grant Program (HMGP) and the Pre-Disaster Mitigation (PDM) program, both of which are administered by the Federal Emergency Management Agency (FEMA) under the Department of Homeland Security. Communities with an adopted and federally-approved hazard mitigation plan thereby become pre-positioned and more apt to receive available mitigation funds before and after the next disaster strikes.

Additionally, the Biggert Waters Flood Insurance Reform Act of 2012 modified the existing Flood Mitigation Assistance (FMA) program. One of the requirements of this Act is that a FEMA-approved Hazard Mitigation Plan is now required if communities wish to be eligible for these FEMA mitigation programs.

The Buncombe Madison Regional Hazard Mitigation Plan has been prepared in coordination with FEMA Region IV and the North Carolina Division of Emergency Management (NCDEM) to ensure that the Plan meets all applicable FEMA and state requirements for hazard mitigation plans. A *Local Mitigation Plan Review Tool*, found in Appendix C, provides a summary of federal and state minimum standards and notes the location where each requirement is met within the Plan.

1.2 PURPOSE

The purpose of the Buncombe Madison Regional Hazard Mitigation Plan is to:

- Merge the existing Buncombe County and Madison County plans into one regional plan;
- Complete update of existing plans to demonstrate progress and reflect current conditions;
- Increase public awareness and education;
- Maintain grant eligibility for participating jurisdictions; and
- Maintain compliance with state and federal legislative requirements for local hazard mitigation plans.

1.3 SCOPE

The focus of the Buncombe Madison Regional Hazard Mitigation Plan is on those hazards determined to be "high" or "moderate" risks to the Buncombe Madison Region, as determined through a detailed hazard risk assessment. Other hazards that pose a "low" or "negligible" risk will continue to be evaluated during future updates to the Plan, but they may not be fully addressed until they are determined to be of high or moderate risk. This enables the participating counties and municipalities to prioritize mitigation actions based on those hazards which are understood to present the greatest risk to lives and property.

The geographic scope (i.e., the planning area) for the Plan includes the counties of Buncombe and Madison as well as their incorporated jurisdictions. **Table 1.1** indicates the participating jurisdictions.

TABLE 1.1: PARTICIPATING JURISDICTIONS IN THE BUNCOMBE MADISON REGIONAL HAZARD MITIGATION PLAN

Buncombe County	
Asheville	Montreat
Biltmore Forest	Weaverville
Black Mountain	Woodfin
Madison County	
Hot Springs	Mars Hill
Marshall	

1.4 AUTHORITY

The Buncombe Madison Regional Hazard Mitigation Plan has been developed in accordance with current state and federal rules and regulations governing local hazard mitigation plans and has been adopted by each participating county, local jurisdiction in accordance with standard local procedures. Copies of the adoption resolutions for each participating jurisdiction are provided in Appendix A. The Plan shall be routinely monitored and revised to maintain compliance with the following provisions, rules, and legislation:

- Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390);
- FEMA's Final Rule published in the Federal Register, at 44 CFR Part 201 (201.6 for local mitigation planning requirements); and
- Biggert Waters Flood Insurance Reform Act of 2012(P.L. 112-141).

1.5 SUMMARY OF PLAN CONTENTS

The contents of this Plan are designed and organized to be as reader-friendly and functional as possible. While significant background information is included on the processes used and studies completed (i.e., risk assessment, capability assessment), this information is separated from the more meaningful planning outcomes or actions (i.e., mitigation strategy, mitigation action plan).

Section 2, ***Planning Process***, provides a complete narrative description of the process used to prepare the Plan. This includes the identification of participants on the planning team and describes how the public and other stakeholders were involved. It also includes a detailed summary for each of the key meetings held, along with any associated outcomes.

The ***Community Profile***, located in Section 3, provides a general overview of the Buncombe Madison Region, including prevalent geographic, demographic, and economic characteristics. In addition, building characteristics and land use patterns are discussed. This baseline information provides a snapshot of the planning area and helps local officials recognize those social, environmental, and economic factors that ultimately play a role in determining the region's vulnerability to hazards.

The Risk Assessment is presented in three sections: Section 4, ***Hazard Identification***; Section 5, ***Hazard Profiles***; and Section 6, ***Vulnerability Assessment***. Together, these sections serve to identify, analyze, and assess hazards that pose a threat to the Buncombe Madison Region. The risk assessment also attempts to define any hazard risks that may uniquely or exclusively affect specific areas of the Buncombe Madison Region.

The Risk Assessment begins by identifying hazards that threaten the Buncombe Madison Region. Next, detailed profiles are established for each hazard, building on available historical data from past hazard occurrences, spatial extent, and probability of future occurrence. This section culminates in a hazard risk ranking based on conclusions regarding the frequency of occurrence, spatial extent, and potential impact highlighted in each of the hazard profiles. In the vulnerability assessment, FEMA's Hazus®MH loss estimation methodology is used to evaluate known hazard risks by their relative long-term cost in expected damages. In essence, the information generated through the risk assessment serves a critical function as the participating jurisdictions in the Buncombe Madison Region seek to determine the most appropriate mitigation actions to pursue and implement—enabling them to prioritize and focus their efforts on those hazards of greatest concern and those structures or planning areas facing the greatest risk(s).

The ***Capability Assessment***, found in Section 7, provides a comprehensive examination of the Buncombe Madison Region's capacity to implement meaningful mitigation strategies and identifies opportunities to increase and enhance that capacity. Specific capabilities addressed in this section include planning and regulatory capability, staff and organizational (administrative) capability, technical capability, fiscal capability, and political capability. Information was obtained through the use of a detailed survey

questionnaire and an inventory and analysis of existing plans, ordinances, and relevant documents. The purpose of this assessment is to identify any existing gaps, weaknesses, or conflicts in programs or activities that may hinder mitigation efforts and to identify those activities that should be built upon in establishing a successful and sustainable local hazard mitigation program.

The *Community Profile*, *Risk Assessment*, and *Capability Assessment* collectively serve as a basis for determining the goals for the Buncombe Madison Regional Hazard Mitigation Plan, each contributing to the development, adoption, and implementation of a meaningful and manageable *Mitigation Strategy* that is based on accurate background information.

The ***Mitigation Strategy***, found in Section 8, consists of broad goal statements as well as an analysis of hazard mitigation techniques for the jurisdictions participating in the Buncombe Madison Regional Hazard Mitigation Plan to consider in reducing hazard vulnerabilities. The strategy provides the foundation for a detailed ***Mitigation Action Plan***, found in Section 9, which links specific mitigation actions for each county and municipal department or agency to locally-assigned implementation mechanisms and target completion dates. Together, these sections are designed to make the Plan both strategic, through the identification of long-term goals, and functional, through the identification of immediate and short-term actions that will guide day-to-day decision-making and project implementation.

In addition to the identification and prioritization of possible mitigation projects, emphasis is placed on the use of program and policy alternatives to help make the Buncombe Madison Region less vulnerable to the damaging forces of hazards while improving the economic, social, and environmental health of the community. The concept of multi-objective planning was emphasized throughout the planning process, particularly in identifying ways to link, where possible, hazard mitigation policies and programs with complimentary community goals related to disaster recovery, housing, economic development, recreational opportunities, transportation improvements, environmental quality, land development, and public health and safety.

Plan Maintenance, found in Section 10, includes the measures that the jurisdictions participating in the Buncombe Madison Regional plan will take to ensure the Plan's continuous long-term implementation. The procedures also include the manner in which the Plan will be regularly evaluated and updated to remain a current and meaningful planning document.

County-specific **Annexes** have been created to include specific information for each County and participating jurisdiction. Topics covered in the annexes include community profile, risk assessment, vulnerability, and capability assessment information. The mitigation actions relevant for each particular county and their participating municipal jurisdictions are also included in the Annex.

SECTION 2
PLANNING PROCESS

This section describes the planning process undertaken to develop the Buncombe Madison Regional Hazard Mitigation Plan. It consists of the following eight subsections:

- 2.1 Overview of Hazard Mitigation Planning
- 2.2 History of Hazard Mitigation Planning in the Buncombe Madison Region
- 2.3 Preparing the 2014 Plan
- 2.4 The Buncombe Madison Regional Hazard Mitigation Planning Team
- 2.5 Community Meetings and Workshops
- 2.6 Involving the Public
- 2.7 Involving the Stakeholders
- 2.8 Documentation of Plan Progress

44 CFR Requirement
44 CFR Part 201.6(c)(1): The plan shall include documentation of the planning process used to develop the plan, including how it was prepared, who was involved in the process and how the public was involved.

2.1 OVERVIEW OF HAZARD MITIGATION PLANNING

Local hazard mitigation planning is the process of organizing community resources, identifying and assessing hazard risks, and determining how to best minimize or manage those risks. This process culminates in a hazard mitigation plan that identifies specific mitigation actions, each designed to achieve both short-term planning objectives and a long-term community vision.

To ensure the functionality of a hazard mitigation plan, responsibility is assigned for each proposed mitigation action to a specific individual, department, or agency along with a schedule or target completion date for its implementation (see Section 10: *Plan Maintenance*). Plan maintenance procedures are established for the routine monitoring of implementation progress, as well as the evaluation and enhancement of the mitigation plan itself. These plan maintenance procedures ensure that the Plan remains a current, dynamic, and effective planning document over time that becomes integrated into the routine local decision making process.

Communities that participate in hazard mitigation planning have the potential to accomplish many benefits, including:

- saving lives and property,
- saving money,
- speeding recovery following disasters,
- reducing future vulnerability through wise development and post-disaster recovery and reconstruction,

- expediting the receipt of pre-disaster and post-disaster grant funding, and
- demonstrating a firm commitment to improving community health and safety.

Typically, communities that participate in mitigation planning are described as having the potential to produce long-term and recurring benefits by breaking the repetitive cycle of disaster loss. A core assumption of hazard mitigation is that the investments made before a hazard event will significantly reduce the demand for post-disaster assistance by lessening the need for emergency response, repair, recovery, and reconstruction. Furthermore, mitigation practices will enable local residents, businesses, and industries to re-establish themselves in the wake of a disaster, getting the community economy back on track sooner and with less interruption.

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

2.2 HISTORY OF HAZARD MITIGATION PLANNING IN THE BUNCOMBE MADISON REGION

Both of the counties participating in this Plan have a previously adopted hazard mitigation plan. The FEMA approval dates for each of these plans, along with a list of the participating municipalities for each plan, are listed below:

- *Buncombe County – County-Wide All Hazards Mitigation Plan* (September 2011)
  - City of Asheville
  - Town of Biltmore Forest
  - Town of Black Mountain
  - Town of Montreat
  - Town of Weaverville
  - Town of Woodfin
- *Hazard Mitigation Plan for Madison County, North Carolina and the Municipalities of Hot Springs, Marshall and Mars Hill* (June 2013)
  - Town of Hot Springs
  - Town of Mars Hill
  - Town of Marshall

Each of the county-levels plans was developed using the multi-jurisdictional planning process recommended by the Federal Emergency Management Agency (FEMA). For this plan, all of the aforementioned jurisdictions have joined to form a regional plan. All of the jurisdictions that participated in previous planning efforts have participated in the development of this regional plan.

The process of merging the two plans listed above into this regional plan is described in more detail below.

2.3 PREPARING THE 2014 PLAN

Hazard mitigation plans are required to be updated every five years to remain eligible for federal mitigation funding. To simplify planning efforts, the jurisdictions in the Buncombe Madison Region decided to join together to create the *Buncombe Madison Regional Hazard Mitigation Plan*. This allows resources to be shared amongst the participating jurisdictions and eases the administrative duties of all of the participants by combining the existing county plans into one multi-jurisdictional plan.

To prepare the 2014 *Buncombe Madison Regional Hazard Mitigation Plan*, Atkins was hired as an outside consultant to provide professional mitigation planning services. To meet requirements of the Community Rating System, the region ensured that the planning process was facilitated under the direction of a professional planner. Nathan Slaughter from Atkins served as the lead planner for this project and is a member of the American Institute of Certified Planners (AICP).

Per the contractual scope of work, the consultant team followed the mitigation planning process recommended by FEMA (Publication Series 386 and Local Mitigation Plan Review Guide) and recommendations provided by North Carolina Division of Emergency Management (NCEM) mitigation planning staff[1]. The Local Mitigation Plan Review Tool, found in Appendix C, provides a detailed summary of FEMA's current minimum standards of acceptability for compliance with DMA 2000 and notes the location where each requirement is met within this Plan. These standards are based upon FEMA's Final Rule as published in the Federal Register in Part 201 of the Code of Federal Regulations (CFR). The planning team used FEMA's Local Mitigation Plan Review Guide (October 2011) for reference as they completed the Plan.

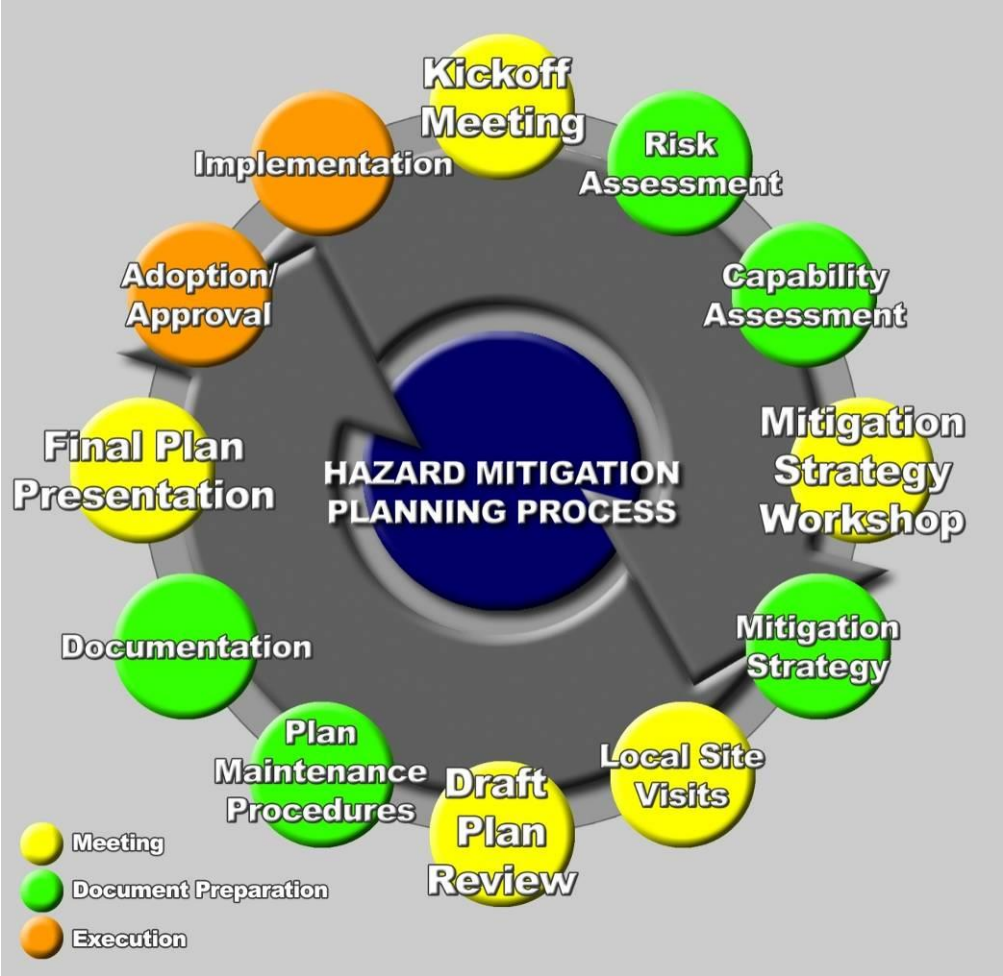
Although each participating jurisdiction had already developed a plan in the past, the combination of the two plans into one regional plan still required making some plan update revisions based on FEMA's Local Mitigation Plan Guide. Since all sections of the regional plan are technically new, plan update requirements do not apply. However, since this is the first regional plan among the jurisdictions, key elements from the previous approved plans are referenced throughout the document (e.g., existing actions) and required a discussion of changes made. For example, all of the risk assessment elements needed to be updated to include most recent information. It was also necessary to formulate a single set of goals for the region, but they were based on previously determined goals (Section 8: *Mitigation Strategy*). The Capability Assessment section includes updated information for all of the participating jurisdictions and the Mitigation Action Plan provides implementation status updates for all of the actions identified in the previous plans.

The process used to prepare this Plan included twelve major steps that were completed over the course of approximately nine months beginning in September 2013. Each of these planning steps (illustrated in **Figure 2.1**) resulted in critical work products and outcomes that collectively make up the Plan. Specific plan sections are further described in Section 1: *Introduction*.

[1] A copy of the negotiated contractual scope of work between the participating counties and Atkins is available through Madison County upon request.

Over the past five years, each participating jurisdiction has been actively working to implement their existing plans. This is documented in the Mitigation Action Plan through the implementation status updates for each of the Mitigation Actions. The Capability Assessment also documents changes and improvements in the capabilities of each participating jurisdiction to implement the Mitigation Strategy.

FIGURE 2.1: MITIGATION PLANNING PROCESS FOR THE BUNCOMBE MADISON REGION



2.4 THE BUNCOMBE MADISON REGIONAL HAZARD MITIGATION PLANNING TEAM

In order to guide the development of this Plan, the Buncombe Madison jurisdictions created the Buncombe Madison Regional Hazard Mitigation Planning Team (Regional Hazard Mitigation Planning Team or Regional Planning Team). The Regional Hazard Mitigation Planning Team represents a community-based planning team made up of representatives from various county and municipal departments, and other key stakeholders identified to serve as critical partners in the planning process.

Beginning in September 2013, the Regional Hazard Mitigation Planning Team members engaged in regular discussions as well as local meetings and planning workshops to discuss and complete tasks associated with preparing the Plan. This working group coordinated on all aspects of plan preparation

and provided valuable input to the process. In addition to regular meetings, team members routinely communicated and were kept informed through an e-mail distribution list.

Specifically, the tasks assigned to the Regional Hazard Mitigation Planning Team members included:

- participate in Regional Hazard Mitigation Planning Team meetings and workshops
- provide best available data as required for the risk assessment portion of the Plan
- provide information that will help complete the Capability Assessment section of the plan and provide copies of any mitigation or hazard-related documents for review and incorporation into the Plan
- support the development of the Mitigation Strategy, including the design and adoption of regional goal statements
- help design and propose appropriate mitigation actions for their department/agency for incorporation into the Mitigation Action Plan
- review and provide timely comments on all study findings and draft plan deliverables
- support the adoption of the 2014 *Buncombe Madison Regional Hazard Mitigation Plan*

Table 2.1 lists the members of the Regional Hazard Mitigation Planning Team who were responsible for participating in the development of the Plan. Team members are listed in alphabetical order by last name.

TABLE 2.1: MEMBERS OF THE BUNCOMBE MADISON REGIONAL HAZARD MITIGATION PLANNING TEAM

NAME	POSITION	DEPARTMENT / AGENCY
Bandy, Chad	Engineer	NCDOT
Barcklow, Cynthia Fox	Planner	Buncombe County Planning
Cervantes, Brandon	Forest Service Liaison	USFS
Coates, McCray	Stormwater Services Manager	City of Asheville
Deyton, Chris	Engineer	NCDOT
Fox, Eddie	Fire Chief	Town of Mars Hill
Fox, Cleve	Forest Service Liaison	USFS
Freeman, Steve	Public Works Director	Town of Montreat
Garrison, Lewis	Deputy Fire Marshal	Asheville FD
Harrold, Josh	Planner	Town of Black Mountain
Harwood, Jayson	Fire Marshal	Weaverville Fire
Jones, Steve	Fire Chief	Town of Black Mountain
Ledford, Angela*	Planner	Buncombe County EM
Malone, Terry	Fire Chief	Weaverville Fire
Meadows, Joe	Division Chief	Asheville FD
Moore, Abby	Emergency Management Specialist	Asheville Fire RRT-6
Nalley, Ron	Administrator	Town of Montreat

NAME	POSITION	DEPARTMENT / AGENCY
Ramsey, Martha	Zoning Officer	Town of Marshall
Roberts, Edward	Fire Liaison	Laurel Fire Department
Smith, Nelson	Town Manager	Biltmore Forest
Stines, Allen	Radio Operator	Madison County Amateur Radio
Stoude, Stephen	EMS Representative	Madison EMS
Tuch, Shannon	Planning Director	Asheville Planning and Development Services
Vehaun, Jerry	Emergency Services Director	Buncombe County EM
Williams, Ted	Deputy Fire Chief	Weaverville FD
Willis, Jeff*	Emergency Management Director	Madison County EM
Young, Jason	Town Manager	Town of Woodfin

* Served as the County's main Point of Contact

Table 2.2 lists points of contact for several of the jurisdictions who elected to designate their respective county officials to represent their jurisdiction on the planning team, generally because they did not have the time or staff to be able to attend on their own. Although these members designated county officials to represent them at in-person meetings, each was still contacted throughout the planning process and participated by providing suggestions and comments on the Plan via email and phone conversations. These members are listed in alphabetical order by first name below.

TABLE 2.2: MEMBERS DESIGNATING REPRESENTATIVES TO BUNCOMBE MADISON REGIONAL HAZARD MITIGATION PLANNING TEAM

NAME	POSITION	DEPARTMENT / AGENCY / TITLE
Brian Reese	Mayor	Town of Hot Springs

2.4.1 Multi-Jurisdictional Participation

The Buncombe Madison Regional Multi-Jurisdictional Hazard Mitigation Plan includes two counties and nine incorporated municipalities. To satisfy multi-jurisdictional participation requirements, each county and its participating jurisdictions were required to perform the following tasks:

- Participate in mitigation planning workshops;
- Identify completed mitigation projects, if applicable; and
- Develop and adopt (or update) their local Mitigation Action Plan.

Each jurisdiction participated in the planning process and has developed a local Mitigation Action Plan unique to their jurisdiction. Each jurisdiction will adopt their Mitigation Action Plan separately. This provides the means for jurisdictions to monitor and update their Plan on a regular basis.

2.5 COMMUNITY MEETINGS AND WORKSHOPS

The preparation of this Plan required a series of meetings and workshops for facilitating discussion, gaining consensus and initiating data collection efforts with local government staff, community officials,

and other identified stakeholders. More importantly, the meetings and workshops prompted continuous input and feedback from relevant participants throughout the drafting stages of the Plan. The following is a summary of the key meetings and community workshops held during the development of the plan update.[2] In many cases, routine discussions and additional meetings were held by local staff to accomplish planning tasks specific to their department or agency, such as the approval of specific mitigation actions for their department or agency to undertake and include in the Mitigation Action Plan.

The following meetings were held during the development of this plan. Copies of agendas, sign-in sheets, minutes, and handout materials for all meetings and workshops can be found in Appendix D.

November 7, 2013 Buncombe Madison Regional Hazard Mitigation Planning Team Meeting

November 7, 2013
First Regional Hazard Mitigation Planning Team Meeting – Project Kickoff Meeting - Weaverville Town Hall

April 7, 2014
Second Regional Hazard Mitigation Planning Team Meeting – Mitigation Strategy Meeting - Weaverville Town Hall

2.6 INVOLVING THE PUBLIC

44 CFR Requirement
44 CFR Part 201.6(b)(1): The planning process shall include an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

An important component of the mitigation planning process involved public participation. Individual citizen and community-based input provides the entire planning team with a greater understanding of local concerns and increases the likelihood of successfully implementing mitigation actions by developing community "buy-in" from those directly affected by the decisions of public officials. As citizens become more involved in decisions that affect their safety, they are more likely to gain a greater appreciation of the hazards present in their community and take the steps necessary to reduce their impact. Public awareness is a key component of any community's overall mitigation strategy aimed at making a home, neighborhood, school, business or entire city safer from the potential effects of hazards.

Public involvement in the development of the *Buncombe Madison Regional Hazard Mitigation Plan* was sought using two methods: (1) public survey instruments were made available in hard copy and online;

[2] Copies of agendas, sign-in sheets, minutes, and handout materials for all meetings and workshops can be found in Appendix D.

and (2) copies of the draft Plan deliverables were made available for public review on county and municipal websites and at government offices. The public was provided two opportunities to be involved in the development of the regional plan at two distinct periods during the planning process: (1) during the drafting stage of the Plan; and (2) upon completion of a final draft Plan, but prior to official plan approval and adoption. In addition, a public participation survey (discussed in greater detail in Section 2.6.1) was made available during the planning process at various locations throughout the region and on county and municipal websites.

Each of the participating jurisdictions will hold public meetings before the final plan is officially adopted by the local governing bodies. These meetings will occur at different times once FEMA has granted conditional approval of the Plan. Adoption resolutions will be included in Appendix A.

2.6.1 Public Participation Survey

The Regional Hazard Mitigation Planning Team was successful in getting citizens to provide input to the mitigation planning process through the use of the *Public Participation Survey*. The *Public Participation Survey* was designed to capture data and information from residents of the region that might not be able to attend public meetings or participate through other means in the mitigation planning process.

Copies of the *Public Participation Survey* were distributed to the Regional Hazard Mitigation Planning Team to be made available for residents to complete at local public offices. A link to an electronic version of the survey was also posted on each county's website. A total of 176 survey responses were received, which provided valuable input for the Regional Hazard Mitigation Planning Team to consider in the development of the plan update. Selected survey results are presented below.

- Approximately 46 percent of survey respondents had been impacted by a disaster, mainly flooding, hurricanes, and winter storms.
- Respondents ranked Severe Winter Storm/Freeze as the highest threat to their neighborhood (28 percent), followed by Flood (20 percent) and Severe Thunderstorm/High Wind (15 percent).
- Approximately 43 percent of respondents have taken actions to make their homes more resistant to hazards and 84 percent are interested in making their homes more resistant to hazards.
- 75 percent of respondents do not know what office to contact regarding reducing their risks to hazards.
- Natural Resource Protection, Prevention, and Emergency Services were ranked as the most important activities for communities to pursue in reducing risks.

A copy of the survey is provided in Appendix B and a detailed summary of the survey results are provided in Appendix D.

2.7 INVOLVING THE STAKEHOLDERS

44 CFR Requirement
44 CFR Part 201.6(b)(2): The planning process shall include an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other non-profit interests to be involved in the planning process.

At the beginning of the planning process for the development of this plan, the project consultant worked with both of the County Emergency Management leads to initiate outreach to stakeholders to be involved in the planning process. The project consultant sent out a list of recommended stakeholders provided from FEMA Publication 386-1 titled **Getting Started: Building Support for Mitigation Planning**. The list of recommended stakeholders is found in Appendix C of that publication (Worksheet #1: Build the Planning Team) and has been included in **Appendix D** of this plan to demonstrate the wide range of stakeholders that were considered to participate in the development of this plan. Each of the County Emergency Management leads used that list for reference as they invited stakeholders from their counties to participate in the planning process.

In addition to participation from a wide variety of County-level departments, additional stakeholders that were involved in the process of developing this plan included: North Carolina Department of Transportation and the US Forest Service.

In addition to the efforts described above, the regional Hazard Mitigation Planning Team encouraged more open and widespread participation in the mitigation planning process by designing and distributing the *Public Participation Survey*. These opportunities were provided for local officials, residents, businesses, academia, and other private interests in the region to be involved and offer input throughout the local mitigation planning process.

2.8 DOCUMENTATION OF PLAN PROGRESS

Progress in hazard mitigation planning for the participating jurisdictions in the Buncombe Madison Region is documented in this plan update. Since hazard mitigation planning efforts officially began in the participating counties with the development of the initial Hazard Mitigation Plans in the late 1990s and early 2000s, many mitigation actions have been completed and implemented in the participating jurisdictions. These actions will help reduce the overall risk to natural hazards for the people and property in the Buncombe Madison Region. The actions that have been completed are documented in the Mitigation Action Plan found in Section 9.

In addition, community capability continues to improve with the implementation of new plans, policies and programs that help to promote hazard mitigation at the local level. The current state of local capabilities for the participating jurisdictions is captured in Section 7: *Capability Assessment*. The participating jurisdictions continue to demonstrate their commitment to hazard mitigation and hazard mitigation planning and have proven this by developing the Regional Hazard Mitigation Planning Team to update the Plan and by continuing to involve the public in the hazard mitigation planning process.

SECTION 3
Community Profile

This section of the Plan provides a general overview of the Buncombe Madison Region. It consists of the following four subsections:

- 3.1 Geography and the Environment
- 3.2 Population and Demographics
- 3.3 Housing, Infrastructure, and Land Use
- 3.4 Employment and Industry

3.1 GEOGRAPHY AND THE ENVIRONMENT

The Buncombe Madison Region is located in Western North Carolina in the Blue Ridge Mountain portion of the Appalachian Mountains. For the purposes of this plan, the Buncombe Madison Region includes the two counties of Buncombe and Madison and their participating municipalities. An orientation map is provided as **Figure 3.1**.

The Buncombe Madison Region includes many natural attractions. Located in the Blue Ridge Mountains, the area draws tourists and outdoor enthusiasts alike to the Pisgah National Forest. The Pisgah National Forest covers over 500,000 acres, has some of the highest mountains in the eastern United States, and includes over 60 miles of Appalachian Trail. A portion of the scenic Blue Ridge Parkway also traverses the region.

Fall is considered the region's "peak season" due to the colorful foliage; however, tourists visit the area year-round to see the diverse wildlife and waterfalls, hike, bike, fish, picnic, and camp. Other natural attractions include the French Broad River and hot springs. In addition, the Biltmore Estate, America's largest privately-owned house, is also located in the region.

The total land area of each of the participating counties is presented in **Table 3.1**.

TABLE 3.1: TOTAL LAND AREAS OF PARTICIPATING COUNTIES

County	Total Land Area
Buncombe County	657 square miles
Madison County	450 square miles

Source: United States Census Bureau

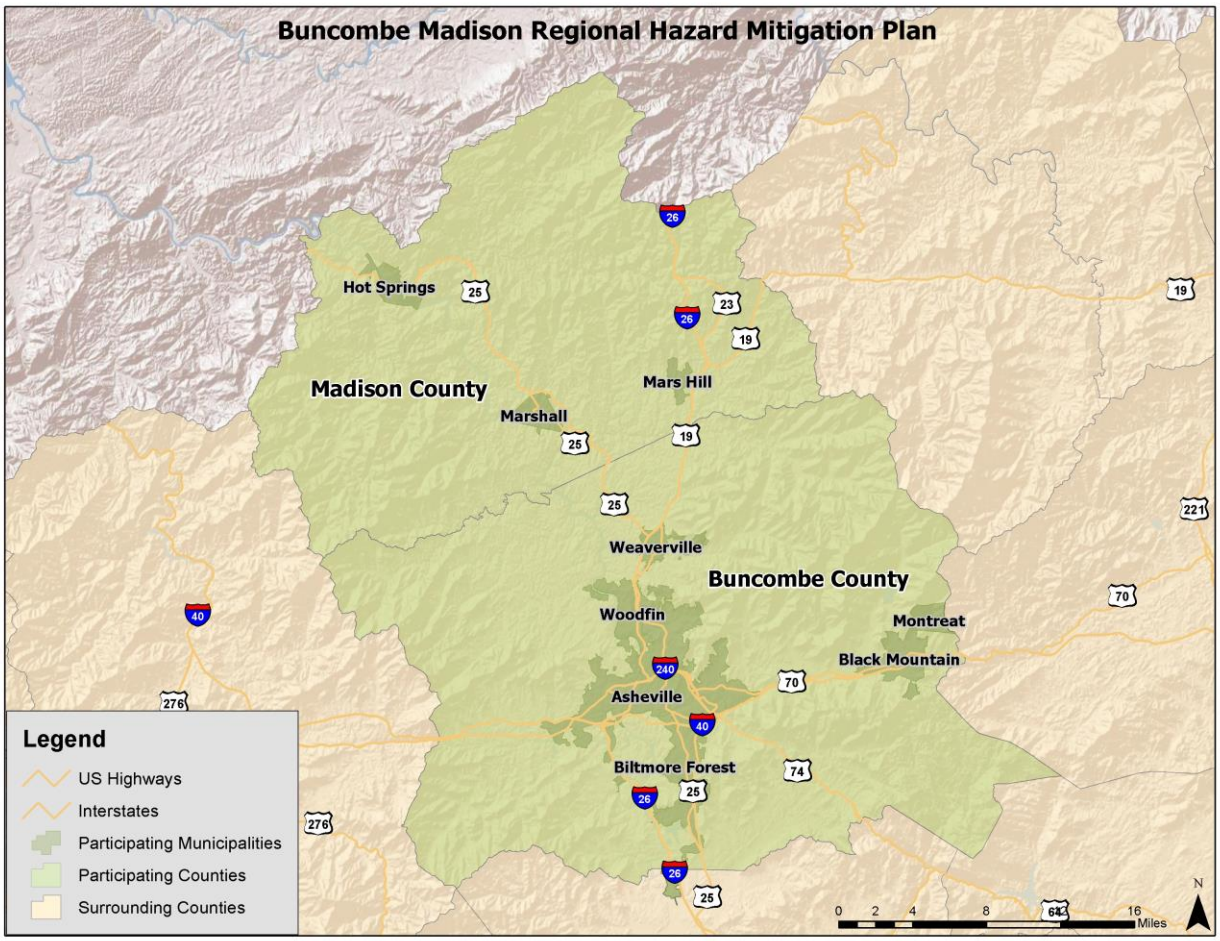
The Buncombe Madison Region enjoys a moderate climate that is characterized by mild winter and warm summers; however, variation in elevation and topography can drastically affect local weather. In general, the spring months are marked by unpredictable weather and changes can occur rapidly with sunny skies yielding to snow in just a few hours. From March through May, temperatures in the lower elevations have an average high of 67˚F and an average low of 45˚F. Typically the weather is milder by mid-April and warm in May.

In the summer, afternoon showers and thunderstorms are common and average temperatures increase with afternoon highs reaching the 80s in July and August. At higher elevations, weather is much more pleasant during the summer.

September through mid-November is typified by clear skies and cooler weather that alternates between warm days and cool nights. Daytime highs are usually in the 70s during September but fall to the 50s and 60s by early November. The first frost often occurs in late October and the lows are near freezing by November. During these autumn months, there are only occasional rain showers making it the driest period of the year.

Winter in the Buncombe Madison Region is generally moderate but extremes do occur, especially at higher elevations. About half of the days from mid-November through February have high temperatures of 50˚F or more. Winter lows are usually at or below freezing but temperatures can drop to -20˚F at high elevations. Snow is most common during January and February. At low elevations, snows of one inch or more occur one to five times per year; however, in the higher mountains, snow falls more frequently and up to two feet can fall at one time.

FIGURE 3.1: BUNCOMBE MADISON REGION ORIENTATION MAP



3.2 POPULATION AND DEMOGRAPHICS

Buncombe County is the largest participating county by area and it also has the largest population. Between 2000 and 2010, the majority of participating jurisdictions experienced population growth, with the exception of Biltmore Forest and Host Springs which saw declines. In total, Buncombe County experienced growth of 15.5% whereas Madison County only experienced a 5.7% increase. Population counts from the US Census Bureau for 1990, 2000, and 2010 for each of the participating counties are presented in **Table 3.2**.

TABLE 3.2: POPULATION COUNTS FOR PARTICIPATING COUNTIES

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Buncombe County	174,821	206,330	238,318	15.5%
Madison County	16,953	19,635	20,764	5.7%

Source: United States Census Bureau

Based on the 2010 Census, the median age of residents of the participating counties ranges from 41 to 43 years. The racial characteristics of the participating counties are presented in **Table 3.3**. Generally, whites make up the majority of the population in the region accounting for over 87 and 96 percent of the population in Buncombe and Madison Counties, respectively.

TABLE 3.3: DEMOGRAPHICS OF PARTICIPATING COUNTIES

Jurisdiction	White, Percent (2010)	Black or African American, Percent (2010)	American Indian or Alaska Native, Percent (2010)	Asian, Percent (2010)	Native Hawaiian or Other Pacific Islander, Percent (2010)	Other Race, Percent (2010)	Two or More Races, percent (2010)	Persons of Hispanic Origin, Percent (2010)*
Buncombe County	87.4%	6.4%	0.4%	1.0%	0.1%	2.6%	2.1%	6.0%
Madison County	96.5%	1.2%	0.2%	0.3%	0.0%	0.5%	1.3%	2.0%

*Hispanics may be of any race, so also are included in applicable race categories
Source: United States Census Bureau

3.3 HOUSING, INFRASTRUCTURE, AND LAND USE

3.3.1 Housing

According to the 2010 US Census, there were 123,973 housing units in the Buncombe Madison Region, the majority of which are single family homes or mobile homes. Housing information for the two participating counties is presented in **Table 3.4**. As shown in the table, Buncombe County has a lower percentage of seasonal housing units compared to the Madison County.

TABLE 3.4: HOUSING CHARACTERISTICS OF PARTICIPATING COUNTIES

Jurisdiction	Housing Units (2000)	Housing Units (2010)	Seasonal Units, Percent (2010)	Median Home Value (2006-2010)
Buncombe County	93,973	113,365	3.4%	$192,200
Madison County	9,722	10,608	9.5%	$163,100

Source: United States Census Bureau

3.3.2 Infrastructure

Transportation

The Buncombe Madison Region contains some of North Carolina's most recognized scenic roadways. The most popular among tourists is the Blue Ridge Parkway. This National Parkway runs 469 miles through 29 Virginia and North Carolina Counties, including Buncombe County. Built to connect Shenandoah National Park to the Great Smoky Mountain National park, the Parkway has been the most visited unit of the National Park System every year since 1946 with the exception of 1949.

Another scenic highway unique to the region is the I-26 Scenic Byway. The nine-mile segment of I-26 that runs through Madison County is the only interstate in the state to be selected as a scenic byway. Running east to west, the stretch begins at Exit 9 north of Asheville (traveling on I-26 West) and offers spectacular views from some of the highest elevations on any interstate in North Carolina.

Other scenic highways in the region, also rich in history, include the French Broad Overview and the Appalachian Medley. The French Broad Overview consists of multiple roadways passing through Buncombe and Madison Counties for 17 miles following the French Broad River. The route begins at the 1-26 Weaverville Exit (Exit 29) and proves through Alexander towards Marshall, including routes SR 1727, NC 251, and US 25B/70B. The Appalachian Medley byway begins its 45-mile stretch at I-40 Exit 24 on NC 209 just south of the region and travels north along NC 209 through Madison County. From NC 29, the route follows US 25/70 and ends in Walnut.

In addition to the designated scenic routes, three interstates (I-26, I-40, and I-240), five U.S. highways (US Highways 19, 23, 25, 70, and 74), and fifteen North Carolina state routes (NC Routes 9, 63, 81, 112, 146, 151, 191, 197, 208, 209, 212, 213, 251, 280, and 694) complete the region's highway system. The primary mode of transportation is personal vehicle with the City of Asheville being the only jurisdiction to provide public transit service in the region.

The Asheville Regional Airport is the largest airport in the mountains serving all of Western North Carolina. The airport currently offers non-stop commercial flights on four airlines to six major cities. The major airport located nearest to the region is the Charlotte Douglas International airport, which offers non-stop commercial flights on nine airlines to numerous destinations across the eastern US and Midwest as well as to several international destinations. This airport is approximately 125 miles from Asheville. Other major nearby airports include the Hartsfield-Jackson Atlanta International Airport in Georgia and the Nashville Metropolitan Airport in Tennessee.

Utilities

Electrical power in the Buncombe Madison Region is provided by Duke Progress Energy and French Broad Electric Membership Corporation (EMC). Water and sewer services are provided by the City of Asheville, Metropolitan Water District, and Woodfin Water District. Since municipal water systems are

extremely limited in the mountains, private or shared wells and septic systems are considered the norm in this region.

Community Facilities

There are a number of public buildings and community facilities located throughout the Buncombe Madison Region. According to the data collected for the vulnerability assessment (Section 6.4.1), there are 2 emergency operations centers, 49 fire/EMS stations, 11 police stations, 8 medical care facilities, and 63 public schools located within the study area.

The medical facilities located in the region are concentrated in the Asheville area; including Mission Hospital and Asheville Surgery Center, a 744-bd general medical and surgical provider; Asheville Specialty Hospital, a 34-bed facility offering long-term acute care; and CarePartners Rehabilitation Hospital, an 80-bed rehabilitation facility. Additionally, Asheville is home to the Charles George VA Medical Center which provides care for veterans. Other medical facilities in the study area include: Mountain Area Health Education Center (MAHEC) in Asheville which provides health care education and services, and The Sisters of Mercy Urgent Care with facilities in West Asheville, South Asheville, and Weaverville.

In addition to Pisgah National Forest, the Buncombe Madison Region contains numerous local, state, and national parks and recreation areas. These include the Blue Ridge Parkway, French Broad River, Lake Julian, and the privately-owned Biltmore Estate. These facilities offer recreational opportunities to area residents and millions of visitors each year.

3.3.3 Land Use

Aside from Asheville, many areas of the Buncombe Madison Region are undeveloped or sparsely developed due to the mountainous terrain and the conservation of land in state and national parks and forests. As shown in **Figure 3.1** above, there are several small incorporated municipalities located throughout the study area comprising a large number of the region's population. The incorporated areas are also where many businesses, commercial uses, and institutional uses are located. Land uses in the balance of the study area generally consist of rural residential development, agricultural uses, recreational areas, and forestland.

Local land use (and associated regulations, or lack thereof) is further discussed in *Section 7: Capability Assessment.*

3.4 EMPLOYMENT AND INDUSTRY

The early modern economy in the Buncombe Madison Region was built around extractive industries; such as mining, logging, and agriculture; manufacturing; and textiles. Like many other mountain towns in North Carolina, the jurisdictions in the Buncombe Madison Region have focused recent economic development efforts on cultural and natural heritage tourism.

According to the North Carolina Employment Security Commission, in 2012, Buncombe County had an average annual employment of 117,664 workers and an average unemployment rate of 7.5 percent (compared to 9.5 for the state). In 2012, the Education and Health Services industry employed 27.4 percent of the County's workforce followed by Trade, Transportation, and Utilities (20.3%); Leisure and

Hospitality (14.7%); Professional and Business Services (10.7%); and Manufacturing (9.5%). From 2010 to 2012, the average annual median household income in Buncombe County was $43,177 compared to $45,215 for the state of North Carolina.

Madison County had an average annual employment of 9,223 workers and an average unemployment rate of 9.2 percent in 2012. According to the NCESC, in 2012, the Education and Health Services industry was again the largest employment sector with 40.6 percent of the County's workforce. The other leading industries were Trade, Transportation, and Utilities (14.7%); Public Administration (11.6%); Leisure and Hospitality (10.8%); and Manufacturing (9.5%). The average annual median household income in Madison County was $36,961 from 2010 to 2012.

SECTION 4
HAZARD IDENTIFICATION

This section describes how the planning team identified the hazards to be included this plan. It consists of the following five subsections:

- 4.1 Overview
- 4.2 Description of Full Range of Hazards
- 4.3 Disaster Declarations
- 4.4 Hazard Evaluation
- 4.5 Hazard Identification Results

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

4.1 OVERVIEW

The Buncombe Madison Region is vulnerable to a wide range of natural and human-caused hazards that threaten life and property. Current FEMA regulations and guidance under the Disaster Mitigation Act of 2000 (DMA 2000) require, at a minimum, an evaluation of a full range of natural hazards. An evaluation of human-caused hazards (i.e., technological hazards, terrorism, etc.) is encouraged, though not required, for plan approval. The Buncombe Madison Region has included a comprehensive assessment of both types of hazards.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the participating counties in the Buncombe Madison Region (Buncombe County and Madison County) have identified a number of hazards that are to be addressed in its Regional Hazard Mitigation Plan. These hazards were identified through an extensive process that utilized input from the Buncombe Madison Regional Hazard Mitigation Planning Team members, research of past disaster declarations in the participating counties[1], and review of the North Carolina State Hazard Mitigation Plan (2010). Readily available information from reputable sources (such as federal and state agencies) was also evaluated to supplement information from these key sources.

Table 4.1 lists the full range of natural hazards initially identified for inclusion in the Plan and provides a brief description for each. This table includes 23 individual hazards. Some of these hazards are considered to be interrelated or cascading, but for preliminary hazard identification purposes these individual hazards are broken out separately.

Next, **Table 4.2** lists the disaster declarations in the Buncombe Madison Region

[1] A complete list of disaster declarations for the Buncombe Madison Region can be found below in Section 4.3.

Next, **Table 4.3** documents the evaluation process used for determining which of the initially identified hazards are considered significant enough to warrant further evaluation in the risk assessment. For each hazard considered, the table indicates whether or not the hazard was identified as a significant hazard to be further assessed, how this determination was made, and why this determination was made. The table works to summarize not only those hazards that *were* identified (and why) but also those that *were not* identified (and why not). Hazard events not identified for inclusion at this time may be addressed during future evaluations and updates of the risk assessment if deemed necessary by the Regional Hazard Mitigation Planning Team during the plan update process.

Lastly, **Table 4.4** provides a summary of the hazard identification and evaluation process noting that 15 of the 23 initially identified hazards are considered significant enough for further evaluation through this Plan's risk assessment (marked with a "☑").

4.2 DESCRIPTION OF FULL RANGE OF HAZARDS

TABLE 4.1: DESCRIPTIONS OF THE FULL RANGE OF INITIALLY IDENTIFIED HAZARDS

Hazard	Description
ATMOSPHERIC HAZARDS	
Avalanche	A rapid fall or slide of a large mass of snow down a mountainside.
Drought	A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common effects of drought include crop failure, water supply shortages, and fish and wildlife mortality. High temperatures, high winds, and low humidity can worsen drought conditions and also make areas more susceptible to wildfire. Human demands and actions have the ability to hasten or mitigate drought-related impacts on local communities.
Hailstorm	Any storm that produces hailstones that fall to the ground; usually used when the amount or size of the hail is considered significant. Hail is formed when updrafts in thunderstorms carry raindrops into parts of the atmosphere where the temperatures are below freezing.
Heat Wave/Extreme Heat	A heat wave may occur when temperatures hover 10 degrees or more above the average high temperature for the region and last for several weeks. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground. Excessively dry and hot conditions can provoke dust storms and low visibility. A heat wave combined with a drought can be very dangerous and have severe economic consequences on a community.

Hurricane and Tropical Storm	Hurricanes and tropical storms are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and with a diameter averaging 10 to 30 miles across. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves and tidal flooding which can be more destructive than cyclone wind. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea and Gulf of Mexico during the official Atlantic hurricane season, which extends from June through November.
Lightning	Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a “bolt” when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 73 people are killed each year by lightning strikes in the United States.
Nor’easter	Similar to hurricanes, nor’easters are ocean storms capable of causing substantial damage to coastal areas in the Eastern United States due to their associated strong winds and heavy surf. Nor'easters are named for the winds that blow in from the northeast and drive the storm up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful. Nor’easters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding.
Tornado	A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. Tornadoes are most often generated by thunderstorm activity when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The destruction caused by tornadoes ranges from light to catastrophic depending on the intensity, size and duration of the storm.
Severe Thunderstorm	Thunderstorms are caused by air masses of varying temperatures meeting in the atmosphere. Rapidly rising warm moist air fuels the formation of thunderstorms. Thunderstorms may occur singularly, in lines, or in clusters. They can move through an area very quickly or linger for several hours. Thunderstorms may result in hail, tornadoes, or straight-line winds. Windstorms pose a threat to lives, property, and vital utilities primarily due to the effects of flying debris and can down trees and power lines.

Winter Storm and Freeze	Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 miles per hour, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, power lines, communication towers, structures, roads and other hard surfaces. Winter storms and ice storms can down trees, cause widespread power outages, damage property, and cause fatalities and injuries to human life.
GEOLOGIC HAZARDS	
Earthquake	A sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the surface. This movement forces the gradual building and accumulation of energy. Eventually, strain becomes so great that the energy is abruptly released, causing the shaking at the earth's surface which we know as an earthquake. Roughly 90 percent of all earthquakes occur at the boundaries where plates meet, although it is possible for earthquakes to occur entirely within plates. Earthquakes can affect hundreds of thousands of square miles; cause damage to property measured in the tens of billions of dollars; result in loss of life and injury to hundreds of thousands of persons; and disrupt the social and economic functioning of the affected area.
Expansive Soils	Soils that will exhibit some degree of volume change with variations in moisture conditions. The most important properties affecting degree of volume change in a soil are clay mineralogy and the aqueous environment. Expansive soils will exhibit expansion caused by the intake of water and, conversely, will exhibit contraction when moisture is removed by drying. Generally speaking, they often appear sticky when wet, and are characterized by surface cracks when dry. Expansive soils become a problem when structures are built upon them without taking proper design precautions into account with regard to soil type. Cracking in walls and floors can be minor, or can be severe enough for the home to be structurally unsafe.
Landslide	The movements of a mass of rock, debris, or earth down a slope when the force of gravity pulling down the slope exceeds the strength of the earth materials that comprise to hold it in place. Slopes greater than 10 degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high.
Land Subsidence	The gradual settling or sudden sinking of the Earth's surface due to the subsurface movement of earth materials. Causes of land subsidence include groundwater pumpage, aquifer system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost.
Tsunami	A series of waves generated by an undersea disturbance such as an earthquake. The speed of a tsunami traveling away from its source can range from up to 500 miles per hour in deep water to approximately 20 to 30 miles per hour in shallower areas near coastlines. Tsunamis differ from regular ocean waves in that their currents travel from the water surface all the way down to the sea floor. Wave amplitudes in deep water are typically less than one meter; they are often barely detectable to the human eye. However, as they approach shore, they slow in shallower water, basically causing the waves from behind to effectively "pile up", and wave heights to increase dramatically. As opposed to typical waves which crash at the shoreline, tsunamis bring with them a continuously flowing 'wall of water' with the potential to cause devastating damage in coastal areas located immediately along the shore.

Volcano	A mountain that opens downward to a reservoir of molten rock below the surface of the earth. While most mountains are created by forces pushing up the earth from below, volcanoes are different in that they are built up over time by an accumulation of their own eruptive products: lava, ash flows, and airborne ash and dust. Volcanoes erupt when pressure from gases and the molten rock beneath becomes strong enough to cause an explosion.
HYDROLOGIC HAZARDS	
Dam and Levee Failure	Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam. Dam failure can result from natural events, human-induced events, or a combination of the two. The most common cause of dam failure is prolonged rainfall that produces flooding. Failures due to other natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning.
Erosion	Erosion is the gradual breakdown and movement of land due to both physical and chemical processes of water, wind, and general meteorological conditions. Natural, or geologic, erosion has occurred since the Earth's formation and continues at a very slow and uniform rate each year.
Flood	The accumulation of water within a water body which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream ocean, lake or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, or shallow flooding (where shallow flooding refers to sheet flow, ponding and urban drainage).
Storm Surge	A storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane up to more than 30 feet in a Category 5 storm. Storm surge heights and associated waves are also dependent upon the shape of the offshore continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. Storm surge arrives ahead of a storm's actual landfall and the more intense the hurricane is, the sooner the surge arrives. Storm surge can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast. Further, water rise caused by storm surge can be very rapid, posing a serious threat to those who have not yet evacuated flood-prone areas.

OTHER HAZARDS	
Hazardous Materials Incident	Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the nation's highways and on the water. HAZMAT incidents consist of solid, liquid and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind and possibly wildlife as well.
Terror Threat	Terrorism is defined by FEMA as, "the use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom." Terrorist acts may include assassinations, kidnappings, hijackings, bomb scares and bombings, cyber attacks (computer-based), and the use of chemical, biological, nuclear and radiological weapons.
Wildfire	An uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors. Over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning.

4.3 DISASTER DECLARATIONS

Disaster declarations provide initial insight into the hazards that may impact the Buncombe Madison Regional planning area. Since 1973, ten presidential disaster declarations have been reported in the Buncombe Madison Region. This includes four storms related to severe storms and flooding, three storms related to winter storm events, and three storms related to hurricane or tropical storm.

TABLE 4.2: BUNCOMBE MADISON REGION DISASTER DECLARATIONS

Year	Disaster Number	Description	Buncombe County	Madison County
1973	394	SEVERE STORMS & FLOODING	X	
1977	542	SEVERE STORMS & FLOODING	X	X
1995	1073	SEVERE STORMS, FLOODING, HIGH WINDS		X
1996	1087	BLIZZARD OF 96	X	X
1996	1103	WINTER STORM		X
1996	1134	HURRICANE FRAN	X	
1998	1200	SEVERE STORMS AND FLOODING		X
2004	1546	TROPICAL STORM FRANCES	X	X
2004	1553	HURRICANE IVAN	X	X

Year	Disaster Number	Description	Buncombe County	Madison County
2010	1871	SEVERE WINTER STORMS AND FLOODING	X	X

4.4 HAZARD EVALUATION

TABLE 4.3: DOCUMENTATION OF THE HAZARD EVALUATION PROCESS

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
ATMOSPHERIC HAZARDS			
Avalanche	NO	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of the NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of US Forest Service National Avalanche Center website	• The United States avalanche hazard is limited to mountainous western states including Alaska as well as some areas of low risk in New England. • Avalanche hazard was removed from the North Carolina State Hazard Mitigation Plan after determining the mountain elevation in Western North Carolina did have enough snow not produce this hazard. • Avalanche is not included in either of the previous Buncombe Madison hazard mitigation plans. • There is no risk of avalanche events in North Carolina.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Drought	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of the NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of the North Carolina Drought Monitor website	• Drought is a normal part of virtually all climatic regimes, including areas with high and low average rainfall. • Droughts are discussed in the NC State Hazard Mitigation Plan as a lesser hazard. • The NC State Hazard Mitigation Plan lists drought as a top hazard for the Mountain 1 Region, which includes the Buncombe Madison counties. • Drought is included in both of the previous Buncombe Madison hazard mitigation plans. • There are reports of drought conditions in each of the last ten years in the Buncombe Madison Region, according to the North Carolina Drought Monitor.
Hailstorm	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of NOAA NCDC Storm Events Database	• Although hailstorms occur primarily in the Midwestern states, they do occur in every state on the mainland U.S. Most inland regions experience hailstorms at least two or more days each year. • Hailstorm events are discussed in the state plan under the severe thunderstorm hazard. • Hail is addressed under the severe thunderstorm hazard in one of the previous Buncombe Madison hazard mitigation plans. Given the frequency of the event, individual analysis is warranted. • NCDC reports 222 hailstorm events (0.25 inch size hail to 2.0 inches) for the Buncombe Madison Region since 1962. For these events, there was almost $140,000 (2013 dollars) in property damages reported.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Heat Wave/ Extreme Heat	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of the North Carolina State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of NOAA NCDC Storm Events Database	• Many areas of the United States are susceptible to heat waves, including North Carolina. • Although the NC State Hazard Mitigation Plan does not include Heat Wave as a top hazard for the Mountain 1 Region, high temperatures are a threat to most of the state. • Heat wave was mentioned in one of the two previous hazard mitigation plans in tandem with the drought hazard. • NCDC does not report any extreme heat events for the Buncombe Madison counties.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Hurricane and Tropical Storm	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Analysis of NOAA historical tropical cyclone tracks and National Hurricane Center Website • Review of NOAA NCDC Storm Events Database • Review of historical presidential disaster declarations • FEMA Hazus-MH storm return periods	• The Atlantic and Gulf regions are most prone to landfall by hurricanes and tropical storms. • Hurricane and tropical storm events are discussed in the state plan and are listed as a top hazard in the Mountain 1 Region, which includes the Buncombe Madison counties. • Hurricane and tropical storm was addressed in one of the previous Buncombe Madison hazard mitigation plans. • NOAA historical records indicate 2 tropical storms and 22 tropical depressions have come within 75 miles of the Buncombe Madison Region since 1896. • NCDC does not report any hurricane or tropical storm events for the Buncombe Madison Region. • Three out of ten disaster declarations in the Buncombe Madison Region are directly related to hurricane and tropical storm events. • The 50-year return period peak gust for hurricane and tropical storm events in the Buncombe Madison Region is between 48-52 mph.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Lightning	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of NOAA NCDC Storm Events Database • Review of Vaisala's NLDN Lightning Flash Density Map	• The central region of the Florida has the highest density of lightning strikes in the mainland U.S.; however, lightning events are experienced in nearly every region. • Lightning events are discussed in the state plan as part of the severe thunderstorm hazard. • Although lightning is addressed under the severe thunderstorm hazard in one of the previous hazard mitigation plans, given the damage and reported death and injuries, individual analysis is warranted. • NCDC reports 18 lightning events for the Buncombe Madison Region since 1993. These events have resulted in 2 recorded death, 7 injuries, and $775,000 (2013 dollars) in property damage. • According to Vaisala's U.S. National Lightning Detection Network, the Buncombe Madison Region is located in an area that experienced an average of 2 to 4 lightning flashes per square kilometer per year between 1997 and 2010.
Nor'easter	NO	• Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of NOAA NCDC Storm Events Database	• Nor'easters are discussed in the state plan. The Mountain Region, which includes the Buncombe Madison Region, has the lowest vulnerability compared to the state. • Nor'easter was not included in either of the previous Buncombe Madison hazard mitigation plans. • NCDC does not report any nor'easter activity for the Buncombe Madison Region. However, nor'easters may have affected the region as severe winter storms. In this case, the activity would be reported under winter storm events.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Tornado	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of NOAA NCDC Storm Events Database • Review of historical presidential disaster declarations.	• From 1953 to 1993, North Carolina averaged 10 to 25 tornadoes per year. • Tornado events are discussed in the NC State Hazard Mitigation Plan. The Mountain Region, which includes the Buncombe Madison Region, is the region with the lowest vulnerability in the state. • Tornado events were addressed in both of the previous Buncombe Madison hazard mitigation plans. • NCDC reports 10 tornado events in Buncombe Madison Region counties since 1976. These events have resulted in 5 injuries and $5.9 million (2013 dollars) in property damage with the most severe being an F1. • None of the region's ten disaster declarations was directly related to tornado events.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Severe Thunderstorm	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of NOAA NCDC Storm Events Database • Review of historical presidential disaster declarations.	• Over 100,000 thunderstorms are estimated to occur each year on the U.S. mainland, and they are experienced in nearly every region. • Severe thunderstorm events are discussed in the NC State Hazard Mitigation Plan and are identified as the top hazard in the Mountain 1 Region, which includes the Buncombe Madison counties. • Severe weather events were addressed in one of the previous Buncombe Madison hazard mitigation plans. • NCDC reports 279 thunderstorm/high wind events in the Buncombe Madison Region counties since 1959. These events have resulted in 3 deaths, 17 injuries, and $5.9 million (2013 dollars) in property damage. • Four of the region's ten disaster declarations were directly related to severe storm events.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Winter Storm and Freeze	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of NOAA NCDC Storm Events Database • Review of historical presidential disaster declarations.	• Winter storms affect every state in the continental U.S. and Alaska. • Severe winter storms, including snow storms and ice storms, are discussed in the state plan. They are listed as a top hazard in the Mountain 1 Region, which includes the Buncombe Madison counties. • Winter storm events were addressed in both of the previous Buncombe Madison hazard mitigation plans. • NCDC reports that the Buncombe Madison counties have been affected by 351 winter storm events since 1993. These events resulted in $12.9 million (2013 dollars) in damages. Two deaths and ten injuries were reported with these events, but they may have occurred outside of the study region. • Three of the region's ten disaster declarations were directly related to winter storm events.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
GEOLOGIC HAZARDS			
Earthquake	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of the National Geophysical Data Center • USGS Earthquake Hazards Program website	• Although the zone of greatest seismic activity in the United States is along the Pacific Coast, eastern regions have experienced significant earthquakes. • Earthquake events are discussed in the state plan and both of the participating Buncombe Madison counties are in the region with the highest vulnerability to an earthquake event in the state. • Earthquakes have occurred in and around the State of North Carolina in the past. The state is affected by the Charleston and the New Madrid (near Missouri) Fault lines which have generated a magnitude 8.0 earthquake in the last 200 years. • Both of the previous hazard mitigation plans in the Buncombe Madison Region address earthquake. • 87 events are known to have occurred in the region according to the National Geophysical Data Center. The greatest MMI reported was a 6. • According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for the Buncombe Madison Region is approximately 5 to 7%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Expansive Soils	NO	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of USDA Soil Conservation Service's Soil Survey	• The effects of expansive soils are most prevalent in parts of the Southern, Central, and Western U.S. • Expansive soils are identified in the state plan but are not included as a top hazard in the Mountain 1 Region, which includes the Buncombe Madison counties. • Neither of the previous Buncombe Madison hazard mitigation plans identifies expansive soils as a potential hazard. • According to FEMA and USDA sources, the Buncombe Madison Region is located in an area that has "little or no" clay swelling potential.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Landslide	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of USGS Landslide Incidence and Susceptibility Hazard Map • Review of the North Carolina Geological Survey database of historic landslides	• Landslides occur in every state in the U.S, and they are most common in the coastal ranges of California, the Colorado Plateau, the Rocky Mountains, and the Appalachian Mountains. • Landslide/debris flow events are discussed in the state plan and are listed as the top hazard for the Mountain 1 Region, which includes the Buncombe Madison counties. • The NC State Hazard Mitigation Plan found the Mountain Region to have the highest vulnerability to landslides in the state. • Both of the previous Buncombe Madison hazard mitigation plans address landslides. • USGS landslide hazard maps indicate "high susceptibility" is found throughout the entire Buncombe Madison Region. However, there is "high incidence" (more than 15% of the area is involved in landsliding) in Madison County and the northwest portion Buncombe County and "moderate incidence" to "low incidence" in the southeastern part of Buncombe County. • Data provided by NCGS indicate 213 recorded landslide events in the Buncombe Madison Region.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Land Subsidence	NO	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans	• Land subsidence affects at least 45 states, including North Carolina. However, because of the broad range of causes and impacts, there has been limited national focus on this hazard. • The state plan delineates certain areas that are susceptible to land subsidence hazards in North Carolina; however, the Buncombe Madison counties have zero vulnerability. • Neither of the previous Buncombe Madison hazard mitigation plans identifies land subsidence as a potential hazard.
Tsunami	NO	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of FEMA "How-to" mitigation planning guidance (Publication 386-2, "Understanding Your Risks – Identifying Hazards and Estimating Losses).	• No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States. • Tsunami inundation zone maps are not available for communities located along the U.S. East Coast. • Tsunamis are discussed in the state plan and described as a "greater" hazard for the state. However, the Mountain Region, which includes the Buncombe Madison counties, scored a zero for tsunami hazard risk. • Tsunami was mentioned in one of the previous Buncombe Madison hazard mitigation plans; however, it was found to pose extremely slight risk and was not analyzed as a hazard. • FEMA mitigation planning guidance suggests that locations along the U.S. East Coast have a relatively low tsunami risk and need not conduct a tsunami risk assessment at this time.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Volcano	NO	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program website	• More than 65 potentially active volcanoes exist in the United States and most are located in Alaska. The Western states and Hawaii are also potentially affected by volcanic hazards. • There are no active volcanoes in North Carolina. • There has not been a volcanic eruption in North Carolina in over 1 million years. • No volcanoes are located near the Buncombe Madison Region.
HYDROLOGIC HAZARDS			
Dam and Levee Failure	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of North Carolina Division of Land Management website	• The National Inventory of Dams shows dams are located in every state. • Dam failure is discussed in the state plan and is listed as a top hazard for Mountain 1 Region, which includes the Buncombe Madison counties. • Both of the previous Buncombe Madison hazard mitigation plans address dam failure. • Of the 112 dams reported on the North Carolina Inventory of Dams, 59 are high hazard (53%). (High hazard is defined as "where failure or mis-operation will probably cause loss of human life.")

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Erosion	YES	• Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans	• Coastal erosion is discussed in the state plan but only for coastal areas (there is no discussion of riverine erosion). Buncombe Madison is not located in a coastal area. • Riverine erosion is discussed in one of the previous Buncombe Madison hazard mitigation plans. However, it was found to be a lesser hazard. • Although erosion was not previously identified as a top hazard, it remains a natural, dynamic, and continuous process in the Buncombe Madison Region that warrants inclusion as a potential hazard.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Flood	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of NOAA NCDC Storm Events Database • Review of historical disaster declarations • Review of FEMA DFIRM data • Review of FEMA's NFIP Community Status Book and Community Rating System (CRS)	• Floods occur in all 50 states and in the U.S. territories. • The flood hazard is thoroughly discussed in the state plan. The Buncombe Madison Region was found to have relatively moderate vulnerability compared to the state. • Both of the previous hazard mitigation plans in the Buncombe Madison Region address flood hazard. • NCDC reports that the Buncombe Madison Region counties have been affected by 62 flood events since 1993. These events in total caused 3 deaths, 2 injuries, and an estimated $128.1 million (2013 dollars) in property damages. • Five of the ten Presidential Disaster Declarations were flood-related and an additional three were hurricane or tropical storm-related which caused flooding issues. • Just over 3% of the Buncombe Madison Region is located in an identified floodplain (100 or 500 year). • All 11 municipalities in the Buncombe Madison Region participate in the NFIP; however, no jurisdictions currently participate in the CRS.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Storm Surge	NO	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation plans • Review of NOAA NCDC Storm Events Database	• Given the inland location of the Buncombe Madison Region, storm surge would not affect the area. • Storm surge is discussed in the state plan under the hurricane hazard. The Mountain Region, which includes the Buncombe Madison Region, has zero vulnerability to storm surge. • One of the previous hazard mitigation plans in the Buncombe Madison Region mentions storm surge, but indicates it is a hazard limited to the 18 counties in the state bordering the shoreline and sound. • No historical events were reported by NCDC
OTHER HAZARDS			
Hazardous Materials Incident	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of previous Buncombe Madison county hazard mitigation plans	• Cities, counties, and towns where hazardous materials fabrication, processing, and storage sites are located, and those where hazardous waste treatment, storage or disposal facilities operate are at risk for hazardous materials events. • Both of previous Buncombe Madison Region hazard mitigation plans includes hazardous materials incident.
Terror Threat	NO	• Review of previous Buncombe Madison county hazard mitigation plans • Review of local official knowledge	• Terrorism was included in one of the two previous Buncombe Madison hazard mitigation plans; however, there are no past incidents nor current expectations of an incident.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Wildfire	YES	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of previous Buncombe Madison county hazard mitigation • Review of Southern Wildfire Risk Assessment (SWRA) Data • Review of the NC Division of Forest Resources website	• Wildfires occur in virtually all parts of the United States. Wildfire hazard risks will increase as low-density development along the urban/wildland interface increases. • Wildfires are discussed in the state plan as a "greater" hazard of concern, although the Mountain Region, which includes the Buncombe Madison Region, shares the lowest vulnerability in the state. • Both of the previous hazard mitigation plans in the Buncombe Madison Region address wildfire. • A review of SWRA data indicates that there are some areas of elevated concern in the Buncombe Madison Region. • According to the North Carolina Division of Forest Resources, the Buncombe Madison Region experiences an average of 105 fires each year which burn a combined average of 455 acres.

4.5 HAZARD IDENTIFICATION RESULTS

TABLE 4.4: SUMMARY RESULTS OF THE HAZARD IDENTIFICATION AND EVALUATION PROCESS

ATMOSPHERIC HAZARDS	GEOLOGIC HAZARDS
☐ Avalanche	☑ Earthquake
☑ Drought	☐ Expansive Soils
☑ Hailstorm	☑ Landslide
☑ Heat Wave	☐ Land Subsidence
☑ Hurricane and Tropical Storm	☐ Tsunami
☑ Lightning	☐ Volcano
☐ Nor'easter	**HYDROLOGIC HAZARDS**
☑ Tornado	☑ Dam and Levee Failure
☑ Severe Thunderstorm	☑ Erosion
☑ Winter Storm and Freeze	☑ Flood
	☐ Storm Surge
	OTHER HAZARDS
	☑ Hazardous Materials Incident
	☑ Wildfire

☑ = Hazard considered significant enough for further evaluation in the Buncombe Madison Region hazard risk assessment.

SECTION 5
HAZARD PROFILES

This section includes detailed hazard profiles for each of the hazards identified in the previous section (*Hazard Identification*) as significant enough for further evaluation in the Buncombe Madison Regional Hazard Mitigation Plan. It contains the following subsections:

- 5.1 Overview
- 5.2 Study Area
- 5.3 Drought
- 5.4 Extreme Heat
- 5.5 Hailstorm
- 5.6 Hurricane and Tropical Storm
- 5.7 Lightning
- 5.8 Thunderstorm Wind / High Wind
- 5.9 Tornado
- 5.10 Winter Storm and Freeze
- 5.11 Earthquake
- 5.12 Landslide
- 5.13 Dam and Levee Failure
- 5.14 Erosion
- 5.15 Flood
- 5.16 Hazardous Materials Incident
- 5.17 Wildfire
- 5.18 Conclusions on Hazard Risk
- 5.19 Final Determinations

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

5.1 OVERVIEW

This section includes detailed hazard profiles for each of the hazards identified in the previous section (*Hazard Identification*) as significant enough for further evaluation in the Buncombe Madison Region hazard risk assessment by creating a hazard profile. Each hazard profile includes a general description of the hazard, its location and extent, notable historical occurrences, and the probability of future occurrences. Each profile also includes specific items noted by members of the Buncombe Madison Regional Hazard Mitigation Planning Committee as it relates to unique historical or anecdotal hazard information for the counties in the Buncombe Madison Region, or a participating municipality within them.

The following hazards were identified:

- **Atmospheric**
  - Drought
  - Extreme Heat
  - Hailstorm
  - Hurricane and Tropical Storm
  - Lightning

- Severe Thunderstorm (including straight-line winds)
- Tornado
- Winter Storm and Freeze

- **Geologic**
  - Earthquake
  - Landslide
- **Hydrologic**
  - Dam and Levee Failure
  - Erosion
  - Flood
- **Other**
  - Hazardous Materials Incident
  - Wildfire

5.2 STUDY AREA

The Buncombe Madison Region includes two counties: Buncombe and Madison Counties. **Table 5.1** provides a summary table of the participating jurisdictions within each county. In addition, **Figure 5.1** provides a base map, for reference, of the Buncombe Madison Region.

TABLE 5.1: PARTICIPATING JURISDICTIONS IN THE BUNCOMBE MADISON REGIONAL HAZARD MITIGATION PLAN

Buncombe County	
Asheville	Montreat
Biltmore Forest	Weaverville
Black Mountain	Woodfin
Madison County	
Hot Springs	Mars Hill
Marshall	

FIGURE 5.1: BUNCOMBE MADISON REGION BASE MAP

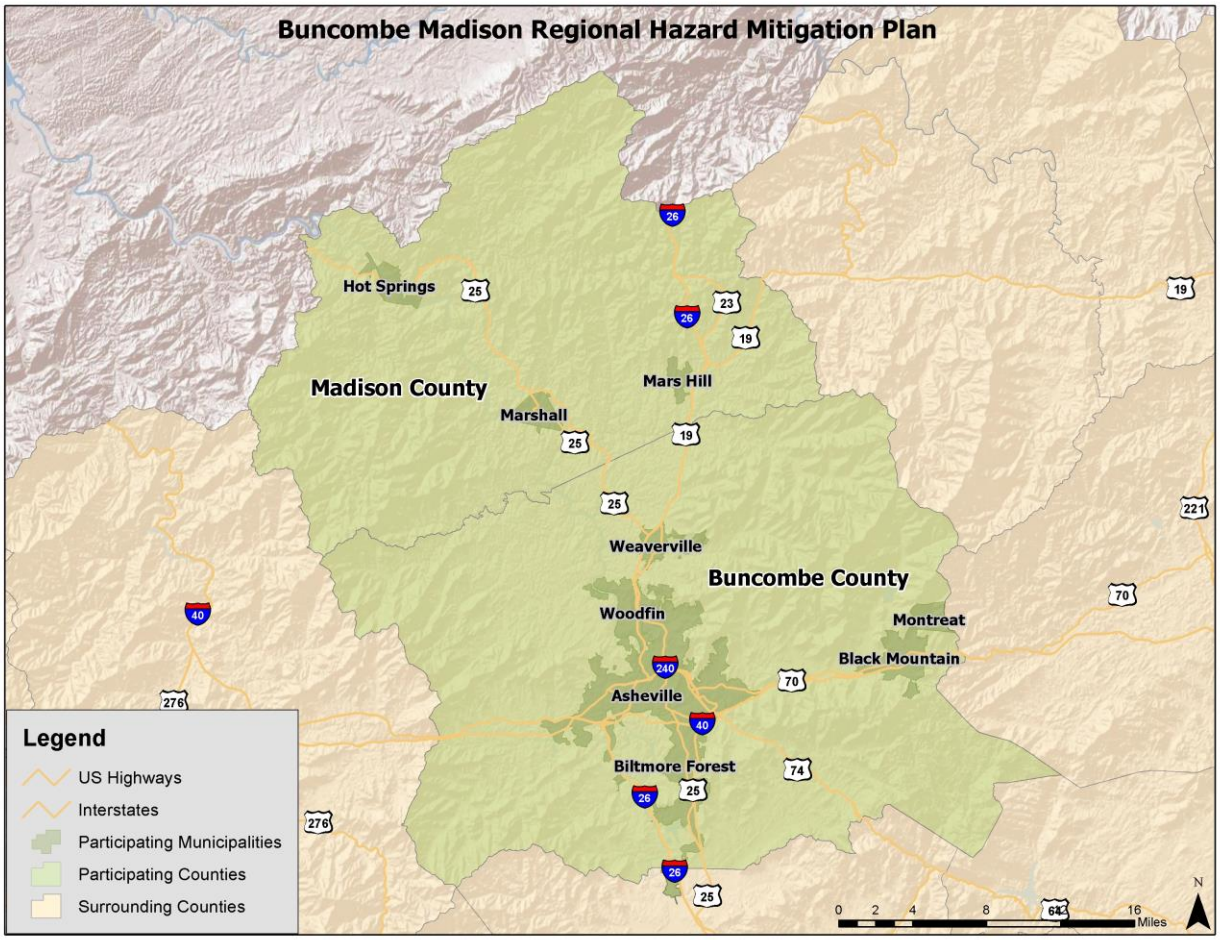


Table 5.2 lists each significant hazard for the Buncombe Madison Region and identifies whether or not it has been determined to be a specific hazard of concern for the nine municipal jurisdictions and each of the two county's unincorporated areas. This is the based on the best available data and information from the Buncombe Madison Regional Hazard Mitigation Planning Committee. (● = hazard of concern)

TABLE 5.2 SUMMARY OF IDENTIFIED HAZARD EVENTS IN THE BUNCOMBE MADISON REGION

Jurisdiction	Atmospheric								Geologic		Hydrologic			Other	
	Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm	Earthquake	Landslide	Dam and Levee Failure	Erosion	Flood	HAZMAT	Wildfire
Buncombe County															
Asheville	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Biltmore Forest	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Black Mountain	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Montreat	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Jurisdiction	Atmospheric								Geologic		Hydrologic			Other	
	Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm	Earthquake	Landslide	Dam and Levee Failure	Erosion	Flood	HAZMAT	Wildfire
Weaverville	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Woodfin	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Unincorporated Area	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Madison County															
Hot Springs	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Marshall	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Mars Hill	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Unincorporated Area	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Atmospheric Hazards

5.3 DROUGHT

5.3.1 Background

Drought is a normal part of virtually all climatic regions, including areas with high and low average rainfall. Drought is the consequence of a natural reduction in the amount of precipitation expected over an extended period of time, usually a season or more in length. High temperatures, high winds, and low humidity can exacerbate drought conditions. In addition, human actions and demands for water resources can hasten drought-related impacts.

Droughts are typically classified into one of four types: 1) meteorological, 2) hydrologic, 3) agricultural, or 4) socioeconomic. **Table 5.3** presents definitions for these types of drought.

TABLE 5.3 DROUGHT CLASSIFICATION DEFINITIONS

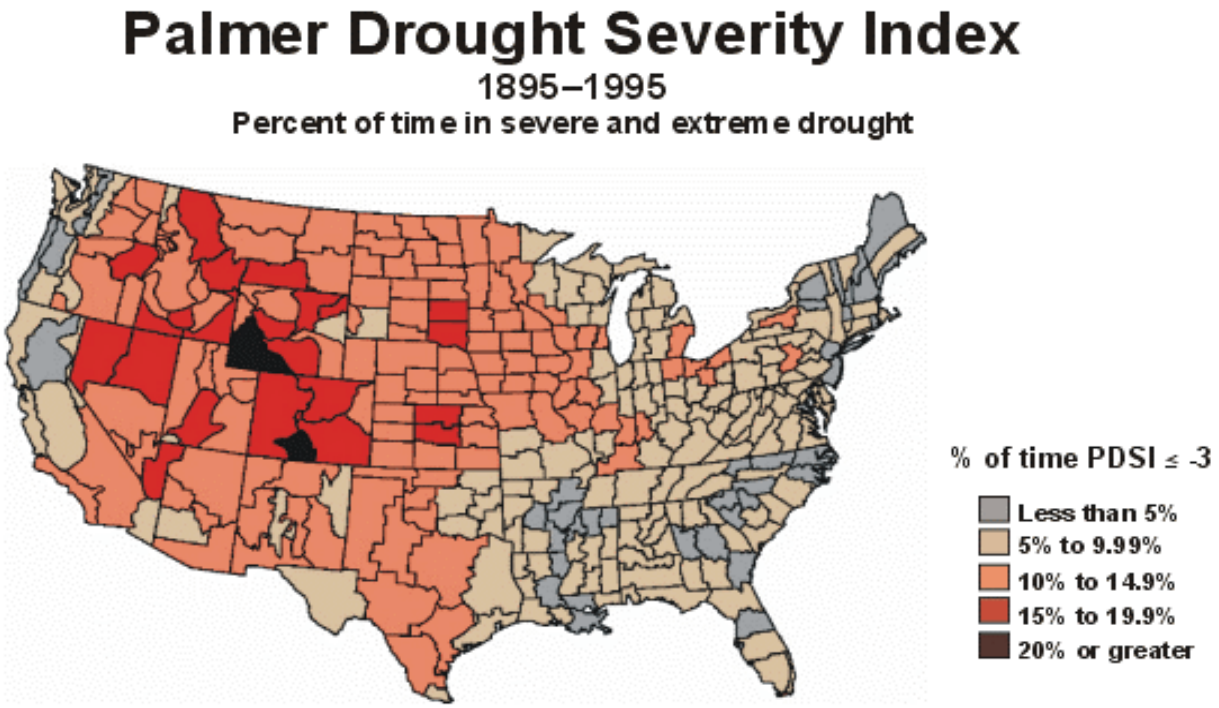
Meteorological Drought	The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
Hydrologic Drought	The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
Agricultural Drought	Soil moisture deficiencies relative to water demands of plant life, usually crops.
Socioeconomic Drought	The effect of demands for water exceeding the supply as a result of a weather-related supply shortfall.

Source: Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, Federal Emergency Management Agency

Droughts are slow-onset hazards, but, over time, can have very damaging affects to crops, municipal water supplies, recreational uses, and wildlife. If drought conditions extend over a number of years, the direct and indirect economic impact can be significant.

The Palmer Drought Severity Index (PDSI) is based on observed drought conditions and range from -0.5 (incipient dry spell) to -4.0 (extreme drought). Evident in **Figure 5.2**, the Palmer Drought Severity Index Summary Map for the United Stated, drought affects most areas of the United States, but is less severe in the Eastern United States.

FIGURE 5.2: PALMER DROUGHT SEVERITY INDEX SUMMARY MAP FOR THE UNITED STATES



Source: National Drought Mitigation Center

5.3.2 Location and Spatial Extent

Drought typically covers a large area and cannot be confined to any geographic or political boundaries. According to the Palmer Drought Severity Index (**Figure 5.2**), Western North Carolina has a relatively low risk for drought hazard. However, local areas may experience much more severe and/or frequent drought events than what is represented on the Palmer Drought Severity Index map. Furthermore, it is assumed that the Buncombe Madison Region would be uniformly exposed to drought, making the spatial extent potentially widespread. It is also notable that drought conditions typically do not cause significant damage to the built environment.

5.3.3 Historical Occurrences

Data from the North Carolina Drought Management Advisory Council and National Climatic Data Center (NCDC) were used to ascertain historical drought events in the Buncombe Madison Region. The North Carolina Drought Management Advisory Council reports data on North Carolina drought conditions from 2000 to 2013 through the North Carolina Drought Monitor. It classifies drought conditions by county on a scale of D0 to D4:

- D0: Abnormally Dry
- D1: Moderate Drought
- D2: Severe Drought
- D3: Extreme Drought
- D4: Exceptional Drought

According to the North Carolina Drought Monitor, at least one or more of the counties in the Buncombe Madison Region has had drought occurrences in thirteen of the last fourteen years (2000-2013) (**Table 5.4**). In addition, the most severe drought classification for each year in each county, according to North Carolina Drought Monitor classifications, is listed in the jurisdiction-specific annexes. It should be noted that the North Carolina Drought Monitor also estimates what percentage of the county is in each classification of drought severity. For example, the most severe classification reported may be exceptional, but a majority of the county may actually be in a less severe condition.

TABLE 5.4: SUMMARY OF DROUGHT OCCURRENCES IN THE BUNCOMBE MADISON REGION

Location	Number Years with Drought Occurrences	Number Years with Exceptional Drought Occurrences
Buncombe County	13	2
Madison County	13	2

Source: North Carolina Drought Monitor (through October 2013)

5.3.4 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of the Buncombe Madison Region has a probability level of likely (10 to 100 percent annual probability) for future drought events. This hazard may vary slightly by location but each area has an equal probability of experiencing a drought. However, historical information also indicates that there is a much lower probability for extreme, long-lasting drought conditions.

5.4 EXTREME HEAT

5.4.1 Background

Extreme heat, like drought, poses little risk to property. However, extreme heat can have devastating effects on health. Extreme heat is often referred to as a "heat wave." According to the National Weather Service, there is no universal definition for a heat wave, but the standard U.S. definition is any event lasting at least three days where temperatures reach ninety degrees Fahrenheit or higher. However, it may also be defined as an event at least three days long where temperatures are ten degrees greater than the normal temperature for the affected area. Heat waves are typically accompanied by humidity but may also be very dry. These conditions can pose serious health threats causing an average of 1,500 deaths each summer in the United States[1].

[1] http://www.noaawatch.gov/themes/heat.php

According to the National Oceanic and Atmospheric Administration, heat is the number one weather-related killer among natural hazards, followed by frigid winter temperatures[1]. The National Weather Service devised the Heat Index as a mechanism to better inform the public of heat dangers. The Heat Index Chart, shown in **Figure 5.3**, uses air temperature and humidity to determine the heat index or apparent temperature. **Table 5.5** shows the dangers associated with different heat index temperatures. Some populations, such as the elderly and young, are more susceptible to heat danger than other segments of the population.

FIGURE 5.3: HEAT INDEX CHART

Air Temp (in F)	Relative Humidity (in percent)																				
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
140	125																				
135	120	128																			
130	117	122	131																		
125	111	116	123	131	141																
120	107	111	116	123	130	139	148														
115	103	107	111	115	120	127	135	143	151												
110	99	102	105	108	112	117	123	130	137	143	150										
105	95	97	100	102	105	109	113	118	123	129	135	142	149								
100	91	93	95	97	99	101	104	107	110	115	120	126	132	138	144						
95	87	88	90	91	93	94	96	98	101	104	107	110	114	119	124	130	136				
90	83	84	85	86	87	88	90	91	93	95	96	98	100	102	106	109	113	117	122		
85	78	79	80	81	82	83	84	85	86	87	88	89	90	91	93	95	97	99	102	105	108
80	73	74	75	76	77	77	78	79	79	80	81	81	82	83	85	86	86	87	88	89	91
75	69	69	70	71	72	72	73	73	74	74	75	75	76	76	77	77	78	78	79	79	80
70	64	64	65	65	66	66	67	67	68	68	69	69	70	70	70	70	71	71	71	71	72

Source: National Oceanic and Atmospheric Administration

TABLE 5.5: HEAT DISORDERS ASSOCIATED WITH HEAT INDEX TEMPERATURE

Heat Index Temperature (Fahrenheit)	Description of Risks
80°- 90°	Fatigue possible with prolonged exposure and/or physical activity
90°- 105°	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity
105°- 130°	Sunstroke, heat cramps, and heat exhaustion likely, and heatstroke possible with prolonged exposure and/or physical activity
130° or higher	Heatstroke or sunstroke is highly likely with continued exposure

Source: National Weather Service, National Ocean and Atmospheric Adminsitration

In addition, NOAA has seventeen metropolitan areas participating in the Heat HealthWatch/Warning System in order to better inform and warn the public of heat dangers. A Heat HealthWatch is issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Heat Warning is issued when an excessive heat event is expected in the next 36 hours. Furthermore, a warning is issued when the conditions are occurring, imminent, or have a high likelihood of occurrence. Urban areas participate in the Heat Health Watch/Warning System because urban areas are at greater risk to heat

affects. Stagnant atmospheric conditions trap pollutants, thus adding unhealthy air to excessively hot temperatures. In addition, the "urban heat island effect" can produce significantly higher nighttime temperatures because asphalt and concrete (which store heat longer) gradually release heat at night.

5.4.2 Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. The entire Buncombe Madison Region is susceptible to extreme heat conditions.

5.4.3 Historical Occurrences

Data from the National Climatic Data Center was used to determine historical extreme heat and heat wave events in the Buncombe Madison Region. There were no events reported.

In addition, information from the State Climate Office of North Carolina was reviewed to obtain historical temperatures in the region. Temperature information has been reported since 1898. The recorded maximum for each county can be found below in **Table 5.6**.

TABLE 5.6: HIGHEST RECORDED TEMPERATURE IN THE BUNCOMBE MADISON REGION

Location	Date	Temperature (°F)
Buncombe County	7/20/1926	103
Madison County	6/30/1936	105
BUNCOMBE MADISON REGION MAXIMUM	--	**105**

Source: State Climate Office of North Carolina

The State Climate Office also reports average maximum temperatures in various locations in the region. The most centralized location is in Marshall (Madison County). **Table 5.7** shows the average maximum temperatures from 1971 to 2000 at the Marshall observation station which can be used as a general comparison for the region.

TABLE 5.7: AVERAGE MAXIMUM TEMPERATURE IN MARSHALL, MADISON COUNTY

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Avg. Max (°F)	45.5	49.9	58.3	66.8	74.6	81.3	84.9	83.8	78.3	68.6	58.2	49.1

Source: State Climate Office of North Carolina

5.4.4 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of the Buncombe Madison Region has a probability level of unlikely (less than 1 percent annual probability) for future extreme heat events to impact the region.

5.5 HAILSTORM

5.5.1 Background

Hailstorms are a potentially damaging outgrowth of severe thunderstorms (thunderstorms are discussed separately in Section 5.8). Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until they develop to a sufficient weight and fall as precipitation. Hail typically takes the form of spheres or irregularly-shaped masses greater than 0.75 inches in diameter. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size.

5.5.2 Location and Spatial Extent

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. It is assumed that the Buncombe Madison Region is uniformly exposed to severe thunderstorms; therefore, all areas of the region are equally exposed to hail which may be produced by such storms.

5.5.3 Historical Occurrences

According to the National Climatic Data Center, 222 recorded hailstorm events have affected the Buncombe Madison Region since 1962.[2] **Table 5.8** is a summary of the hail events in the Buncombe Madison Region. Detailed information about each event that occurred in the region is provided in the jurisdiction-specific annexes. In all, hail occurrences resulted in over $34,000 (2013 dollars) in property damages, most of which were reported in Madison County. Hail ranged in diameter from 0.25 inches to 2.0 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Climatic Data Center. Therefore, it is likely that damages are greater than the reported value. Additionally, a single storm event may have affected multiple counties.

TABLE 5.8: SUMMARY OF HAIL OCCURRENCES IN THE BUNCOMBE MADISON REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Buncombe County	**159**	**0/0**	**$6,921**
Asheville	33	0/0	$6,921
Biltmore Forest	1	0/0	$0
Black Mountain	9	0/0	$0
Montreat	2	0/0	$0
Weaverville	19	0/0	$0
Woodfin	0	0/0	$0

[2] These hail events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional hail events have affected the Buncombe Madison Region. In addition to NCDC, the North Carolina Department of Insurance office was contacted for information. As additional local data becomes available, this hazard profile will be amended.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Unincorporated Area	95	0/0	$0
Madison County	**63**	**0/0**	**$27,685**
Hot Springs	4	0/0	$0
Marshall	19	0/0	$27,685
Mars Hill	12	0/0	$0
Unincorporated Area	28	0/0	$0
BUNCOMBE MADISON REGION TOTAL	**222**	**0/0**	**$34,606**

Source: National Climatic Data Center

5.5.4 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that the probability of future hail occurrences is highly likely (100 percent annual probability). Since hail is an atmospheric hazard (coinciding with thunderstorms), it is assumed that the entire Buncombe Madison Region has equal exposure to this hazard. It can be expected that future hail events will continue to cause minor damage to property and vehicles throughout the region.

5.6 HURRICANE AND TROPICAL STORM

5.6.1 Background

Hurricanes and tropical storms are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. A tropical cyclone refers to any such circulation that develops over tropical waters. Tropical cyclones act as a "safety-valve," limiting the continued build-up of heat and energy in tropical regions by maintaining the atmospheric heat and moisture balance between the tropics and the pole-ward latitudes. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation, and tornadoes.

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

As an incipient hurricane develops, barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a

hurricane. Hurricane intensity is further classified by the Saffir-Simpson Scale (**Table 5.9**), which rates hurricane intensity on a scale of 1 to 5, with 5 being the most intense.

TABLE 5.9: SAFFIR-SIMPSON SCALE

Category	Maximum Sustained Wind Speed (MPH)	Minimum Surface Pressure (Millibars)
1	74–95	Greater than 980
2	96–110	979–965
3	111–129	964–945
4	130–156	944–920
5	157 +	Less than 920

Source: National Hurricane Center (2012)

The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds and barometric pressure, which are combined to estimate potential damage. Categories 3, 4, and 5 are classified as "major" hurricanes and, while hurricanes within this range comprise only 20 percent of total tropical cyclone landfalls, they account for over 70 percent of the damage in the United States. **Table 5.10** describes the damage that could be expected for each category of hurricane. Damage during hurricanes may also result from spawned tornadoes, storm surge, and inland flooding associated with heavy rainfall that usually accompanies these storms.

TABLE 5.10: HURRICANE DAMAGE CLASSIFICATIONS

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

Source: National Hurricane Center; Federal Emergency Management Agency

5.6.2 Location and Spatial Extent

Hurricanes and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect the Buncombe Madison Region. All areas in the Buncombe Madison Region are equally susceptible to hurricane and tropical storms.

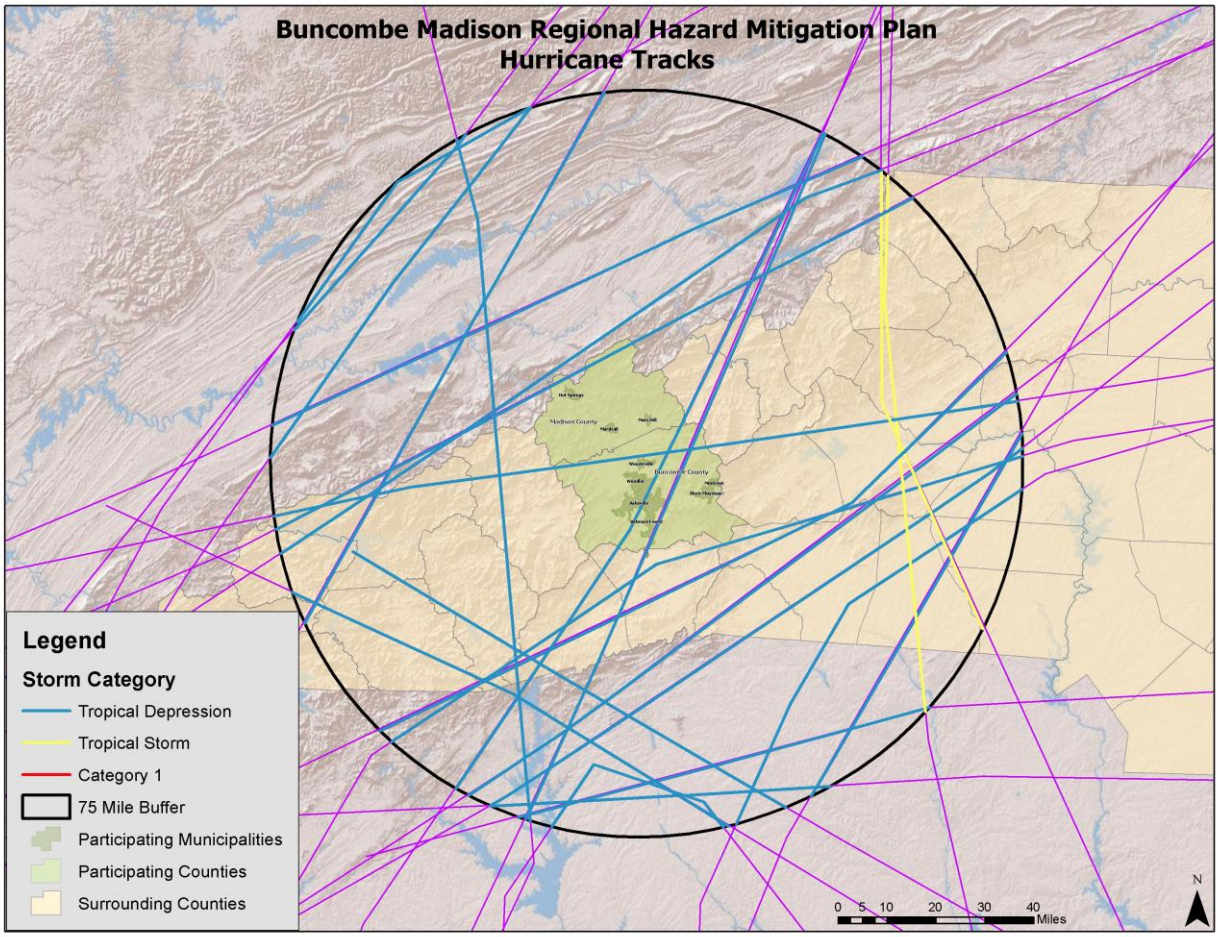
5.5.3 Historical Occurrences

According to the National Hurricane Center's historical storm track records, 24 tropical storm tracks have passed within 75 miles of the Buncombe Madison Region since 1896.[3] This includes 2 tropical storms and 22 tropical depressions.

Of the recorded storm events, five tropical depressions traversed directly through the Buncombe Madison Region as shown in **Figure 5.4**. **Table 5.11** provides the date of occurrence, name (if applicable), maximum wind speed (as recorded within 75 miles of the Buncombe Madison Region) and Category of the storm based on the Saffir-Simpson Scale for each event.

[3] These storm track statistics do not include extra-tropical storms. Though these related hazard events are less severe in intensity, they may cause significant local impact in terms of rainfall and high winds.

FIGURE 5.4: HISTORICAL HURRICANE STORM TRACKS WITHIN 75 MILES OF THE BUNCOMBE MADISON REGION



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

TABLE 5.11: HISTORICAL STORM TRACKS WITHIN 75 MILES OF THE BUNCOMBE MADISON REGION (1850–2013)

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
7/17/1896	NOT NAMED	26.4	Tropical Depression
9/28/1901	NOT NAMED	30.8	Tropical Depression
10/7/1902	NOT NAMED	30.8	Tropical Depression
10/5/1905	NOT NAMED	22	Tropical Depression
9/3/1906	NOT NAMED	26.4	Tropical Depression
9/21/1907	NOT NAMED	30.8	Tropical Depression
8/26/1911	NOT NAMED	22	Tropical Depression
8/30/1913	NOT NAMED	22	Tropical Depression
8/4/1916	NOT NAMED	30.8	Tropical Depression
8/7/1928	NOT NAMED	26.4	Tropical Depression
10/7/1932	NOT NAMED	13.2	Tropical Depression
5/27/1934	NOT NAMED	22	Tropical Depression

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
8/23/1949	NOT NAMED	--	Tropical Depression
9/20/1959	GRACIE	39.6	Tropical Storm
7/18/1968	CELESTE	22	Tropical Depression
9/14/1975	ELOISE	17.6	Tropical Depression
9/3/1977	BABE	22	Tropical Depression
8/20/1985	ONE-C	22	Tropical Depression
9/22/1989	HUGO	48.4	Tropical Storm
8/14/1994	BERYL	13.2	Tropical Depression
7/6/2003	DOLORES	17.6	Tropical Depression
9/5/2004	FRANCES	22	Tropical Depression
9/6/2004	IVAN	17.6	Tropical Depression
7/3/2005	CINDY	17.6	Tropical Depression

Source: National Hurricane Center

The National Climatic Data Center did not report any events associated with a hurricane or tropical storm in the Buncombe Madison Region between 1950 and 2013.

Federal records indicate that three disaster declarations were made in 1996 (Hurricane Fran), 2004 (Tropical Storm Frances), and 2004 (Hurricane Ivan) for the region.[4]

Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in the Buncombe Madison Region. Most events do not carry winds that are above that of the winter storms and straight line winds received by the Buncombe Madison counties. Some anecdotal information is available for the major storms that have impacted that area as found below:

Tropical Storm Frances – September 7-8, 2004
Tropical Storm Frances was a slow-moving, relatively large storm that dumped heavy rains over the eastern United States. The remnants of Frances produced a swath of 5 to 15 inches of rain across the North Carolina Mountains with reports of 12 to 15 inches of rain along the higher terrain and isolated reports in excess of 18 inches. Wind gusts reached between 40 and 60 mph along the Appalachian Mountains and numerous trees were downed. Frances caused significant crop damages totaling $55 million statewide. North Carolina residents received almost $20.6 million in federal disaster assistance following the storm.

Hurricane Ivan – September 16-17, 2004
Just a week and a half following Tropical Storm Frances, the remnants of Hurricane Ivan hit western North Carolina when many streams and rivers were already well above flood stage. The widespread flooding forced many roads to be closed and landslides were common across the mountain region. Wind gusts reached between 40 and 60 mph across the higher elevations of the Appalachian Mountains resulting in numerous downed trees. More than $13.8 million of federal aid was dispersed across North Carolina following Ivan.

[4] Not all of the participating counties were declared disaster areas for these storms. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Identification*.

5.6.4 Probability of Future Occurrences

Given the inland location of the region, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to the Buncombe Madison Region due to induced events like flooding and landsliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). Given the regional nature of the hazard, all areas are equally exposed to this hazard. However, when the region is impacted, the damage could be catastrophic, threatening lives and property throughout the planning area.

5.7 LIGHTNING

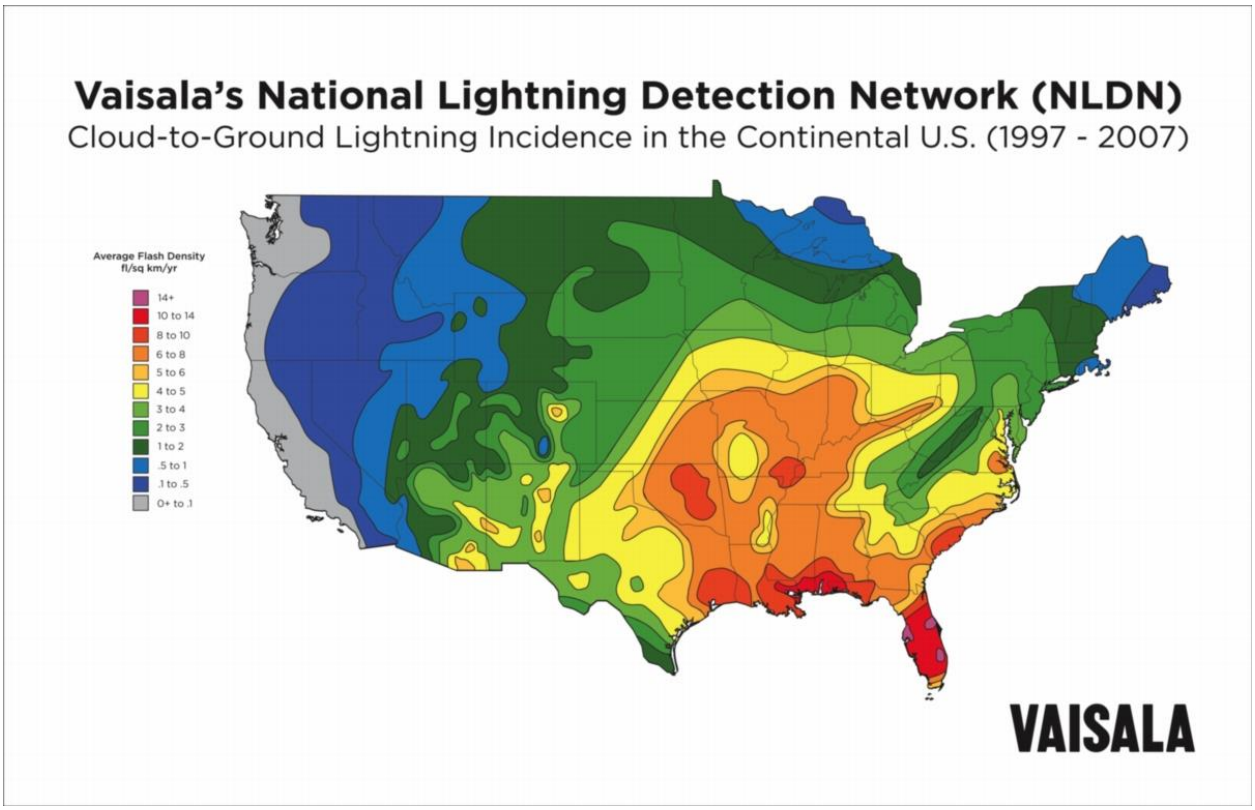
5.7.1 Background

Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a "bolt" when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes the thunder which often accompanies lightning strikes. While most often affiliated with severe thunderstorms, lightning may also strike outside of heavy rain and might occur as far as 10 miles away from any rainfall.

Lightning strikes occur in very small, localized areas. For example, they may strike a building, electrical transformer, or even a person. According to FEMA, lightning injures an average of 300 people and kills 80 people each year in the United States. Direct lightning strikes also have the ability to cause significant damage to buildings, critical facilities, and infrastructure largely by igniting a fire. Lightning is also responsible for igniting wildfires that can result in widespread damages to property.

Figure 5.5 shows a lightning flash density map for the years 1996-2000 based upon data provided by Vaisala's U.S. National Lightning Detection Network (NLDN®).

FIGURE 5.5: LIGHTNING FLASH DENSITY IN THE UNITED STATES



Source: Vaisala U.S. National Lightning Detection Network

5.7.2 Location and Spatial Extent

Lightning occurs randomly, therefore it is impossible to predict where and with what frequency it will strike. It is assumed that all of the Buncombe Madison Region is uniformly exposed to lightning.

5.7.3 Historical Occurrences

According to the National Climatic Data Center, there have been a total of 18 recorded lightning events in the Buncombe Madison Region since 1993.[5] These events resulted in 2 deaths, 7 injuries, and over $775,000 (2013 dollars) in damages, as listed in summary **Table 5.12**. Detailed information on historical lightning events can be found in the jurisdiction-specific annexes.

It is certain that more than 18 events have impacted the region. Many of the reported events are those that caused damage. Therefore, it should be expected that damages are likely much higher for this hazard than what is reported.

[5] These lightning events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional lightning events have occurred in the Buncombe Madison Region. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

TABLE 5.12: SUMMARY OF LIGHTNING OCCURRENCES IN THE BUNCOMBE MADISON REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Buncombe County	**15**	**1/7**	**$467,703**
Asheville	4	0/6	$21,386
Biltmore Forest	0	0/0	$0
Black Mountain	1	0/0	$69,212
Montreat	0	0/0	$0
Weaverville	1	0/1	$0
Woodfin	0	0/0	$0
Unincorporated Area	9	1/0	$377,105
Madison County	**3**	**1/0**	**$307,549**
Hot Springs	0	0/0	$0
Marshall	1	0/0	$13,842
Mars Hill	1	0/0	$293,707
Unincorporated Area	1	1/0	$0
BUNCOMBE MADISON REGION TOTAL	**18**	**2/7**	**$775,252**

Source: National Climatic Data Center

5.7.4 Probability of Future Occurrences

Although there were not a high number of historical lightning events reported throughout the Buncombe Madison Region via NCDC data, it is a regular occurrence accompanied by thunderstorms. In fact, lightning events will assuredly happen on an annual basis, though not all events will cause damage. According to Vaisala's U.S. National Lightning Detection Network (NLDN®), the Buncombe Madison Region is located in an area of the country that experienced an average of 2 to 4 lightning flashes per square kilometer per year between 1997 and 2010. Therefore, the probability of future events is highly likely (100 percent annual probability). It can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the region.

5.8 THUNDERSTORM WIND / HIGH WIND

5.8.1 Background

Thunderstorms can produce a variety of accompanying hazards including wind (discussed here), hail, and lightning.[6] Although thunderstorms generally affect a small area, they are very dangerous and may cause substantial property damage.

Three conditions need to occur for a thunderstorm to form. First, it needs moisture to form clouds and rain. Second, it needs unstable air, such as warm air that can rise rapidly (this often referred to as the "engine" of the storm). Third, thunderstorms need lift, which comes in the form of cold or warm fronts, sea breezes, mountains, or the sun's heat. When these conditions occur simultaneously, air masses of varying temperatures meet, and a thunderstorm is formed. These storm events can occur singularly, in lines, or in clusters. Furthermore, they can move through an area very quickly or linger for several hours.

[6]Lightning and hail hazards are discussed as separate hazards in this section.

According to the National Weather Service, more than 100,000 thunderstorms occur each year, though only about 10 percent of these storms are classified as "severe." A severe thunderstorm occurs when the storm produces at least one of these three elements: 1) hail of three-quarters of an inch, 2) a tornado, or 3) winds of at least 58 miles per hour.

Thunderstorm events have the capability of producing straight-line winds that can cause severe destruction to communities and threaten the safety of a population. Such wind events, sometimes separate from a thunderstorm event, are common throughout the Buncombe Madison Region. Therefore, high winds are also reported in this section.

High winds can form due to pressure of the Northeast coast that combines with strong pressure moving through the Ohio Valley. This creates a tight pressure gradient across the region, resulting in high winds which increase with elevation. It is common for gusts of 30 to 60 miles per hour during the winter months.

Downbursts are also possible with thunderstorm events. Such events are an excessive burst of wind in excess of 125 miles per hour. They are often confused with tornadoes. Downbursts are caused by down drafts from the base of a convective thunderstorm cloud. It occurs when rain-cooled air within the cloud becomes heavier than its surroundings. Thus, air rushes towards the ground in a destructive yet isolated manner. There are two types of downbursts. Downbursts less than 2.5 miles wide, duration less than 5 minutes, and winds up to 168 miles per hour are called "microbursts." Larger events greater than 2.5 miles at the surface and longer than 5 minutes with winds up to 130 miles per hour are referred to as "macrobursts."

5.8.2 Location and Spatial Extent

A wind event is an atmospheric hazard, and thus has no geographic boundaries. It is typically a widespread event that can occur in all regions of the United States. However, thunderstorms are most common in the central and southern states because atmospheric conditions in those regions are favorable for generating these powerful storms. Also, the Buncombe Madison Region typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that the Buncombe Madison Region has uniform exposure to a thunderstorm/wind event and the spatial extent of an impact could be large.

5.8.3 Historical Occurrences

Severe storms resulted in four disaster declarations in the Buncombe Madison Region in 1973, 1977, 1995, and 1998.[7] According to NCDC, there have been 279 reported thunderstorm and high wind events since 1959 in the Buncombe Madison Region.[8] These events caused over $5.8 million (2013 dollars) in damages. There were reports of 17 injuries and 3 fatalities. **Table 5.13** summarizes this information.

[7]Not all of the participating counties were declared disaster areas for these storms. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Profiles*.

[8] These thunderstorm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional thunderstorm events have occurred in the Buncombe Madison Region. As additional local data becomes available, this hazard profile will be amended.

Detailed thunderstorm and high wind event reports, including date, magnitude, and associated damages for each event, are presented in the jurisdiction-specific annexes.[9]

TABLE 5.13: SUMMARY OF THUNDERSTORM / HIGH WIND OCCURRENCES IN THE BUNCOMBE MADISON REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Buncombe County	**180**	**2/12**	**$3,882,319**
Asheville	26	0/1	$196,286
Biltmore Forest	0	0/0	$0
Black Mountain	4	0/0	$1,384
Montreat	1	0/0	$0
Weaverville	11	0/1	$5,376
Woodfin	4	0/1	$0
Unincorporated Area	134	2/7	$3,679,273
Madison County	**99**	**1/5**	**$1,978,329**
Hot Springs	12	0/0	$0
Marshall	17	0/0	$24,597
Mars Hill	8	0/0	$2,610
Unincorporated Area	62	1/5	$1,951,122
BUNCOMBE MADISON REGION TOTAL	**279**	**3/17**	**$5,860,648**

Source: National Climatic Data Center

5.8.4 Probability of Future Occurrences

Given the high number of previous events, it is certain that wind events, including straight-line wind and thunderstorm wind, will occur in the future. This results in a probability level of highly likely (100 percent annual probability) for future wind events for the entire planning area.

5.9 TORNADO

5.9.1 Background

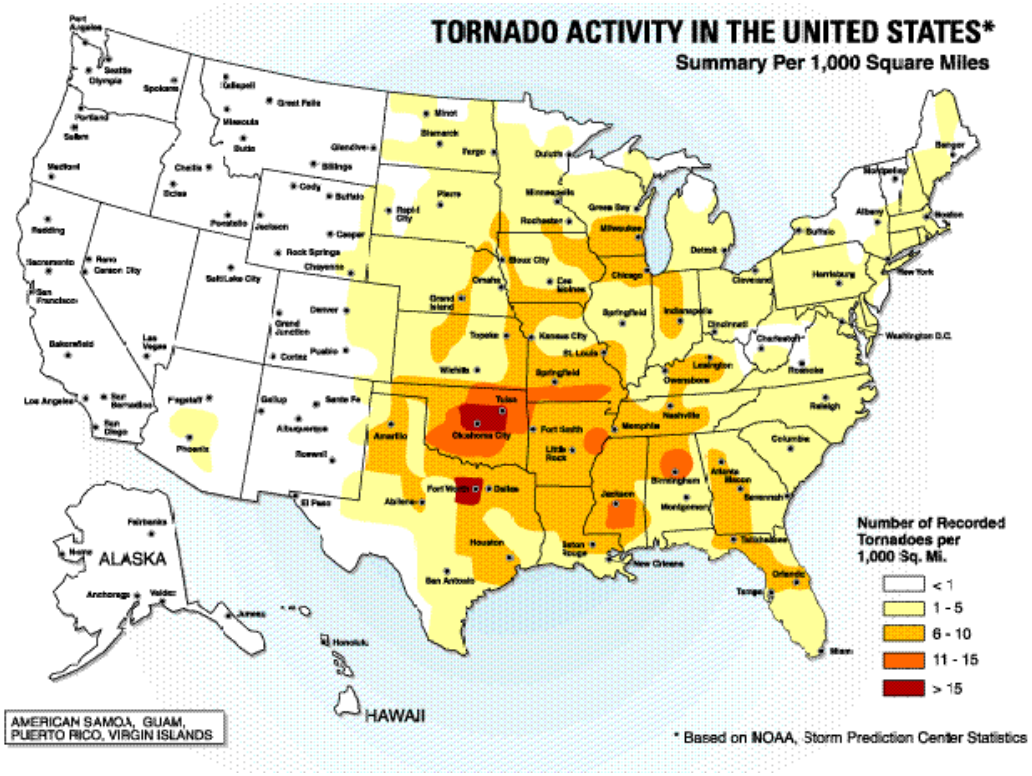
A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but sometimes result from hurricanes and other tropical storms) when cool, dry air intersects and overrides a layer of warm, moist air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

Each year, an average of over 800 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries.[10] According to the NOAA Storm Prediction Center (SPC), the highest

[9] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

concentration of tornadoes in the United States has been in Oklahoma, Texas, Kansas, and Florida respectively. Although the Great Plains region of the Central United States does favor the development of the largest and most dangerous tornadoes (earning the designation of "tornado alley"), Florida experiences the greatest number of tornadoes per square mile of all U.S. states (SPC, 2002). **Figure 5.6** shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles.

FIGURE 5.6: TORNADO ACTIVITY IN THE UNITED STATES



Source: Federal Emergency Management Agency

Tornadoes are more likely to occur during the months of March through May and are most likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touch down briefly, but even small short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes may carve out a path over a mile wide and several miles long.

The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, including residential dwellings (particularly mobile homes). Tornadic magnitude is reported according to the Fujita and Enhanced Fujita Scales. Tornado magnitudes prior to 2005 were determined using the traditional version of the Fujita Scale (**Table 5.14**). Tornado magnitudes that were determined in 2005 and later were determined using the Enhanced Fujita Scale (**Table 5.15**).

[10] NOAA, 2009.

TABLE 5.14: THE FUJITA SCALE (EFFECTIVE PRIOR TO 2005)

F-SCALE NUMBER	INTENSITY	WIND SPEED	TYPE OF DAMAGE DONE
F0	GALE TORNADO	40–72 MPH	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
F1	MODERATE TORNADO	73–112 MPH	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	SIGNIFICANT TORNADO	113–157 MPH	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	SEVERE TORNADO	158–206 MPH	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
F4	DEVASTATING TORNADO	207–260 MPH	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	INCREDIBLE TORNADO	261–318 MPH	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.
F6	INCONCEIVABLE TORNADO	319–379 MPH	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies.

Source: National Weather Service

TABLE 5.15 THE ENHANCED FUJITA SCALE (EFFECTIVE 2005 AND LATER)

EF-SCALE NUMBER	INTENSITY PHRASE	3 SECOND GUST (MPH)	TYPE OF DAMAGE DONE
F0	GALE	65–85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
F1	MODERATE	86–110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	SIGNIFICANT	111–135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	SEVERE	136–165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
F4	DEVASTATING	166–200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	INCREDIBLE	Over 200	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.

Source: National Weather Service

5.9.2 Location and Spatial Extent

Tornadoes occur throughout the state of North Carolina, and thus in the Buncombe Madison Region. Tornadoes typically impact a relatively small area, but damage may be extensive. Event locations are completely random and it is not possible to predict specific areas that are more susceptible to tornado strikes over time. Therefore, it is assumed that the Buncombe Madison Region is uniformly exposed to this hazard.

5.9.3 Historical Occurrences

Tornadoes are a fairly rare occurrence in mountainous areas. However, they have and do occur in the Buncombe Madison Region. Tornadoes have not resulted in any disaster declarations in the Buncombe Madison Region.[11] According to the National Climatic Data Center, there have been a total of 10 recorded tornado events in the Buncombe Madison Region since 1976 (**Table 5.16**), resulting in nearly $6 million (2013 dollars) in property damages.[12] In addition, five injuries were reported. The magnitude of these tornadoes ranges from F0 to F1 in intensity, although an F2 through F5 event is possible. It is important to note that only tornadoes that have been reported are factored into this risk assessment. It is likely that a high number of occurrences have gone unreported over the past 63 years. Detailed information on historical tornado events can be found in the jurisdiction-specific annexes.

[11] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles.*
[12] These tornado events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional tornadoes have occurred in the Buncombe Madison Region. As additional local data becomes available, this hazard profile will be amended.

TABLE 5.16: SUMMARY OF TORNADO OCCURRENCES IN THE BUNCOMBE MADISON REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Buncombe County	**6**	**0/0**	**$3,684,877**
Asheville	2	0/0	$378,147
Biltmore Forest	0	0/0	$0
Black Mountain	0	0/0	$0
Montreat	0	0/0	$0
Weaverville	0	0/0	$0
Woodfin	0	0/0	$0
Unincorporated Area	4	0/0	$3,306,730
Madison County	**4**	**0/5**	**$2,188,556**
Hot Springs	0	0/0	$0
Marshall	0	0/0	$0
Mars Hill	0	0/0	$0
Unincorporated Area	4	0/5	$2,188,556
BUNCOMBE MADISON REGION TOTAL	**10**	**0/5**	**$5,873,433**

Source: National Climatic Data Center

5.9.4 Probability of Future Occurrences

According to historical information, tornado events are not an annual occurrence for the region. Furthermore, the mountainous terrain of the region makes tornadoes a rare occurrence. While the majority of the reported tornado events are small in terms of size, intensity, and duration, they do pose a significant threat should the Buncombe Madison Region experience a direct tornado strike. The probability of future tornado occurrences affecting the Buncombe Madison Region is possible (1 to 10 percent annual probability).

5.10 WINTER STORM AND FREEZE

5.10.1 Background

A winter storm can range from a moderate snow over a period of a few hours to blizzard conditions with blinding wind-driven snow that lasts for several days. Events may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Some winter storms might be large enough to affect several states, while others might affect only localized areas. Occasionally, heavy snow might also cause significant property damages, such as roof collapses on older buildings.

All winter storm events have the potential to present dangerous conditions to the affected area. Larger snowfalls pose a greater risk, reducing visibility due to blowing snow and making driving conditions treacherous. A heavy snow event is defined by the National Weather Service as an accumulation of 4 of more inches in 12 hours or less. A blizzard is the most severe form of winter storm. It combines low temperatures, heavy snow, and winds of 35 miles per hour or more, which reduces visibility to a quarter mile or less for at least 3 hours. Winter storms are often accompanied by sleet, freezing rain, or an ice storm. Such freeze events are particularly hazardous as they create treacherous surfaces.

Ice storms are defined as storms with significant amounts of freezing rain and are a result of cold air damming (CAD). CAD is a shallow, surface-based layer of relatively cold, stably-stratified air entrenched against the eastern slopes of the Appalachian Mountains. With warmer air above, falling precipitation in the form of snow melts, then becomes either super-cooled (liquid below the melting point of water) or re-freezes. In the former case, super-cooled droplets can freeze on impact (freezing rain), while in the latter case, the re-frozen water particles are ice pellets (or sleet). Sleet is defined as partially frozen raindrops or refrozen snowflakes that form into small ice pellets before reaching the ground. They typically bounce when they hit the ground and do not stick to the surface. However, it does accumulate like snow, posing similar problems and has the potential to accumulate into a layer of ice on surfaces. Freezing rain, conversely, usually sticks to the ground, creating a sheet of ice on the roadways and other surfaces. All of the winter storm elements – snow, low temperatures, sleet, ice, etcetera – have the potential to cause significant hazard to a community. Even small accumulations can down power lines and trees limbs and create hazardous driving conditions. Furthermore, communication and power may be disrupted for days.

5.10.2 Location and Spatial Extent

Nearly the entire continental United States is susceptible to winter storm and freeze events. Some ice and winter storms may be large enough to affect several states, while others might affect limited, localized areas. The degree of exposure typically depends on the normal expected severity of local winter weather. The Buncombe Madison Region is accustomed to severe winter weather conditions and frequently receives winter weather during the winter months. Given the atmospheric nature of the hazard, the entire region has uniform exposure to a winter storm.

5.10.3 Historical Occurrences

Winter weather has resulted in three disaster declarations in the Buncombe Madison Region. This includes the Blizzard of 1996, one subsequent 1996 winter storm, and a severe winter storm in 2010.[13] According to the National Climatic Data Center, there have been a total of 351 recorded winter storm events in the Buncombe Madison Region since 1993 (**Table 5.17**).[14] These events resulted in over $12.8 million (2013 dollars) in damages. Detailed information on the recorded winter storm events can be found in the jurisdiction-specific annexes.[15]

[13] Not all of the participating counties were declared disaster areas for these events. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Profiles*.
[14] These ice and winter storm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional winter storm conditions have affected the Buncombe Madison Region. In addition, the 351 are reported by county, so many of these storms likely affected all of the counties.
[15] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

TABLE 5.17: SUMMARY OF WINTER STORM EVENTS IN THE BUNCOMBE MADISON REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Buncombe County	157	0/0	$6,470,842
Madison County	194	0/0	$6,391,342
BUNCOMBE MADISON REGION TOTAL	**351**	**2/10**[16]	**$12,862,184**

Source: National Climatic Data Center

There have been several severe winter weather events in the Buncombe Madison Region. The text below describes one of the major events and associated impacts on the Region. Similar impacts can be expected with severe winter weather.

1996 Winter Storm
This storm left two feet of snow and several thousand citizens without power for up to nine days. Although shelters were opened, some roads were impassible for up to four days. This event caused considerable disruption to business, industry, schools, and government services.

Winter storms throughout the planning area have several negative externalities including hypothermia, cost of snow and debris cleanup, business and government service interruption, traffic accidents, and power outages. Furthermore, citizens may resort to using inappropriate heating devices that could lead to fire or an accumulation of toxic fumes.

5.10.4 Probability of Future Occurrences

Winter storm events will remain a regular occurrence in the Buncombe Madison Region due to location and elevation. According to historical information, the Buncombe Madison Region experiences multiple winter storm events each year. Therefore, the annual probability is highly likely (100 percent).

Geologic Hazards

5.11 EARTHQUAKE

5.11.1 Background

An earthquake is movement or trembling of the ground produced by sudden displacement of rock in the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of caverns. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area.

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site, and regional geology. Other damaging earthquake effects include landslides, the down-slope movement of soil and

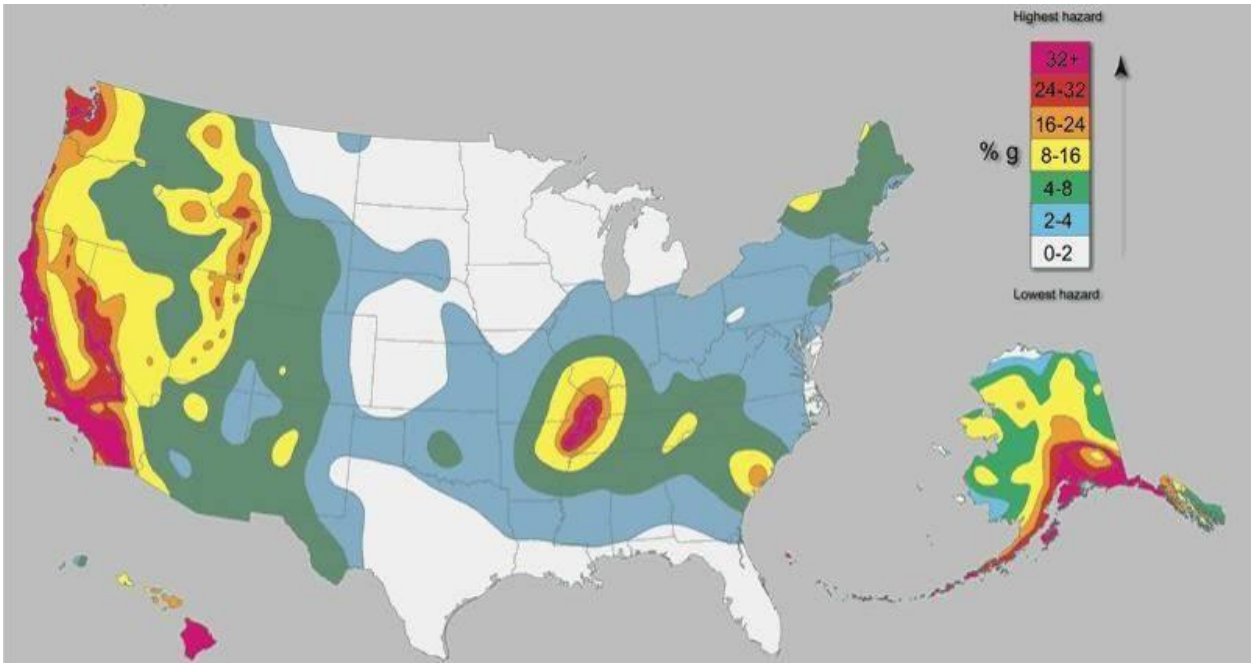
[16] The winter storm of 1993 caused 2 deaths and 10 injuries across the state, so these totals were included in the analysis.

rock (mountain regions and along hillsides), and liquefaction, in which ground soil loses the ability to resist shear and flows much like quick sand. In the case of liquefaction, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

Most earthquakes are caused by the release of stresses accumulated as a result of the rupture of rocks along opposing fault planes in the Earth's outer crust. These fault planes are typically found along borders of the Earth's 10 tectonic plates. The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. Deformation along plate boundaries causes strain in the rock and the consequent buildup of stored energy. When the built-up stress exceeds the rocks' strength a rupture occurs. The rock on both sides of the fracture is snapped, releasing the stored energy and producing seismic waves, generating an earthquake.

The greatest earthquake threat in the United States is along tectonic plate boundaries and seismic fault lines located in the central and western states; however, the Eastern United State does face moderate risk to less frequent, less intense earthquake events. **Figure 5.7** shows relative seismic risk for the United States.

FIGURE 5.7: UNITED STATES EARTHQUAKE HAZARD MAP



Source: United States Geological Survey

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude (**Table 5.18**). Each unit increase in magnitude on the Richter Scale corresponds to a 10-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using roman numerals, ranging from "I" corresponding to imperceptible (instrumental) events to "XII" for

catastrophic (total destruction). A detailed description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter Scale is given in **Table 5.19**.

TABLE 5.18: RICHTER SCALE

RICHTER MAGNITUDES	EARTHQUAKE EFFECTS
< 3.5	Generally not felt, but recorded.
3.5 - 5.4	Often felt, but rarely causes damage.
5.4 - 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 - 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: Federal Emergency Management Agency

TABLE 5.19: MODIFIED MERCALLI INTENSITY SCALE FOR EARTHQUAKES

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER SCALE MAGNITUDE
I	INSTRUMENTAL	Detected only on seismographs.	
II	FEEBLE	Some people feel it.	< 4.2
III	SLIGHT	Felt by people resting; like a truck rumbling by.	
IV	MODERATE	Felt by people walking.	
V	SLIGHTLY STRONG	Sleepers awake; church bells ring.	< 4.8
VI	STRONG	Trees sway; suspended objects swing, objects fall off shelves.	< 5.4
VII	VERY STRONG	Mild alarm; walls crack; plaster falls.	< 6.1
VIII	DESTRUCTIVE	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged.	
IX	RUINOUS	Some houses collapse; ground cracks; pipes break open.	< 6.9
X	DISASTROUS	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread.	< 7.3
XI	VERY DISASTROUS	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards.	< 8.1
XII	CATASTROPHIC	Total destruction; trees fall; ground rises and falls in waves.	> 8.1

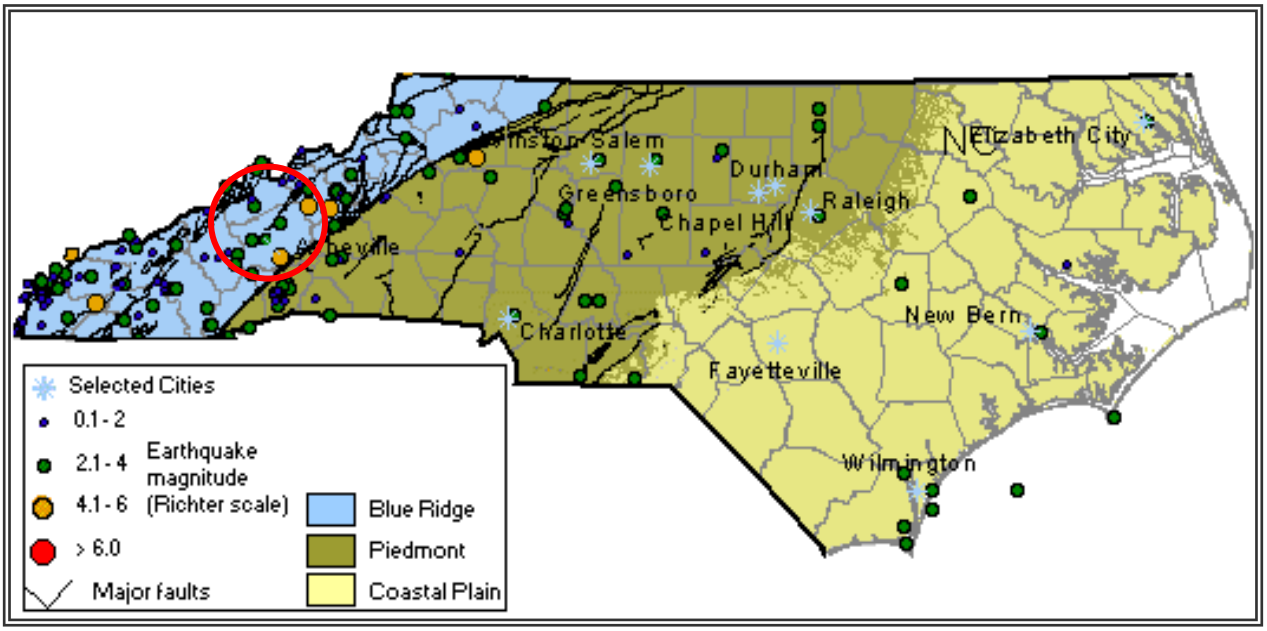
Source: Federal Emergency Management Agency

5.11.2 Location and Spatial Extent

Approximately two-thirds of North Carolina is subject to earthquakes, with the western and southeast region most vulnerable to a very damaging earthquake. The state is affected by both the Charleston

Fault in South Carolina and New Madrid Fault in Tennessee. Both of these faults have generated earthquakes measuring greater than 8 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines throughout North Carolina. **Figure 5.8** is a map showing geological and seismic information for North Carolina.

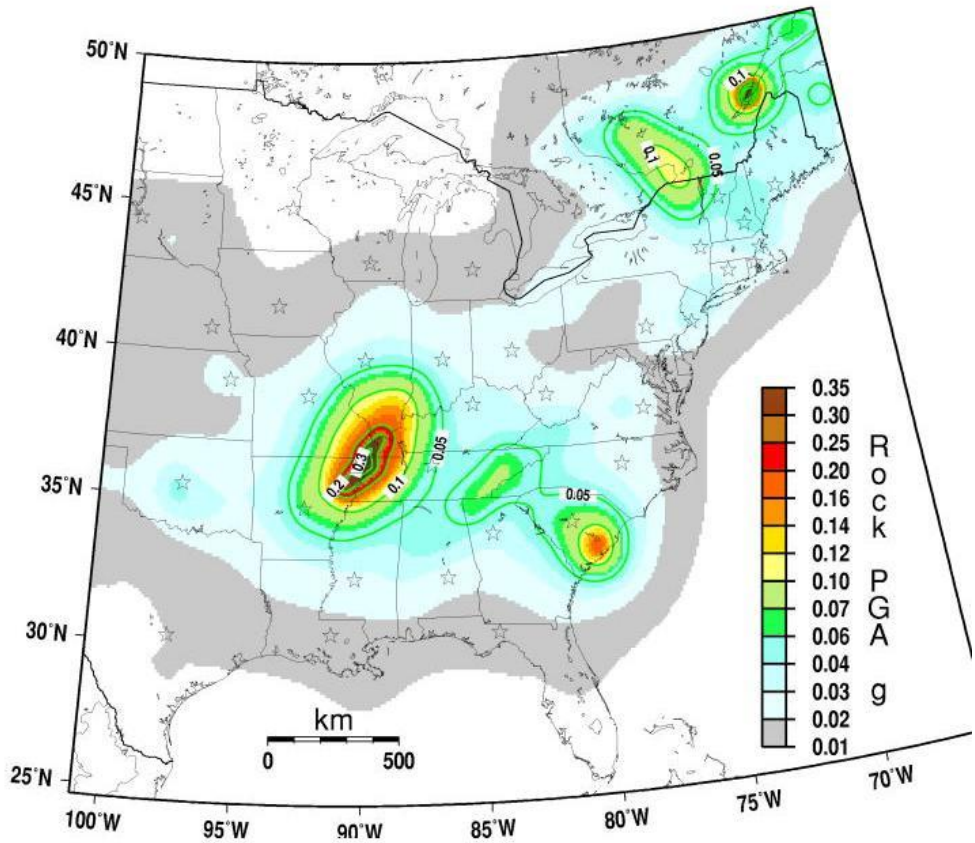
FIGURE 5.8: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure 5.9 shows the intensity level associated with the Buncombe Madison Region, based on the national USGS map of peak acceleration with 10 percent probability of exceedance in 50 years. It is the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The map was compiled by the U.S. Geological Survey (USGS) Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards. According to this map, much of the Buncombe Madison Region lies within an approximate zone of level "5" to "7" ground acceleration. This indicates that the region as a whole exists within an area of moderate seismic risk.

FIGURE 5.9: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: United States Geological Survey, 2008

5.11.3 Historical Occurrences

At least 87 earthquakes are known to have affected the Buncombe Madison Region since 1874. The strongest of these measured a VII on the Modified Mercalli Intensity (MMI) scale. **Table 5.20** provides a summary of earthquake events reported by the National Geophysical Data Center between 1638 and 1985. A detailed occurrence of each event including the date, distance for the epicenter, magnitude, and Modified Mercalli Intensity (if known) can be found in the jurisdiction-specific annexes.[17]

TABLE 5.20: SUMMARY OF SEISMIC ACTIVITY IN THE BUNCOMBE MADISON REGION

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Buncombe County	**70**	**VI**	**--**
Asheville	26	VI	--
Biltmore Forest	0	--	--
Black Mountain	3	IV	3.3
Montreat	5	V	--

[17] Due to reporting mechanisms, not all earthquakes events were recorded during this time. Furthermore, some are missing data, such as the epicenter location, due to a lack of widely used technology. In these instances, a value of "unknown" is reported.

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Weaverville	2	VI	--
Woodfin	0	--	--
Unincorporated Area	34	VI	--
Madison County	**17**	**VI**	**--**
Hot Springs	4	IV	4.7
Marshall	8	VI	--
Mars Hill	5	V	--
Unincorporated Area	0	--	--
BUNCOMBE MADISON REGION TOTAL	**87**	**VI**	--

Source: National Geophysical Data Center

In addition to those earthquakes specifically affecting the Buncombe Madison Region, a list of earthquakes that have caused damage throughout North Carolina is presented below in **Table 5.21.**

TABLE 5.21: EARTHQUAKES WHICH HAVE CAUSED DAMAGE IN NORTH CAROLINA

Date	Location	Richter Scale (Magnitude)	MMI (Intensity)	MMI in North Carolina
12/16/1811 - 1	NE Arkansas	8.5	XI	VI
12/16/1811 - 2	NE Arkansas	8.0	X	VI
12/18/1811 - 3	NE Arkansas	8.0	X	VI
01/23/1812	New Madrid, MO	8.4	XI	VI
02/071812	New Madrid, MO	8.7	XII	VI
04/29/1852	Wytheville, VA	5.0	VI	VI
08/31/1861	Wilkesboro, NC	5.1	VII	VII
12/23/1875	Central Virginia	5.0	VII	VI
08/31/1886	Charleston, SC	7.3	X	VII
05/31/1897	Giles County, VA	5.8	VIII	VI
01/01/1913	Union County, SC	4.8	VII	VI
02/21/1916*	Asheville, NC	5.5	VII	VII
07/08/1926	Mitchell County, NC	5.2	VII	VII
11/03/1928*	Newport, TN	4.5	VI	VI
05/13/1957	McDowell County, NC	4.1	VI	VI
07/02/1957*	Buncombe County, NC	3.7	VI	VI
11/24/1957*	Jackson County, NC	4.0	VI	VI
10/27/1959 **	Chesterfield, SC	4.0	VI	VI
07/13/1971	Newry, SC	3.8	VI	VI
11/30/1973*	Alcoa, TN	4.6	VI	VI
11/13/1976	Southwest Virginia	4.1	VI	VI
05/05/1981	Henderson County, NC	3.5	VI	VI

*This event is accounted for in the Buncombe Madison occurrences.

** Conflicting reports on this event, intensity in North Carolina could have been either V or VI

Source: This information compiled by Dr. Kenneth B. Taylor and provided by Tiawana Ramsey of NCEM. Information was compiled from the National Earthquake Center, Earthquakes of the US by Carl von Hake (1983), and a compilation of newspaper reports in the Eastern Tennessee Seismic Zone compiled by Arch Johnston, CERI, Memphis State University (1983).

5.11.4 Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting the Buncombe Madison Region is unlikely. However, it is likely that future earthquakes resulting in light to moderate perceived shaking and damages ranging from none to very light will affect the region. The annual probability level for the region is estimated between 10 and 100 percent (likely).

5.12 LANDSLIDE

5.12.1 Background

A landslide is the downward and outward movement of slope-forming soil, rock, and vegetation, which is driven by gravity. Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening of slopes due to construction or erosion, earthquakes, volcanic eruptions, and changes in groundwater levels.

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

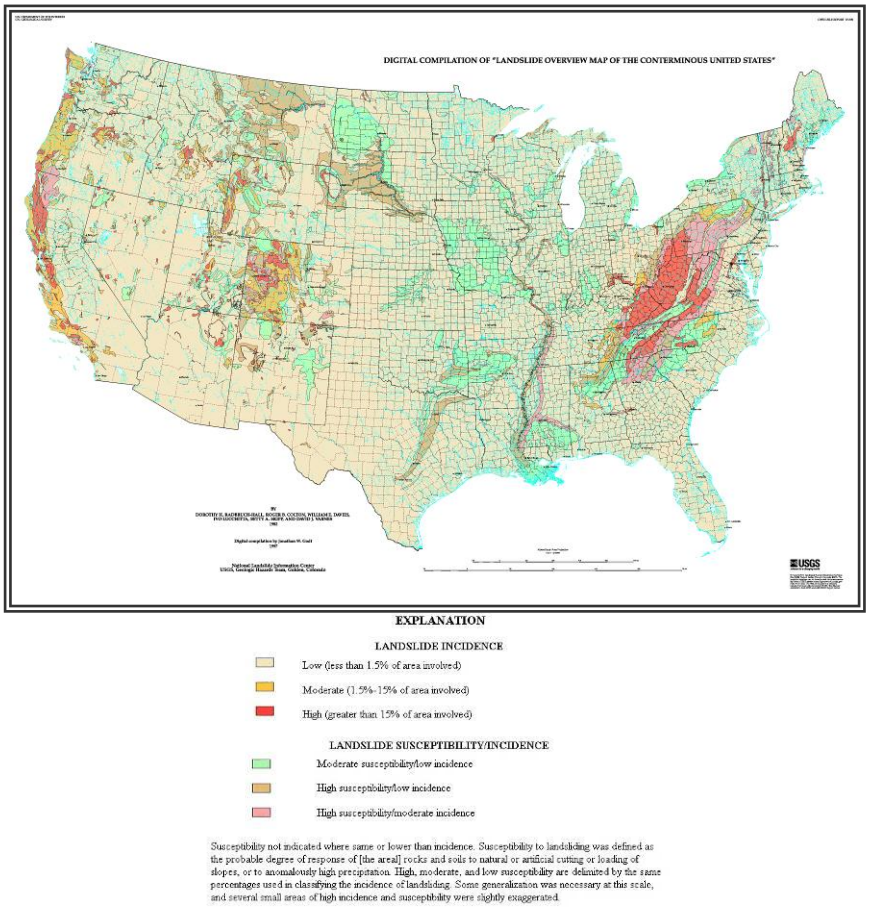
Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Some landslides move slowly and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

Among the most destructive types of debris flows are those that accompany volcanic eruptions. A spectacular example in the United States was a massive debris flow resulting from the 1980 eruptions of Mount St. Helens, Washington. Areas near the bases of many volcanoes in the Cascade Mountain Range of California, Oregon, and Washington are at risk from the same types of flows during future volcanic eruptions.

Areas that are generally prone to landslide hazards include previous landslide areas, the bases of steep slopes, the bases of drainage channels, and developed hillsides where leach-field septic systems are used. Areas that are typically considered safe from landslides include areas that have not moved in the past, relatively flat-lying areas away from sudden changes in slope, and areas at the top or along ridges set back from the tops of slopes.

According to the United States Geological Survey, each year landslides cause $5.1 billion (2009 dollars) in damage and between 25 and 50 deaths in the United States.[18] **Figure 5.10** delineates areas where large numbers of landslides have occurred and areas that are susceptible to landsliding in the conterminous United States.[19]

FIGURE 5.10: LANDSLIDE OVERVIEW MAP OF THE CONTERMINOUS UNITED STATES



Source: United States Geological Survey

5.12.2 Location and Spatial Extent

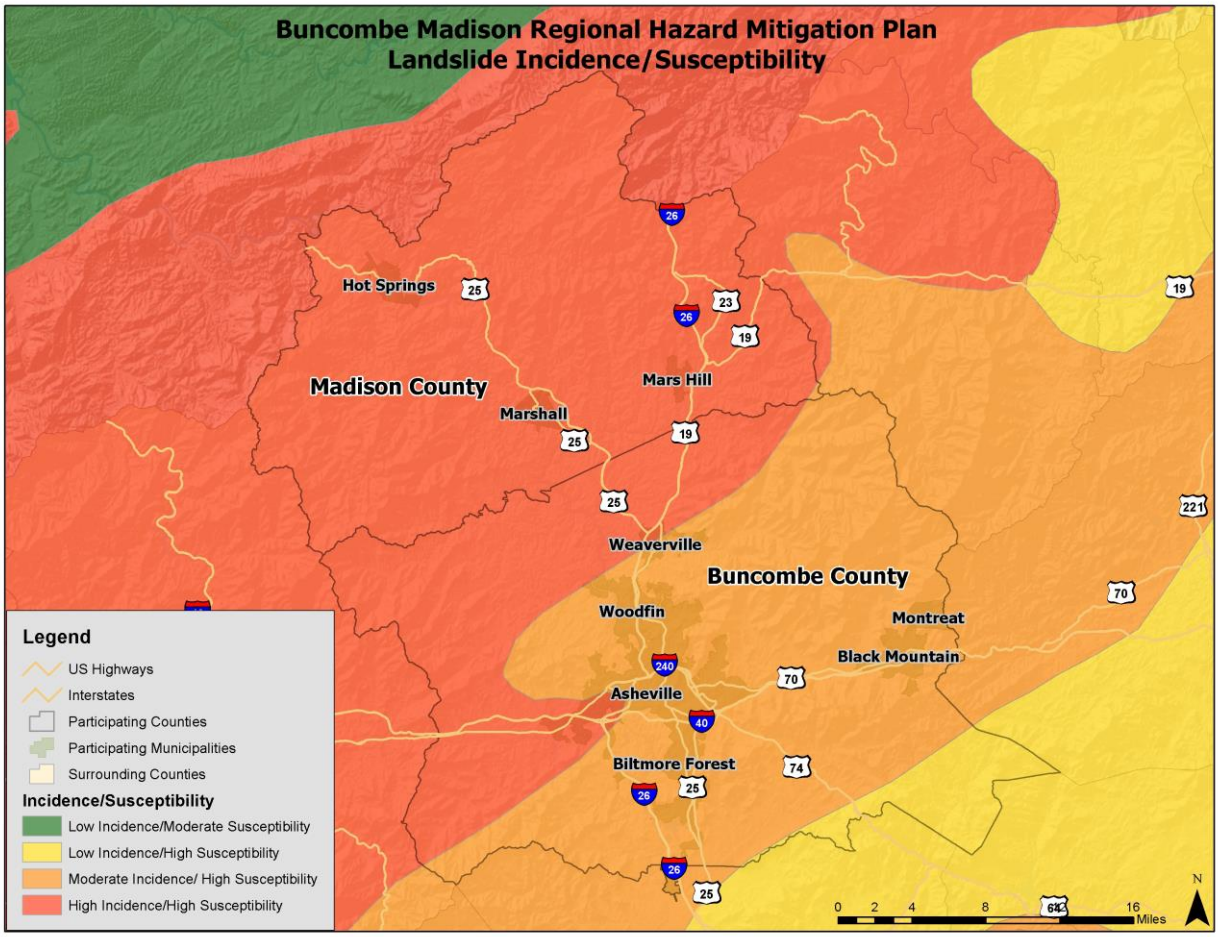
Landslides occur along steep slopes when the pull of gravity can no longer be resisted (often due to heavy rain throughout the Appalachian Mountain region). Human development can also exacerbate risk by building on previously undevelopable steep slopes and constructing roads by cutting through mountains. Landslides are possible throughout the Buncombe Madison Region.

According to **Figure 5.11** below, the majority of the region has high landslide activity. Most of the remaining portion of the region (in Buncombe County) has a moderate incidence occurrence rate,

[18] United States Geological Survey (USGS). United States Department of the Interior. "Landslide Hazards – A National Threat." 2005.
[19] This map layer is provided in the U.S. Geological Survey Professional Paper 1183, Landslide Overview Map of the Conterminous United States, available online at: http://landslides.usgs.gov/html_files/landslides/nationalmap/national.html.

although there is a small area of low incidence in the southeast corner of the region. It should also be noted that there is high susceptibility throughout the entire region.

FIGURE 5.11: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF THE BUNCOMBE MADISON REGION



Source: United States Geological Survey

5.12.3 Historical Occurrences

Steep topography throughout the Buncombe Madison Region makes the planning area susceptible to landslides. Most landslides are caused by heavy rainfall in the area. Building on steep slopes that was not previously possible also contributes to risk. **Table 5.22** presents a summary of the landslide occurrence events as provided by the North Carolina Geological Survey[20]. The locations of the landslide events presented in the aforementioned tables are presented in **Figure 5.12**. Some incidence mapping has also been completed throughout the western portion of North Carolina though it is not complete. Therefore, it should be noted that many more incidents than what is reported are likely to have occurred in both counties.

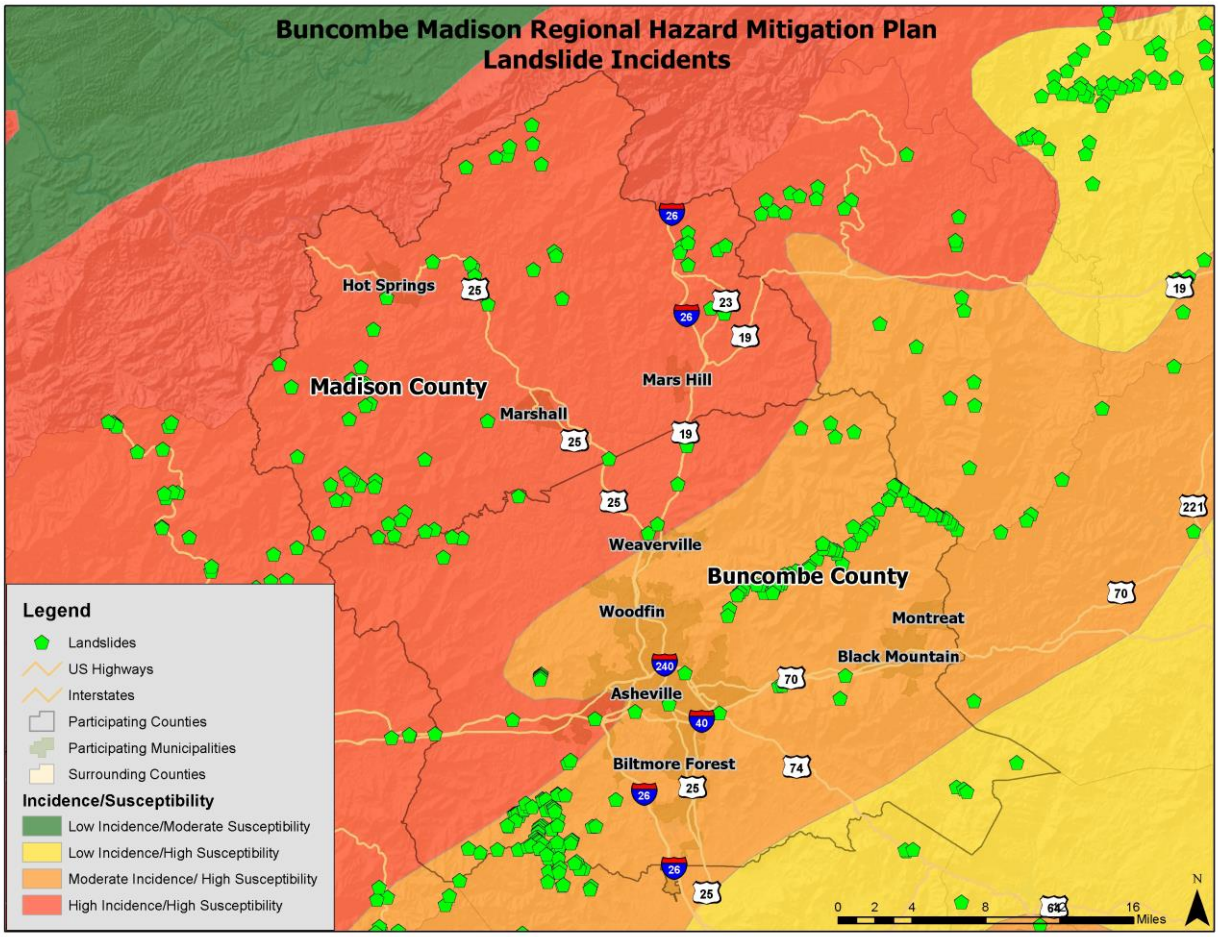
[20] It should be noted that the North Carolina Geological Survey (NCGS) emphasized the dataset provided was incomplete. Therefore, there may be additional historical landslide occurrences. Furthermore, dates were not included for every event. The earliest date reported was 1940. No damage information was provided by NCGS.

TABLE 5.22: SUMMARY OF LANDSLIDE ACTIVITY IN THE BUNCOMBE MADISON REGION

Location	Number of Occurrences
Buncombe County	**152**
Asheville	3
Biltmore Forest	0
Black Mountain	0
Montreat	0
Weaverville	1
Woodfin	0
Unincorporated Area	148
Madison County	**61**
Hot Springs	1
Marshall	0
Mars Hill	0
Unincorporated Area	60
BUNCOMBE MADISON REGION TOTAL	**213**

Source: North Carolina Geological Survey

FIGURE 5.12: LOCATION OF PREVIOUS LANDSLIDE OCCURRENCES IN THE BUNCOMBE MADISON REGION



Source: North Carolina Geological Survey

The National Climatic Data center also reported three landslide events that took place in the Buncombe Madison Region.

Buncombe County — September 8, 2004
Flooding began during the late afternoon across the county and gradually worsened during the evening and overnight hours, with near-record flooding observed along the Swannaoa and French Broad Rivers. Most valley communities across the county were affected by severe flooding along the rivers, or along smaller streams. Flooding along the Swannanoa devastated Asheville's Biltmore area, as well as the Black Mountain and Swannanoa communities. Numerous businesses and residences were damaged or destroyed by flood waters. Widespread damage to roads and bridges also occurred, either due to flooding or landslides. Resulting landslides caused $13,047,732 (2013 dollars) of property damage in Buncombe County.

Buncombe County — September 17, 2004
After many hours of moderate to heavy rainfall, gradual rises on creeks and streams resulted in the second devastating flood across the county in just 9 days. Flooding first began around Candler, but eventually affected every valley community in the county. Flooding was actually more widespread than

during the Frances flood, but was not quite as severe. Virtually every stream in the county flooded, including the French Broad River. Two males, ages 32 and 28, died in Leicester when they attempted to cross a flooded area in a pickup truck. Hundreds of roads were flooded and the bridge over highway 197 in Barnardsville was washed out. The French Broad flooded the studios and other businesses in the River District in downtown Asheville. At Enka, a motel was flooded, which necessitated the rescue of 40 people. Numerous homes were destroyed or severely damaged by flood water or landslides. There was a total of $13,047,732 (2013 dollars) of property damage.

Buncombe County — July 7, 2005
Part of a hillside gave way, damaging the Broad River VFDs building. There was a total of $63,339 (2013 dollars) of property damage.

The information below identifies additional historical information reported in the previous hazard mitigation plans.

Buncombe County
In September 2004, intense rainfall from the remnants of Hurricanes Frances and Ivan triggered at least 400 landslides throughout western North Carolina. Following these events, the NC Department of Environment and Natural Resources (NCDENR) conducted a field study to document the number, location, and extent of previous landslides in Buncombe, Haywood, Henderson, Jackson, Macon, and Watauga Counties. This study revealed 1,253 landslide features throughout Buncombe County (314 landslides and 938 landslide deposit areas). According to a North Carolina Landslide Fact Sheet produced after this study, "…landslide deposits are where significant volumes of unconsolidated soil and rock fragments have accumulated over time from several processes such as debris flows, debris slides, and rock falls. Most mapped deposits are likely prehistoric, but have yet to be verified by modern age-dating techniques."

According to NCDENR data, most recent landslide events include: a storm event in November of 1977 that triggered over 60 debris flows in the Bent Creek area; a debris flow in the Starnes Cove community triggered by the remnants of Hurricane Ivan in September of 2004 that destroyed one home, damaged two vehicles, destroyed the garage of another home, and damaged the road; and a rockslide that caused significant damage to the Broad River Fire Department in July of 2005 during the remnants of Tropical Storm Cindy. The debris deposit volume from the 2004 Starnes Cove event was estimated to be 7,500 to 10,000 cubic yards of earthen material. The volume estimate did not include debris from the damaged and destroyed structures. Volume estimates were not available for the 1977 and 2005 events.

Madison County
Although Madison County is susceptible to large landslides, there have been no major occurrences. Small landslides (10 to 40 cubic yards) are occasional during times of higher than normal precipitation. Data shows that landslides have resulted in the loss of three homes recently in Mars Hill Fire District.

5.12.4 Probability of Future Occurrences

Based on historical information and the USGS susceptibility index, the probability of future landslide events is highly likely (100 percent annual probability). Local conditions may become more favorable for landslides due to heavy rain, for example. This would increase the likelihood of occurrence. It should also be noted that some areas in the Buncombe Madison Region have greater risk than others given factors such as steepness on slope and modification of slopes.

Hydrologic Hazards

5.13 DAM AND LEVEE FAILURE

5.13.1 Background

Worldwide interest in dam and levee safety has risen significantly in recent years. Aging infrastructure, new hydrologic information, and population growth in floodplain areas downstream from dams and near levees have resulted in an increased emphasis on safety, operation, and maintenance.

There are approximately 80,000 dams in the United States today, the majority of which are privately owned. Other owners include state and local authorities, public utilities, and federal agencies. The benefits of dams are numerous: they provide water for drinking, navigation, and agricultural irrigation. Dams also provide hydroelectric power, create lakes for fishing and recreation, and save lives by preventing or reducing floods.

Though dams have many benefits, they also can pose a risk to communities if not designed, operated, and maintained properly. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and great property damage if development exists downstream. If a levee breaks, scores of properties may become submerged in floodwaters and residents may become trapped by rapidly rising water. The failure of dams and levees has the potential to place large numbers of people and great amounts of property in harm's way.

5.13.2 Location and Spatial Extent

The North Carolina Division of Land Resources provides information on dams, including a hazard potential classification. There are three hazard classifications—high, intermediate, and low—that correspond to qualitative descriptions and quantitative guidelines. **Table 5.23** explains these classifications.

TABLE 5.23: NORTH CAROLINA DAM HAZARD CLASSIFICATIONS

Hazard Classification	Description	Quantitative Guidelines
Low	Interruption of road service, low volume roads	Less than 25 vehicles per day
	Economic damage	Less than $30,000
Intermediate	Damage to highways, Interruption of service	25 to less than 250 vehicles per day
	Economic damage	$30,000 to less than $200,000
High	Loss of human life*	Probable loss of 1 or more human lives
	Economic damage	More than $200,000
	*Probable loss of human life due to breached roadway or bridge on or below the dam.	250 or more vehicles per day

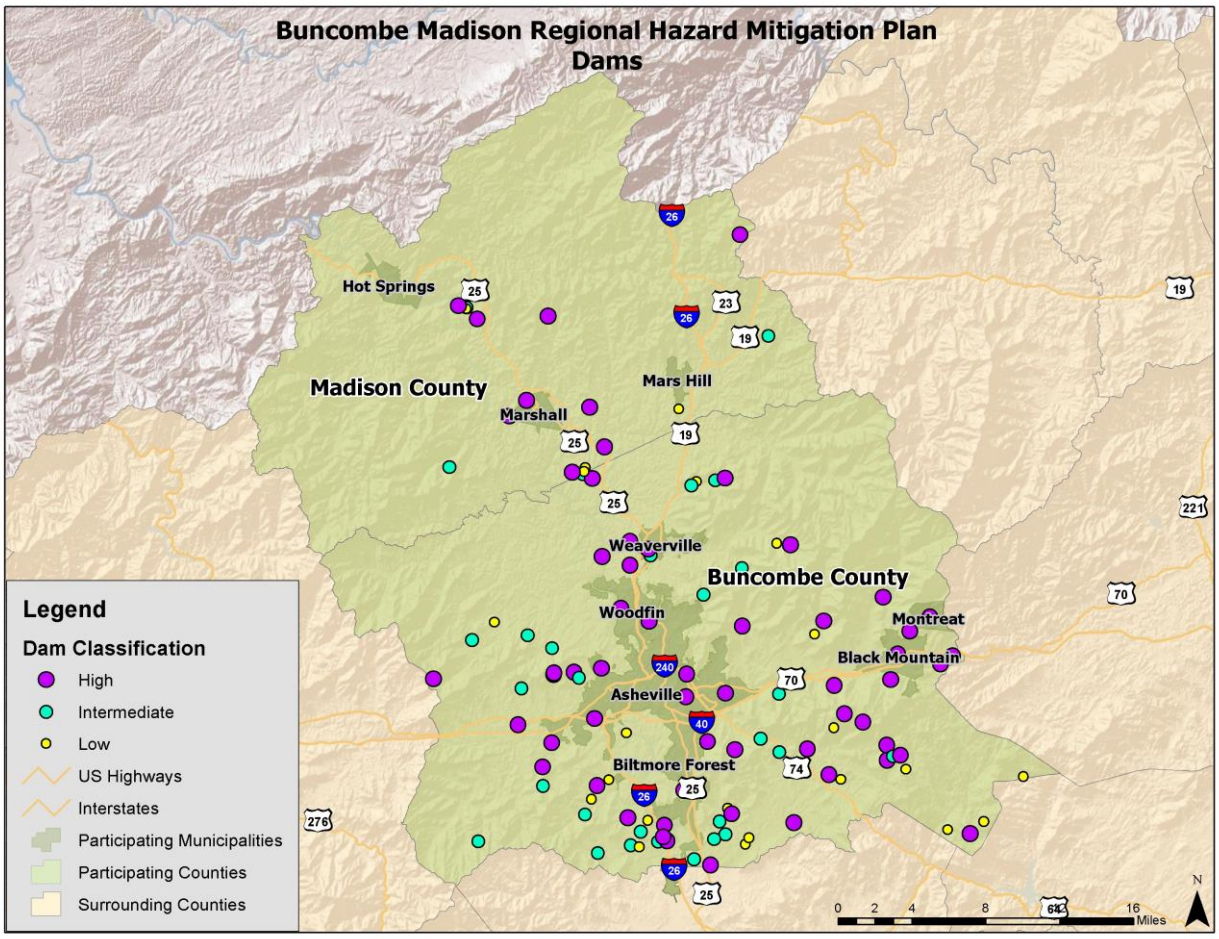
Source: North Carolina Division of Land Resources

According to the North Carolina Division of Energy, Mineral, and Land Resources, there are 112 dams in the Buncombe Madison Region with 96 in Buncombe County and only 16 in Madison County.[21] **Figure 5.13** shows the dam location and the corresponding hazard ranking for each. Of these dams, 59 are classified as high hazard potential. These high hazard dams are summarized by county in **Table 5.24** and more detailed information for each dam is listed in the jurisdiction-specific annexes.

TABLE 5.24: SUMMARY OF HIGH HAZARD DAM LOCATION

Location	Number High Hazard Dams
Buncombe County	50
Madison County	9
BUNCOMBE MADISON REGION TOTAL	**59**

FIGURE 5.13: BUNCOMBE MADISON REGION DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources, 2012

[21] The February 8, 2012 list of high hazard dams obtained from the North Carolina Division of Energy, Mineral, and Land Resources (http://portal.ncdenr.org/web/lr/dams) was reviewed and amended by local officials to the best of their knowledge.

It should also be noted that dam regulations for classifying dams was recently changed. As a result, generally more dams are classified as high hazard.

(Taken from previous Buncombe County hazard mitigation plan.) The highest level of risk [of a dam failure] is along the Swannanoa River below the Bee Tree and North Fork Dams. This area extends along US 70 Highway from Swannanoa to Biltmore. In a breech involving the ¾ Probable Maximum Precipitation the maximum flood depth within the inundation area would be 58.5 feet. These dams have the greatest impoundment and, therefore, larger inundation areas. It is possible that a dam failure having limited impact over a small area could occur.

5.13.3 Historical Occurrences

The only dam failure to cause significant damage occurred when Bear Wallow Dam along Newfound Creek in Buncombe County failed on February 22, 1976. The private earthen dam broke, destroying one home and killing a family of four. There is no record of additional significant dam failures in the region; however, several breach scenarios in the area could be catastrophic.

5.13.4 Probability of Future Occurrence

Given the current dam inventory and historic data, a dam breach is unlikely (less than 1 percent annual probability) in the future. However, as has been demonstrated in the past, regular monitoring is necessary to prevent these events. No further analysis will be completed in Section 6: *Vulnerability Assessment* as more sophisticated dam breach plans (typically completed by the U.S. Army Corp of Engineers) have been completed for dams of concern in the region.

5.14 EROSION

5.14.1 Background

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

There are two types of soil erosion: wind erosion and water erosion. Wind erosion can cause significant soil loss. Winds blowing across sparsely vegetated or disturbed land can pick up soil particles and carry them through the air, thus displacing them. Water erosion can occur over land or in streams and channels. Water erosion that takes place over land may result from raindrops, shallow sheets of water flowing off the land, or shallow surface flow, which becomes concentrated in low spots. Stream channel erosion may occur as the volume and velocity of water flow increases enough to cause movement of the streambed and bank soils. Major storms, such hurricanes in coastal areas, may cause significant erosion by combining high winds with heavy surf and storm surge to significantly impact the shoreline.

An area's potential for erosion is determined by four factors: soil characteristics, vegetative cover, topography climate or rainfall, and topography. Soils composed of a large percentage of silt and fine sand are most susceptible to erosion. As the clay and organic content of these soils increases, the potential for erosion decreases. Well-drained and well-graded gravels and gravel-sand mixtures are the least likely to erode. Coarse gravel soils are highly permeable and have a good capacity for absorption,

which can prevent or delay the amount of surface runoff. Vegetative cover can be very helpful in controlling erosion by shielding the soil surface from falling rain, absorbing water from the soil, and slowing the velocity of runoff. Runoff is also affected by the topography of the area including size, shape, and slope. The greater the slope length and gradient, the more potential an area has for erosion. Climate can affect the amount of runoff, especially the frequency, intensity, and duration of rainfall and storms. When rainstorms are frequent, intense, or of long duration, erosion risks are high. Seasonal changes in temperature and rainfall amounts define the period of highest erosion risk of the year.

During the past 20 years, the importance of erosion control has gained the increased attention of the public. Implementation of erosion control measures consistent with sound agricultural and construction operations is needed to minimize the adverse effects associated with harmful chemicals run-off due to wind or water events. The increase in government regulatory programs and public concern has resulted in a wide range of erosion control products, techniques, and analytical methodologies in the United States. The preferred method of erosion control in recent years has been the restoration of vegetation.

5.14.2 Location and Spatial Extent

Erosion in the Buncombe Madison Region is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine grained particles such as sand, Buncombe Madison soils have much greater organic matter content. Furthermore, extensive vegetation also helps to prevent erosion in the area. Erosion occurs in the Buncombe Madison Region, particularly along the banks of rivers and streams, but it is not an extreme threat to any of the participating counties and jurisdictions. No areas of concern were reported by the planning team.

5.14.3 Historical Occurrences

Several sources were vetted to identify areas of erosion in the Buncombe Madison Region. This includes searching local newspapers, interviewing local officials, and reviewing previous hazard mitigation plans. Little information could be found and erosion was not addressed in the previous Buncombe County and Madison County hazard mitigation plans.

5.14.4 Probability of Future Occurrences

Erosion remains a natural, dynamic, and continuous process for the Buncombe Madison Region, and it will continue to occur. The annual probability level assigned for erosion is possible (between 1 and 10 percent). However, given the lack of historical events, location, data, and threat to life or property, no further analysis will be done in Section 6: *Vulnerability Assessment*.

5.15 FLOOD

5.15.1 Background

Flooding is the most frequent and costly natural hazard in the United States and is a hazard that has caused more than 10,000 deaths since 1900. Nearly 90 percent of presidential disaster declarations result from natural events where flooding was a major component.

Floods generally result from excessive precipitation and can be classified under two categories: general floods, precipitation over a given river basin for a long period of time along with storm-induced wave action, and flash floods, the product of heavy localized precipitation in a short time period over a given location. The severity of a flooding event is typically determined by a combination of several major factors, including stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions, and the degree of vegetative clearing and impervious surface.

General floods are usually long-term events that may last for several days. The primary types of general flooding include riverine, coastal, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, and other large coastal storms. Urban flooding occurs where manmade development has obstructed the natural flow of water and decreased the ability of natural groundcover to absorb and retain surface water runoff.

Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. However, flash flooding events may also occur from a dam or levee failure within minutes or hours of heavy amounts of rainfall or from a sudden release of water held by a retention basin or other stormwater control facility. Although flash flooding occurs most often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces.

The periodic flooding of lands adjacent to rivers, streams, and shorelines (land known as a floodplain) is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will be covered by the 10-year flood and the 100-year floodplain by the 100-year flood. Flood frequencies, such as the 100-year flood, are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1 percent chance of occurring in any given year and the 500-year flood has a 0.2 percent chance of occurring in any given year.

5.15.2 Location and Spatial Extent

There are areas in the Buncombe Madison Region that are susceptible to flood events. Special flood hazard areas in the Buncombe Madison Region were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM).[22] This includes Zone A (1-percent annual chance floodplain), Zone AE (1-percent annual chance floodplain with elevation), and Zone X500 (0.2-percent annual chance floodplain). According to GIS analysis, of the 1,111 square miles that make up the Buncombe Madison Region, there are 31.3 square miles of land in zones A and AE (1-percent annual

[22] The county-level DFIRM data used for both Buncombe County and Madison County was updated in 2011.

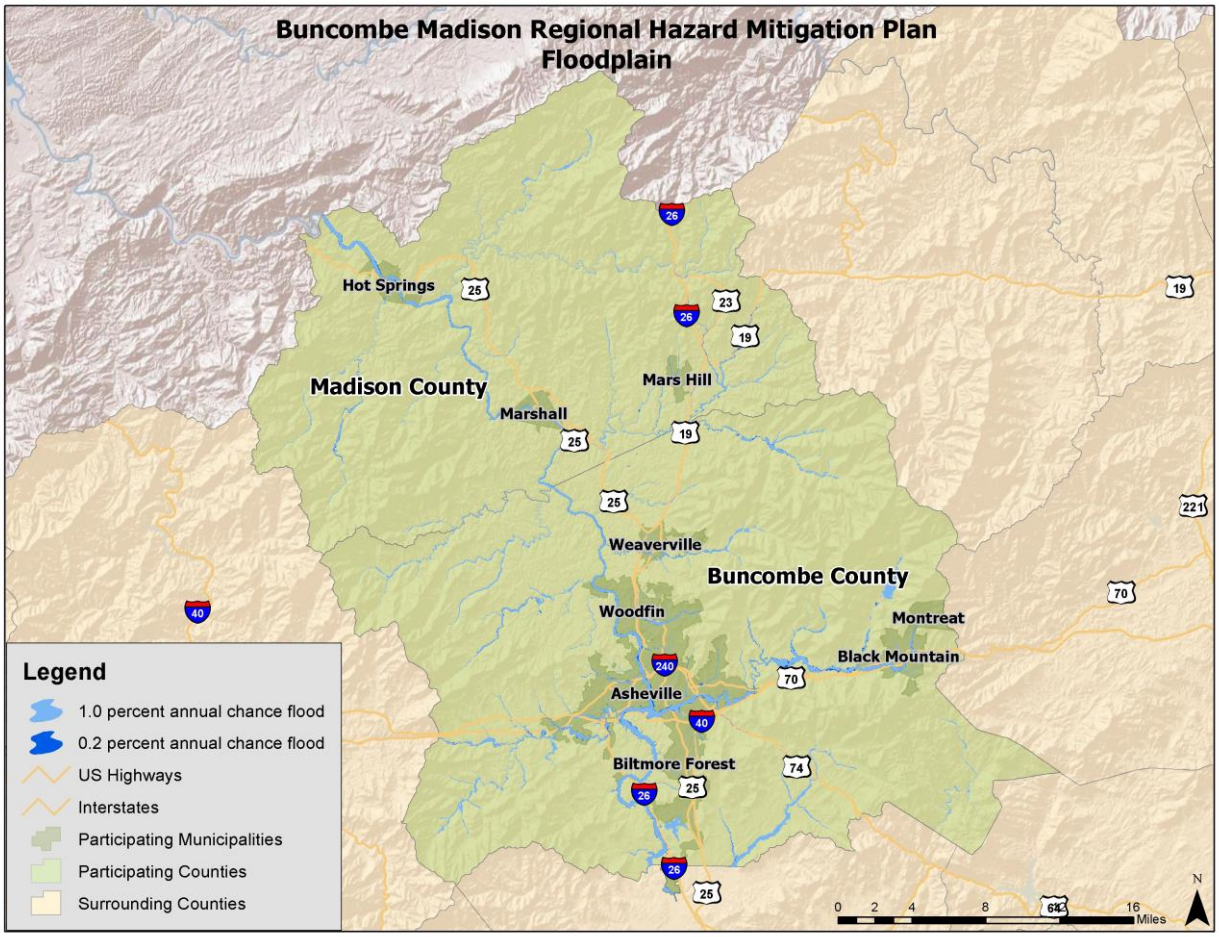
chance floodplain/100-year floodplain) and 3.0 square miles of land in zone X500 (0.2-percent annual chance floodplain/500-year floodplain). The county totals are presented below in **Table 5.25**.

TABLE 5.25: SUMMARY OF FLOODPLAIN AREAS IN THE BUNCOMBE MADISON REGION

Location	100-year area (square miles)	500-year area (square miles)
Buncombe County	22.21	2.16
Madison County	9.11	0.84
BUNCOMBE MADISON REGION TOTAL	**31.32**	**3.00**

These flood zone values account for 3.1 percent of the total land area in the Buncombe Madison Region. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas. **Figure 5.14** illustrates the location and extent of currently mapped special flood hazard areas for the Buncombe Madison Region based on best available FEMA DFIRM data.

FIGURE 5.14: SPECIAL FLOOD HAZARD AREAS IN THE BUNCOMBE MADISON REGION



Source: Federal Emergency Management Agency

Additional, more detailed county-level and jurisdiction-level maps can be found in the annexes.

5.15.3 Historical Occurrences

Flooding has resulted in five disaster declarations in the Buncombe Madison Region.[23] Information from the National Climatic Data Center was used to ascertain additional historical flood events. The National Climatic Data Center reported a total of 62 events throughout the Buncombe Madison Region since 1993.[24] A summary of these events is presented in **Table 5.26**. These events accounted for over $128.1 million (2013 dollars) in property damage throughout the region.[25] Specific information on flood events for each county, including date, type of flooding, and deaths and injuries, can be found in the jurisdiction-specific annexes.

TABLE 5.26: SUMMARY OF FLOOD OCCURRENCES IN THE BUNCOMBE MADISON REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Buncombe County	**25**	**2/0**	**$107,580,059**
Asheville	3	0/0	$13,842
Biltmore Forest	0	0/0	$0
Black Mountain	0	0/0	$0
Montreat	0	0/0	$0
Weaverville	3	0/0	$20,600
Woodfin	0	0/0	$0
Unincorporated Area	19	2/0	$107,545,617
Madison County	**37**	**1/2**	**$20,521,789**
Hot Springs	2	0/0	$0
Marshall	14	0/0	$4,038,229
Mars Hill	2	0/0	$0
Unincorporated Area	19	1/2	$16,483,560
BUNCOMBE MADISON REGION TOTAL	**62**	**3/2**	**$128,101,848**

Source: National Climatic Data Center

5.15.4 Historical Summary of Insured Flood Losses

According to FEMA flood insurance policy records as of July 2013, there have been 421 flood losses reported in the Buncombe Madison Region through the National Flood Insurance Program (NFIP) since 1978, totaling more than $18.1 million in claims payments. A summary of these figures for each Buncombe Madison county is provided in **Table 5.27**. It should be emphasized that these numbers include only those losses to structures that were insured through the NFIP policies, and for losses in which claims were sought and received. It is likely that many additional instances of flood loss in the Buncombe Madison Region were either uninsured, denied claims payment, or not reported.

[23] Not all of the participating counties were declared disaster areas for these events. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Profiles*.
[24] These events are only inclusive of those reported by NCDC. It is likely that additional occurrences have occurred and have gone unreported.
[25] The total damage amount was averaged over the number of affected counties when multiple counties were involved in the flood event.

TABLE 5.27: SUMMARY OF INSURED FLOOD LOSSES IN THE BUNCOMBE MADISON REGION

Location	Flood Losses	Claims Payments
Buncombe County	**373**	**$17,187,134**
Asheville	227	$13,850,453
Biltmore Forest	0	$0
Black Mountain	12	$35,989
Montreat	0	$0
Weaverville	0	$0
Woodfin	1	$1,008
Unincorporated Area	133	$3,299,684
Madison County	**48**	**$936,445**
Hot Springs	1	$2,361
Marshall	36	$517,815
Mars Hill	0	$0
Unincorporated Area	11	$416,269
BUNCOMBE MADISON REGION TOTAL	**421**	**$18,123,579**

Source: Federal Emergency Management Agency, National Flood Insurance Program

5.15.5 Repetitive Loss Properties

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Currently there are over 140,000 repetitive loss properties nationwide.

Currently (as of November 2013), there are 31 non-mitigated repetitive loss properties located in the Buncombe Madison Region, which accounted for 78 losses and more than $4.5 million in claims payments under the NFIP. The average claim amount for these properties is $58,402. Twenty-four of the thirty-one properties are commercial, 4 are institutional, and 4 multi-family residential. Without mitigation these properties will likely continue to experience flood losses. **Table 5.28** presents a summary of these figures for the Buncombe Madison Region. Detailed information on repetitive loss properties and NFIP claims and policies can be found in the jurisdiction-specific annexes.

TABLE 5.28: SUMMARY OF REPETITIVE LOSS PROPERTIES IN THE BUNCOMBE MADISON REGION

Location	Number of Properties	Number of Losses	Total Payments
Buncombe County	**27**	**64**	**$4,432,655.45**
Asheville	27	64	$4,432,655.45
Biltmore Forest	0	0	$0
Black Mountain	0	0	$0
Montreat	0	0	$0
Weaverville	0	0	$0
Woodfin	0	0	$0
Unincorporated Area	0	0	$0
Madison County	**4**	**14**	**$122,726.03**
Hot Springs	0	0	$0
Marhsall	4	14	$122,726.03

Location	Number of Properties	Number of Losses	Total Payments
Mars Hill	0	0	$0
Unincorporated Area	0	0	$0
BUNCOMBE MADISON REGION TOTAL	**31**	**78**	**$4,555,381.48**

Source: National Flood Insurance Program

5.15.6 Probability of Future Occurrences

Flood events will remain a threat in the Buncombe Madison Region, and the probability of future occurrences will remain likely (between 10 and 100 percent annual probability). The probability of future flood events based on magnitude and according to best available data is illustrated in the figures above**,** which indicates those areas susceptible to the 1-percent annual chance flood (100-year floodplain) and the 0.2-percent annual chance flood (500-year floodplain).

Other Hazards

5.16 HAZARDOUS MATERIALS INCIDENTS

5.16.1 Background

Hazardous materials can be found in many forms and quantities that can potentially cause death; serious injury; long-lasting health effects; and damage to buildings, homes, and other property in varying degrees. Such materials are routinely used and stored in many homes and businesses and are also shipped daily on the nation's highways, railroads, waterways, and pipelines. This subsection on the hazardous material hazard is intended to provide a general overview of the hazard, and the threshold for identifying fixed and mobile sources of hazardous materials is limited to general information on rail, highway, and FEMA-identified fixed HAZMAT sites determined to be of greatest significance as appropriate for the purposes of this plan.

Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the nation's highways, and on the water. Approximately 6,774 HAZMAT events occur each year, 5,517 of which are highway incidents, 991 are railroad incidents, and 266 are due to other causes.[26] In essence, HAZMAT incidents consist of solid, liquid, and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind, and possibly wildlife as well.

HAZMAT incidents can also occur as a result of or in tandem with natural hazard events, such as floods, hurricanes, tornadoes, and earthquakes, which in addition to causing incidents can also hinder response efforts. In the case of Hurricane Floyd in September 1999, communities along the Eastern United States were faced with flooded junkyards, disturbed cemeteries, deceased livestock, floating propane tanks,

[26] FEMA, 1997.

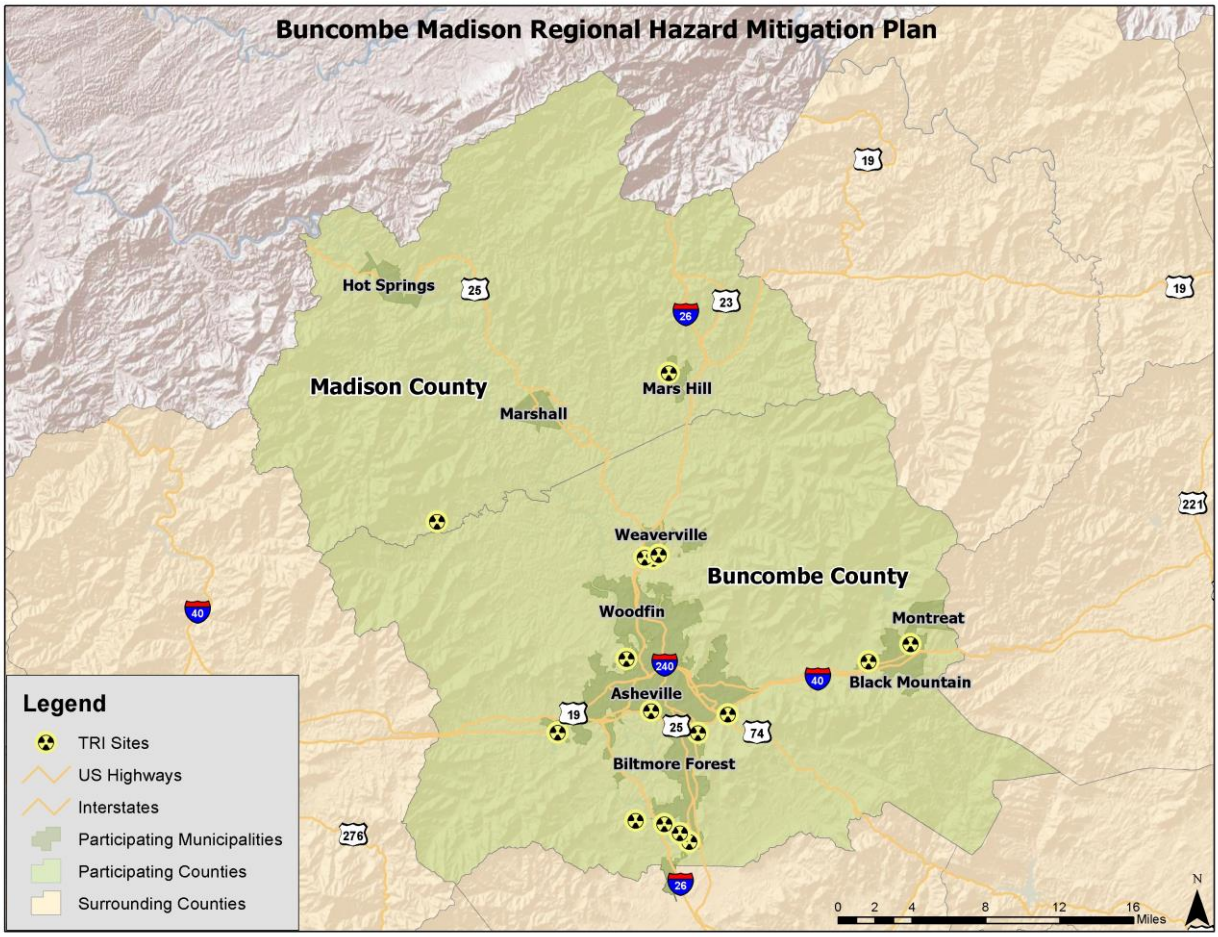
uncontrolled fertilizer spills, and a variety of other environmental pollutants that caused widespread toxological concern.

Hazardous material incidents can include the spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment of a hazardous material, but exclude: (1) any release which results in exposure to poisons solely within the workplace with respect to claims which such persons may assert against the employer of such persons; (2) emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel or pipeline pumping station engine; (3) release of source, byproduct, or special nuclear material from a nuclear incident; and (4) the normal application of fertilizer.

5.16.2 Location and Spatial Extent

As a result of the 1986 Emergency Planning and Community Right to Know Act (EPCRA), the Environmental Protection Agency provides public information on hazardous materials. One facet of this program is to collect information from industrial facilities on the releases and transfers of certain toxic agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where such activity is occurring. The Buncombe Madison Region has 19 TRI sites. These sites are shown in **Figure 5.15.**

FIGURE 5.15: TOXIC RELEASE INVENTORY (TRI) SITES IN THE BUNCOMBE MADISON REGION



Source: Environmental Protection Agency

In addition to "fixed" hazardous materials locations, hazardous materials may also impact the region via roadways and rail. Many roads in the region are narrow and winding, making hazardous material transport in the area especially treacherous. All roads that permit hazardous material transport are considered potentially at risk to an incident.

5.16.3 Historical Occurrences

The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) lists historical occurrences throughout the nation. A "serious incident" (highlighted in yellow in **Table 5.37** below) is a hazardous materials incident that involves:

- a fatality or major injury caused by the release of a hazardous material,
- the evacuation of 25 or more persons as a result of release of a hazardous material or exposure to fire,
- a release or exposure to fire which results in the closure of a major transportation artery,
- the alteration of an aircraft flight plan or operation,
- the release of radioactive materials from Type B packaging,

- the release of over 11.9 galls or 88.2 pounds of a severe marine pollutant, or
- the release of a bulk quantity (over 199 gallons or 882 pounds) of a hazardous material.

However, prior to 2002, a hazardous materials "serious incident" was defined as follows:

- a fatality or major injury due to a hazardous material,
- closure of a major transportation artery or facility or evacuation of six or more person due to the presence of hazardous material, or
- a vehicle accident or derailment resulting in the release of a hazardous material.

Table 5.29 summarizes the HAZMAT incidents reported in the Buncombe Madison Region. Detailed information on these events is presented in the jurisdiction-specific annexes.

TABLE 5.29: SUMMARY OF HAZMAT INCIDENTS IN THE BUNCOMBE MADISON REGION

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Buncombe County	**20**	**0/0**	**$0**
Asheville	18	0/0	$0
Biltmore Forest	0	0/0	$0
Black Mountain	0	0/0	$0
Montreat	0	0/0	$0
Weaverville	0	0/0	$0
Woodfin	0	0/0	$0
Unincorporated Area	2	0/0	$0
Madison County	**1**	**0/0**	**$0**
Hot Springs	0	0/0	$0
Marshall	0	0/0	$0
Mars Hill	1	0/0	$0
Unincorporated Area	0	0/0	$0
BUNCOMBE MADISON REGION TOTAL	**21**	**0/0**	**$0**

Source: United States Department of Transportation Pipeline and Hazardous Materials Safety Administration

5.16.4 Probability of Future Occurrence

Given the location of 19 toxic release inventory sites in the Buncombe Madison Region and several serious roadway incidents, it is possible that a hazardous material incident may occur in the region (between 1 and 10 percent annual probability). County and municipal officials are mindful of this possibility and take precautions to prevent such an event from occurring. Furthermore, there are detailed plans in place to respond to an occurrence.

5.17 WILDFIRE

5.17.1 Background

A wildfire is any outdoor fire (i.e. grassland, forest, brush land) that is not under control, supervised, or prescribed.[27] Wildfires are part of the natural management of forest ecosystems, but may also be caused by human factors.

Nationally, over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning. In North Carolina, a majority of fires are caused by debris burning.

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

Wildfire probability depends on local weather conditions, outdoor activities such as camping, debris burning, and construction, and the degree of public cooperation with fire prevention measures. Drought conditions and other natural hazards (such as tornadoes, hurricanes, etc.) increase the probability of wildfires by producing fuel in both urban and rural settings.

Many individual homes and cabins, subdivisions, resorts, recreational areas, organizational camps, businesses, and industries are located within high wildfire hazard areas. Furthermore, the increasing demand for outdoor recreation places more people in wildlands during holidays, weekends, and vacation periods. Unfortunately, wildland residents and visitors are rarely educated or prepared for wildfire events that can sweep through the brush and timber and destroy property within minutes.

Wildfires can result in severe economic losses as well. Businesses that depend on timber, such as paper mills and lumber companies, experience losses that are often passed along to consumers through higher prices and sometimes jobs are lost. The high cost of responding to and recovering from wildfires can deplete state resources and increase insurance rates. The economic impact of wildfires can also be felt in the tourism industry if roads and tourist attractions are closed due to health and safety concerns.

State and local governments can impose fire safety regulations on home sites and developments to help curb wildfire. Land treatment measures such as fire access roads, water storage, helipads, safety zones, buffers, firebreaks, fuel breaks, and fuel management can be designed as part of an overall fire defense system to aid in fire control. Fuel management, prescribed burning, and cooperative land management planning can also be encouraged to reduce fire hazards.

[27] Prescription burning, or "controlled burn," undertaken by land management agencies is the process of igniting fires under selected conditions, in accordance with strict parameters.

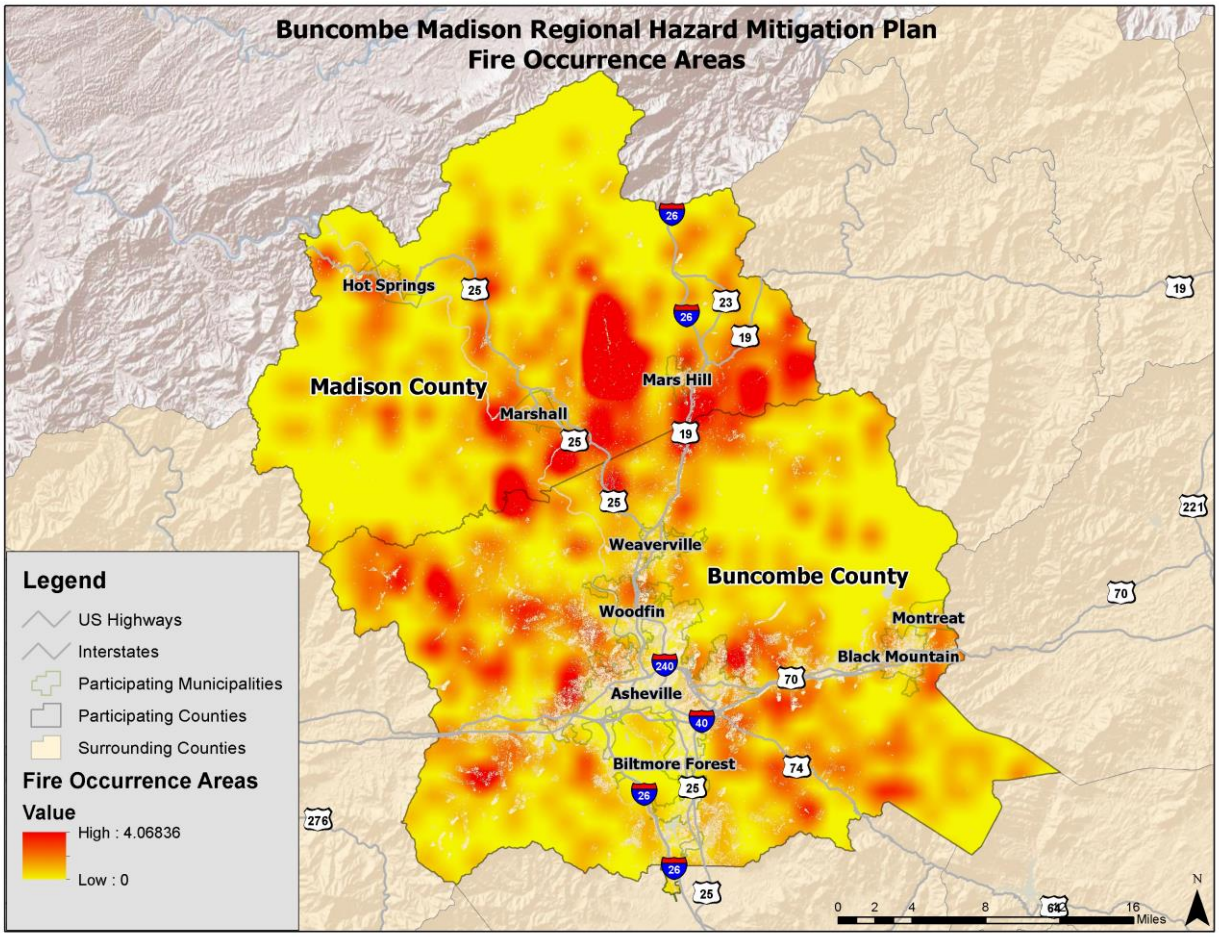
5.17.2 Location and Spatial Extent

The entire region is at risk to a wildfire occurrence. However, several factors such as drought conditions or high levels of fuel on the forest floor, may make a wildfire more likely. Furthermore, areas in the urban-wildland interface are particularly susceptible to fire hazard as populations abut formerly undeveloped areas. The Fire Occurrence Areas in the figure below give an indication of historic locations impacted.

5.17.3 Historical Occurrences

Figure 5.16 shows the Fire Occurrence Areas (FOA) in the Buncombe Madison Region based on data from the Southern Wildfire Risk Assessment. This data is based on historical fire ignitions and is reported as the number of fires that occur per 1,000 acres each year.

FIGURE 5.16: HISTORIC WILDFIRE EVENTS IN THE BUNCOMBE MADISON REGION



Source: Southern Wildfire Risk Assessment

Based on data from the North Carolina Division of Forest Resources from 2003 to 2012, the Buncombe Madison Region experiences an average of 105 wildfires annually which burn a combined 455 acres, on

average. The data indicates that most of these fires are small, averaging four acres per fire. **Table 5.30** provides a summary table for wildfire occurrences in the Buncombe Madison Region.

TABLE 5.30: SUMMARY TABLE OF ANNUAL WILDFIRE OCCURRENCES (2003-2012)*

	Buncombe County	Madison County	Buncombe Madison Region
Average Number of Fires per year	53.8	51.5	105.3
Average Number of Acres Burned per year	170.6	283.9	454.6
Average Number of Acres Burned per fire	3	6	4

5.17.4 Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in the Buncombe Madison Region. The likelihood of wildfires increases during drought cycles and abnormally dry conditions. Fires are likely to stay small in size but could increase due local climate and ground conditions. Dry, windy conditions with an accumulation of forest floor fuel (potentially due to ice storms or lack of fire) could create conditions for a large fire that spreads quickly. It should also be noted that some areas do vary somewhat in risk. For example, highly developed areas are less susceptible unless they are located near the urban-wildland boundary. The risk will also vary due to assets. Areas in the urban-wildland interface will have much more property at risk, resulting in increased vulnerability and need to mitigate, compared to rural, mainly forested areas. The probability assigned to the Buncombe Madison Region for future wildfire events is likely (10 to 100 percent annual probability).

5.18 CONCLUSIONS ON HAZARD RISK

The hazard profiles presented in this section were developed using best available data and result in what may be considered principally a qualitative assessment as recommended by FEMA in its "How-to" guidance document titled *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA Publication 386-2). It relies heavily on historical and anecdotal data, stakeholder input, and professional and experienced judgment regarding observed and/or anticipated hazard impacts. It also carefully considers the findings in other relevant plans, studies, and technical reports.

5.18.1 Hazard Extent

Table 5.31 describes the extent of each natural hazard identified for the Buncombe Madison Region. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE 5.31: EXTENT OF BUNCOMBE MADISON REGION HAZARDS

Atmospheric Hazards	
Drought	Drought extent is defined by the North Carolina Drought Monitor Classifications which include Abnormally Dry, Moderate Drought, Severe Drought, Extreme Drought, and Exceptional Drought (page 5:6). According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Each of the participating jurisdictions has received this ranking (three times) over the fourteen-year reporting period.
Extreme Heat	The extent of extreme heat can be defined by the maximum temperature reached. The highest temperature recorded in the Buncombe Madison Region is 105 degrees Fahrenheit reported on June 30, 1936. • Buncombe County: 103°F • Madison County: 105°F
Hailstorm	Hail extent can be defined by the size of the hail stone. The largest hail stone reported in the Buncombe Madison Region was 2.0 inches (reported on April 16, 1998). It should be noted that future events may exceed this. • Buncombe County: 2.0 inches • Madison County: 1.75 inches
Hurricane and Tropical Storm	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5 (Table 5.9). The greatest classification of hurricane to traverse directly through the Buncombe Madison Region was Unnamed 1901 Storm which carried tropical force winds of 31 knots upon arrival in Buncombe County. The following list the greatest extent of hurricane winds to pass through the area, though it should be noted that stronger storms could impact the region without a direct hit: • Buncombe County: Unnamed 1901 Storm, Tropical Depression (31 knots) • Madison County: One-C (1985), Tropical Depression (22 knots)
Lightning	According to the Vaisala flash density map (Figure 5.5), the Buncombe Madison Region is located in an area that experiences 2 to 4 lightning flashes per square kilometer per year. It should be noted that future lightning occurrences may exceed these figures.
Thunderstorm Wind / High Wind	Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Climatic Data Center, the strongest recorded wind event in the Buncombe Madison Region was reported on May 5, 2009 at 75 knots (approximately 86 mph). It should be noted that future events may exceed these historical occurrences. • Buncombe County: 75 knots • Madison County: 65 knots
Tornado	Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA (Figure 5.6) as well as the Fujita/Enhanced Fujita Scale (Tables 5.14 and 5.15). The greatest magnitude reported was an F1 (last reported on May 6, 1999). • Buncombe County: F1 • Madison County: F1

Winter Storm and Freeze	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall reported in the region was 22 inches reported on March 14, 1993. Due to extreme variations in elevation throughout the region, extent totals will vary for each participating jurisdiction and reliable data on snowfall totals is not available. • Buncombe County: 20 inches • Madison County: 22 inches
Geologic Hazards	
Earthquake	Earthquake extent can be measured by the Richter Scale (Table 5.18) and the Modified Mercalli Intensity (MMI) scale (Table 5.19) and the distance of the epicenter from the Buncombe Madison Region. According to data provided by the National Geophysical Data Center, the greatest MMI to impact the region was VI (slightly strong) with a correlating Richter Scale measurement of approximately 5.4 (last reported on July 2, 1957). The epicenter of this earthquake was located between 3 and 44 km away. • Buncombe County: V1; 3 km to epicenter • Madison County: VI; 37 km to epicenter
Landslide	As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is high throughout the northwestern portion of the region and moderate in southeastern portion of the region. There is also high susceptibility throughout the entire region.
Hydrologic Hazards	
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria (Table 5.23). Of the 112 dams in the Buncombe Madison Region, 59 are classified as high-hazard. • Buncombe County: 50 high hazard dams • Madison County: 9 high hazard dams
Erosion	The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records available for the Buncombe Madison Region.

Flood

Flood extent can be measured by the amount of land and property in the floodplain as well as flood height and velocity. The amount of land in the floodplain accounts for 3.1 percent of the total land area in the Buncombe Madison Region.

Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gage does not exist for each participating jurisdiction, there is one at or near many areas. The greatest peak discharge recorded for the region was reported on July 16, 1916. Water reached a discharge of 115,000 cubic feet per second and the stream gage height was recorded at 22.00 feet. Additional peak discharge readings and gage heights are in the table below.

Location/Jurisdiction	Date	Peak Discharge (cfs)	Gage Height (ft)
Buncombe County			
French Broad River at Asheville, NC	7/16/1916	110,000	23.10
Swannanoa River at Biltmore, NC	7/16/1916	23,000	20.70
Swannanoa River at Interstate 40 at Black Mtn, NC	6/11/2009	306	3.71
Madison County			
French Broad River at Hot Springs, NC	7/16/1916	110,000	22.00
French Broad River at Marshall, NC	7/16/1916	115,000	22.00

Other Hazards

Hazardous Materials Incident

According to USDOT PHMSA, the largest hazardous materials incident reported in the region was 112.5 LGA released on the highway on November 23, 1992. It should be noted that larger events are possible.

- Buncombe County: 112.5 LGA
- Madison County: 0 LGA

Wildfire	Wildfire data was provided by the North Carolina Division of Forest Resources and is reported annually by county from 2003-2012. Analyzing the data by county indicates the following wildfire hazard extent for each county. ***Buncombe County*** • The greatest number of fires to occur in any year was 82 in 2006. • The greatest number of acres to burn in a single year occurred in 2007 when 402 acres were burned. ***Madison County*** • The greatest number of fires to occur in any year was 84 in 2007. • The greatest number of acres to burn in a single year occurred in 2007 when 793 acres were burned. Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout the region.

5.18.2 Priority Risk Index

In order to draw some meaningful planning conclusions on hazard risk for the Buncombe Madison Region, the results of the hazard profiling process were used to generate countywide hazard classifications according to a "Priority Risk Index" (PRI). The purpose of the PRI is to categorize and prioritize all potential hazards for the Buncombe Madison Region as high, moderate, or low risk. Combined with the asset inventory and quantitative vulnerability assessment provided in the next section, the summary hazard classifications generated through the use of the PRI allows for the prioritization of those high hazard risks for mitigation planning purposes, and more specifically, the identification of hazard mitigation opportunities for the jurisdictions in the Buncombe Madison Region to consider as part of their proposed mitigation strategy.

The prioritization and categorization of identified hazards for the Buncombe Madison Region is based principally on the PRI, a tool used to measure the degree of risk for identified hazards in a particular planning area. The PRI is used to assist the Buncombe Madison Regional Hazard Mitigation Planning Team in gaining consensus on the determination of those hazards that pose the most significant threat to the Buncombe Madison counties based on a variety of factors. The PRI is not scientifically based, but is rather meant to be utilized as an objective planning tool for classifying and prioritizing hazard risks in the Buncombe Madison Region based on standardized criteria.

The application of the PRI results in numerical values that allow identified hazards to be ranked against one another (the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories for each hazard (probability, impact, spatial extent, warning time, and duration). Each degree of risk has been assigned a value (1 to 4) and an agreed upon weighting factor[28], as summarized in **Table 5.32**. To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final PRI value, as demonstrated in the example equation below:

[28] The Regional Hazard Mitigation Planning Team, based upon any unique concerns or factors for the planning area, may adjust the PRI weighting scheme during future plan updates.

PRI VALUE = [(PROBABILITY x .30) + (IMPACT x .30) + (SPATIAL EXTENT x .20) + (WARNING TIME x .10) + (DURATION x .10)]

According to the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When the scheme is applied for the Buncombe Madison Region, the highest PRI value is 3.3 (winter storm and freeze hazard). Prior to being finalized, PRI values for each identified hazard were reviewed and accepted by the members of the Regional Hazard Mitigation Planning Team.

TABLE 5.32: PRIORITY RISK INDEX FOR THE BUNCOMBE MADISON REGION

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% annual probability	3	
	Highly Likely	100% annual probability	4	
Impact	Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of critical facilities.	1	30%
	Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	
	Critical	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one week.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self explanatory	1	10%
	12 to 24 hours	Self explanatory	2	
	6 to 12 hours	Self explanatory	3	
	Less than 6 hours	Self explanatory	4	
Duration	Less than 6 hours	Self explanatory	1	10%
	Less than 24 hours	Self explanatory	2	
	Less than one week	Self explanatory	3	
	More than one week	Self explanatory	4	

5.18.3 Priority Risk Index Results

Table 5.33 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Regional Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE 5.33: SUMMARY OF PRI RESULTS FOR THE BUNCOMBE MADISON REGION

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Atmospheric Hazards						
Drought	Likely	Minor	Large	More than 24 hours	More than 1 week	**2.5**
Extreme Heat	Unlikely	Minor	Large	More than 24 hours	Less than 1 week	**1.8**
Hailstorm	Highly Likely	Minor	Moderate	Less than 6 hours	Less than 6 hours	**2.6**
Hurricane and Tropical Storm	Possible	Limited	Large	More than 24 hours	Less than 24 hours	**2.3**
Lightning	Highly Likely	Minor	Negligible	Less than 6 hours	Less than 6 hours	**2.2**
Thunderstorm / High Wind	Highly Likely	Critical	Moderate	6 to 12 hours	Less than 6 hours	**3.1**
Tornado	Possible	Critical	Small	Less than 6 hours	Less than 6 hours	**2.4**
Winter Storm and Freeze	Highly Likely	Critical	Large	More than 24 hours	Less than 1 week	**3.3**
Geologic Hazards						
Earthquake	Likely	Minor	Moderate	Less than 6 hours	Less than 6 hours	**2.3**
Landslide	Highly Likely	Critical	Small	Less than 6 hours	Less than 6 hours	**3.0**
Hydrologic Hazards						
Dam and Levee Failure	Unlikely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.3**
Erosion	Possible	Minor	Small	More than 24 hours	More than 1 week	**1.8**
Flood	Likely	Critical	Small	6 to 12 hours	Less than 1 week	**2.8**
Other Hazards						
Hazardous Materials Incident	Possible	Limited	Small	Less than 6 hours	Less than 24 hours	**2.2**
Wildfire	Likely	Minor	Small	Less than 6 hours	Less than 1 week	**2.4**

5.19 FINAL DETERMINATIONS

The conclusions drawn from the hazard profiling process for the Buncombe Madison Region, including the PRI results and input from the Regional Hazard Mitigation Planning Team, resulted in the classification of risk for each identified hazard according to three categories: High Risk, Moderate Risk, and Low Risk (**Table 5.34**). For purposes of these classifications, risk is expressed in relative terms according to the estimated impact that a hazard will have on human life and property throughout all of the Buncombe Madison Region. A more quantitative analysis to estimate potential dollar losses for each hazard has been performed separately, and is described in Section 6: *Vulnerability Assessment*. It should be noted that although some hazards are classified below as posing low risk, their occurrence of

varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

TABLE 5.34: CONCLUSIONS ON HAZARD RISK FOR THE BUNCOMBE MADISON REGION

HIGH RISK	Winter Storm and Freeze Thunderstorm Wind / High Wind Landslide Flood Hailstorm
MODERATE RISK	Drought Tornado Wildfire Hurricane and Tropical Storm Earthquake Dam and Levee Failure
LOW RISK	Lightning Hazardous Material Incident Extreme Heat Erosion

SECTION 6
VULNERABILITY ASSESSMENT

This section identifies and quantifies the vulnerability of the jurisdictions within the Buncombe Madison Region to the significant hazards identified in the previous sections (*Hazard Identification and Profiles*). It consists of the following subsections:

- 6.1 Overview
- 6.2 Methodology
- 6.3 Explanation of Data Sources
- 6.4 Asset Inventory
- 6.5 Vulnerability Assessment Results
- 6.6 Conclusions on Hazard Vulnerability

44 CFR Requirement
44 CFR Part 201.6(c)(2)(ii): The risk assessment shall include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. The description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: (A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; (B) An estimate of the potential losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate; (C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

6.1 OVERVIEW

This section builds upon the information provided in Section 4: *Hazard Identification and* Section 5*: Hazard Profiles* by identifying and characterizing an inventory of assets in the Buncombe Madison Region. In addition, the potential impact and expected amount of damages caused to these assets by each identified hazard event is assessed. The primary objective of the vulnerability assessment is to quantify exposure and the potential loss estimates for each hazard. In doing so, Buncombe and Madison Counties and their participating jurisdictions may better understand their unique risks to identified hazards and be better prepared to evaluate and prioritize specific hazard mitigation actions.

This section begins with an explanation of the methodology applied to complete the vulnerability assessment, followed by a summary description of the asset inventory as compiled for jurisdictions in the Buncombe Madison Region. The remainder of this section focuses on the results of the assessment conducted.

6.2 METHODOLOGY

This vulnerability assessment was conducted using three distinct methodologies: (1) A stochastic risk assessment; (2) a geographic information system (GIS)-based analysis; and (3) a risk modeling software analysis. Each approach provides estimates for the potential impact of hazards by using a common,

systematic framework for evaluation, including historical occurrence information provided in the *Hazard Identification* and *Hazard Profiles* sections. A brief description of the three different approaches is provided on the following pages.

6.2.1 Stochastic Risk Assessment

The stochastic risk assessment methodology was applied to analyze hazards of concern that were outside the scope of hazard risk models and the GIS-based risk assessment. This involves the consideration of annualized loss estimates and impacts of current and future buildings and populations. Annualized loss is the estimated long-term weighted average value of losses to property in any single year in a specified geographic area (i.e., municipal jurisdiction or county). This methodology is applied primarily to hazards that do not have geographically-definable boundaries and are therefore excluded from spatial analysis through GIS. A stochastic risk methodology was used for the following hazards:

- Dam Failure
- Drought
- Erosion
- Extreme Heat
- Hailstorm
- Lightning
- Thunderstorm Wind
- Tornado
- Winter Storm and Freeze

With the exception of Dam Failure and Erosion, the hazards listed above are considered atmospheric and have the potential to affect all current and future buildings and all populations. **Table 6.1** provides information about all improved property in the Buncombe Madison region that is vulnerable to these hazards. For all hazards annualized loss estimates were determined using the best available data on historical losses from sources including NOAA's National Climatic Data Center records, Buncombe Madison Region county-level hazard mitigation plans, and local knowledge. Annualized loss estimates were generated by totaling the amount of property damage over the period of time for which records were available, and calculating the average annual loss. Given the standard weighting analysis, losses can be readily compared across hazards providing an objective approach for evaluating mitigation alternatives.

For the dam failure[1], drought, erosion, and extreme heat, no data with historical property damages was available. Therefore a detailed vulnerability assessment could not be completed for these hazards at this time.

The results for these hazards are found at the end of this section in **Table 6.15**.

[1] As noted in Section 5: *Hazard Profiles*, dam failure could be catastrophic to structures and populations in the inundation area. However, due to lack of data, no additional analysis was performed. Further, local USACE and NCDENR also complete separate dam failure plans to identify risk and response measures.

6.2.2 GIS-Based Analysis

Other hazards have specified geographic boundaries that permit additional analysis using Geographic Information Systems (GIS). These hazards include:

- Flood
- Hazardous Material Incident
- Landslide
- Wildfire

The objective of the GIS-based analysis was to determine the estimated vulnerability of critical facilities and populations for the identified hazards in the Buncombe Madison Region using best available geospatial data. Digital data was collected from local, regional, state, and national sources for hazards and buildings. This included local tax assessor records for individual parcels and buildings and geo-referenced point locations for identified assets (critical facilities and infrastructure, special populations, etc.) when available. ESRI® ArcGIS™ 10.0 was used to assess hazard vulnerability utilizing digital hazard data, as well as local building data. Using these data layers, hazard vulnerability can be quantified by estimating the assessed building value for parcels and/or buildings determined to be located in identified hazard areas. To estimate vulnerable populations in hazard areas, digital Census 2010 data by census tract was obtained. This was intersected with hazard areas to determine exposed population counts. The results of the analysis provided an estimate of the number of people and critical facilities, as well as the assessed value of parcels and improvements, determined to be potentially at risk to those hazards with delineable geographic hazard boundaries.

6.2.3 Risk Modeling Software Analysis

A risk modeling software was used for the following hazards:

- Earthquake
- Hurricane and Tropical Storm

There are several models that exist to model hazards. Hazus-MH was used in this vulnerability assessment to address the aforementioned hazards.

Hazus-MH

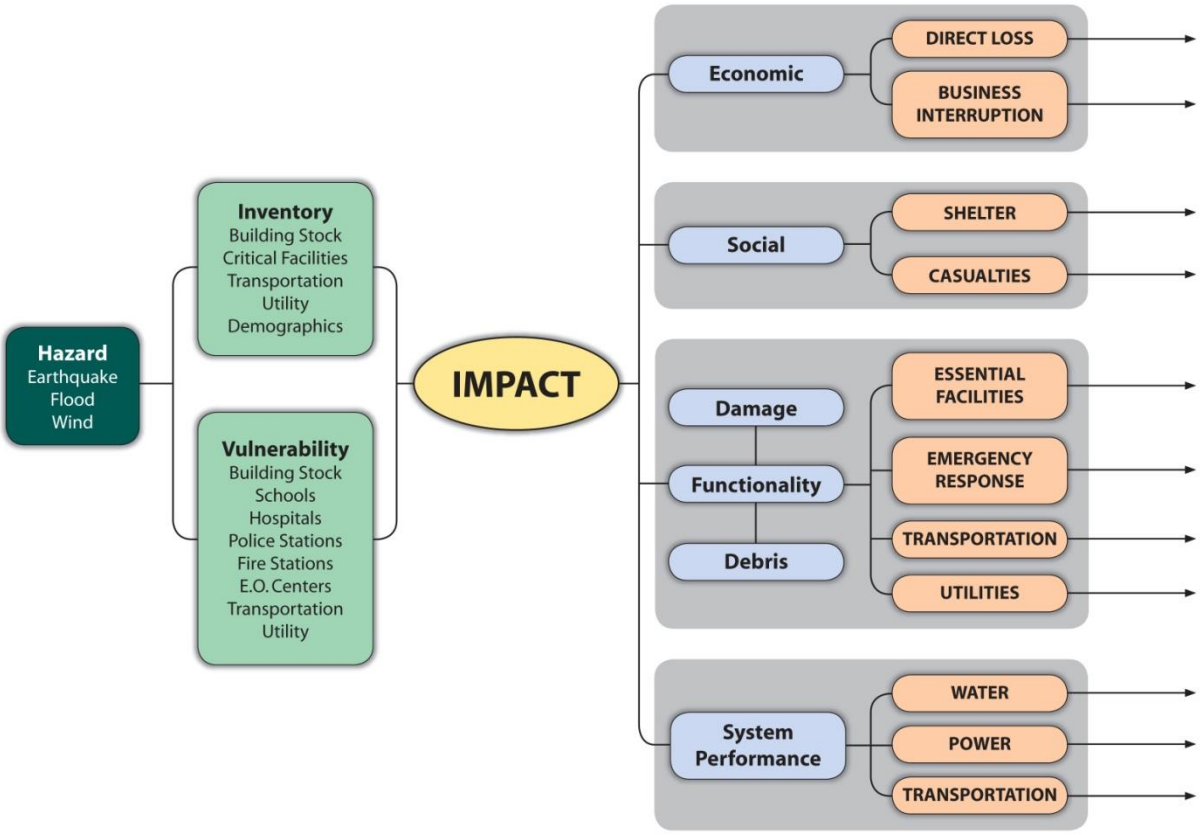
Hazus-MH ("Hazus") is a standardized loss estimation software program developed by FEMA. It is built upon an integrated GIS platform to conduct analysis at a regional level (i.e., not on a structure-by-structure basis). The Hazus risk assessment methodology is parametric, in that distinct hazard and inventory parameters (e.g., wind speed and building types) can be modeled using the software to determine the impact (i.e., damages and losses) on the built environment.

The Buncombe Madison Regional Risk Assessment utilized Hazus-MH to produce hazard damage loss estimations for

hazards for the planning area. At the time this analysis was completed, Hazus-MH 2.1 was used to estimate potential damages from hurricane winds earthquake hazards using Hazus-MH methodology. Although the program can also model losses for flood and storm surge, it was not used in this Risk Assessment.

Figure 6.1 illustrates the conceptual model of the Hazus-MH methodology.

FIGURE 6.1: CONCEPTUAL MODEL OF HAZUS-MH METHODOLOGY



Hazus-MH is capable of providing a variety of loss estimation results. In order to be consistent with other hazard assessments, annualized losses are presented when possible. Some additional results based on location-specific scenarios may also be presented to provide a complete picture of hazard vulnerability.

Loss estimates provided in this vulnerability assessment are based on best available data and methodologies. The results are an approximation of risk. These estimates should be used to understand relative risk from hazards and potential losses. Uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications that are necessary for a comprehensive analysis (e.g., incomplete inventories, non-specific locations, demographics, or economic parameters).

All conclusions are presented in "Conclusions on Hazard Vulnerability" at the end of this section.

6.3 EXPLANATION OF DATA SOURCES

Earthquake

Hazus-MH 2.1 (as described above) was used to assess earthquake vulnerability. A level 1, probabilistic scenario to estimate annualized loss was utilized. In this scenario, several return periods (events of varying intensities) are run to determine annualized loss. Default Hazus earthquake damage functions and methodology were used to determine the probability of damage for 100-, 250- 500-, 750-, 1,000-, 1,500-, and 2,500-year frequency events (also known as a return period). Results are calculated at the 2000 U.S. Census tract level in Hazus and presented at the county level.

Flood

FEMA Digital Flood Insurance Rate Maps (DFIRMs) were used to determine flood vulnerability. DFIRM data can be used in ArcGIS for mapping purposes and, they identify several features including floodplain boundaries and base flood elevations. Identified areas on the DFIRM represent some features of a Flood Insurance Rate Maps including the 100-year flood areas (1.0-percent annual chance flood), and the 500-year flood areas (0.2-percent annual chance flood). For the vulnerability assessment, local parcel and building footprint data and critical facilities were overlaid on the 100-year floodplain areas and 500-year floodplain areas. It should be noted that such an analysis does not account for building elevation.

Hurricane and Tropical Storm Wind

Hazus-MH 2.1 (as described above) was used to assess wind vulnerability. For the hurricane wind analysis, a probabilistic scenario was created to estimate the annualized loss damage and probable peak wind speeds in the Buncombe Madison Region. Default Hazus wind speed data, damage functions, and methodology were used in to determine the probability of damage for 100-, 500-, and 1,000-year frequency events (also known as return periods) in the scenario. Results are calculated in Hazus at the 2000 U.S. Census tract level and presented at the county level.

Hazardous Materials Incident

For the fixed hazardous materials incident analysis, Toxic Release Inventory (TRI) data was used. The Toxics Release Inventory is a publicly available database from the federal Environmental Protection Agency (EPA) that contains information on toxic chemical releases and other waste management activities reported annually by certain covered industry groups as well as federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990. Each year, facilities that meet certain activity thresholds must report their releases and other waste management activities for listed toxic chemicals to EPA and to their state or tribal entity. A facility must report if it meets the following three criteria:

- The facility falls within one of the following industrial categories: manufacturing; metal mining; coal mining; electric generating facilities that combust coal and/or oil; chemical wholesale distributors; petroleum terminals and bulk storage facilities; RCRA Subtitle C treatment, storage, and disposal (TSD) facilities; and solvent recovery services;
- Has 10 or more full-time employee equivalents; and
- Manufactures or processes more than 25,000 pounds or otherwise uses more than 10,000 pounds of any listed chemical during the calendar year. Persistent, bioaccumulative, and toxic (PBT) chemicals are subject to different thresholds of 10 pounds, 100 pounds, or 0.1 grams depending on the chemical.

For the mobile hazardous materials incident analysis, transportation data including major highways and railroads were obtained from the North Carolina Department of Transportation. This data is ArcGIS compatible, lending itself to buffer analysis to determine risk.

Landslide

The USGS Landslide Susceptibility Index was used to determine vulnerability to landslides. The risk levels of low, moderate, and high correspond to the Landslide Susceptibility Index where "Low" indicates a zone of Low Incident/High Susceptibility, "Mod" indicates a zone of Moderate Incident/High Susceptibility, and "High" indicates a zone of High Landslide Susceptibility. For the vulnerability assessment, local parcel data and critical facilities were overlaid on the moderate and high incidence areas.

Wildfire

The data used to determine vulnerability to wildfire in the Buncombe Madison Region is based on GIS data called the Southern Wildfire Risk Assessment (SWRA). It was provided for use in this plan by the North Carolina Division of Forest Resources. A specific layer, known as "Level of Concern" (LOC) was used to determine vulnerability of people and property. The LOC is presented on a scale of 1 to 100. It combines a Wildfire Susceptibility Index (WFSI) with a Fire Effects Index (FEI). The primary purpose of the LOC data is to highlight areas of concern that may be conducive to mitigation actions. Due to the assumptions made, it is not a true probability. However, it does provide a comparison of risk throughout the region.

6.4 ASSET INVENTORY

An inventory of geo-referenced assets within the Buncombe Madison counties and jurisdictions was compiled in order to identify and characterize those properties potentially at risk to the identified hazards[2]. By understanding the type and number of assets that exist and where they are located in relation to known hazard areas, the relative risk and vulnerability for such assets can be assessed. Under this assessment, two categories of physical assets were created and then further assessed through GIS analysis. Additionally, social assets are addressed to determine population at risk to the identified hazards. These are presented below in Section 6.4.2.

6.4.1 Physical and Improved Assets

The two categories of physical assets consist of:

1. Improved Property: Includes all improved properties in the Buncombe Madison Region according to local parcel data provided by counties. The information has been expressed in terms of the number of parcels and total assessed value of improvements (buildings) that may be exposed to the identified hazards.

2. Critical Facilities: Critical facilities vary by jurisdiction. When provided, the critical facilities provided by the jurisdiction are used in this section. If no critical facilities are identified, facilities

[2] While potentially not all-inclusive for the jurisdictions in the Buncombe Madison region, "georeferenced" assets include those assets for which specific location data is readily available for connecting the asset to a specific geographic location for purposes of GIS analysis.

were used from Hazus-MH which includes fire stations, police station, medical care facilities, schools, and emergency operation centers. It should be noted that this listing is not all-inclusive for assets located in the region, but it is anticipated that it will be expanded during future plan updates as more geo-referenced data becomes available for use in GIS analysis.

The following tables provide a detailed listing of the geo-referenced assets that have been identified for inclusion in the vulnerability assessment for the Buncombe Madison Region.

Table 6.1 lists the number of parcels, total value of parcels, total number of parcels with improvements, and the total assessed value of improvements for participating areas of the Buncombe Madison Region (study area of vulnerability assessment).[3]

TABLE 6.1: IMPROVED PROPERTY IN THE BUNCOMBE MADISON REGION

Location	Number of Parcels	Total Assessed Value of Parcels	Estimated Number of Buildings	Total Assessed Value of Improvements
Buncombe County	**121,715**	**$29,936,902,303**	**72,726**	**$20,211,238,703**
Asheville	35,244	$11,206,812,503	21,619	$8,150,333,103
Biltmore Forest	722	$614,875,900	623	$412,272,900
Black Mountain	4,358	$852,294,400	2,645	$586,663,500
Montreat	910	$266,778,600	442	$178,898,100
Weaverville	1,805	$407,464,200	1,045	$294,357,000
Woodfin	2,484	$412,651,300	1,287	$278,079,600
Unincorporated Area	76,192	$16,176,025,400	45,065	$10,310,634,500
Madison County	**20,825**	**$2,362,119,766**	**9,540**	**$997,190,902**
Hot Springs	453	$64,476,128	271	$26,152,076
Marshall	579	$49,630,874	344	$30,013,557
Mars Hill	587	$78,982,239	431	$59,197,091
Unincorporated Area	19,206	$2,169,030,525	8,494	$881,828,178
BUNCOMBE MADISON REGION TOTAL	**142,540**	**$32,299,022,069**	**82,266**	**$21,208,429,605**

Table 6.2 lists the fire stations, police stations, emergency operations centers (EOCs), medical care facilities, and schools and other critical facilities located in the Buncombe Madison Region. All data was collected from local government GIS departments. In addition, **Figure 6.2** shows the locations of essential facilities in the Buncombe Madison Region. **Table 6.16**, near the end of this section, shows a complete list of the critical facilities by name, as well as the hazards that affect each facility. As noted previously, this list is not all-inclusive and only includes information provided by the counties.

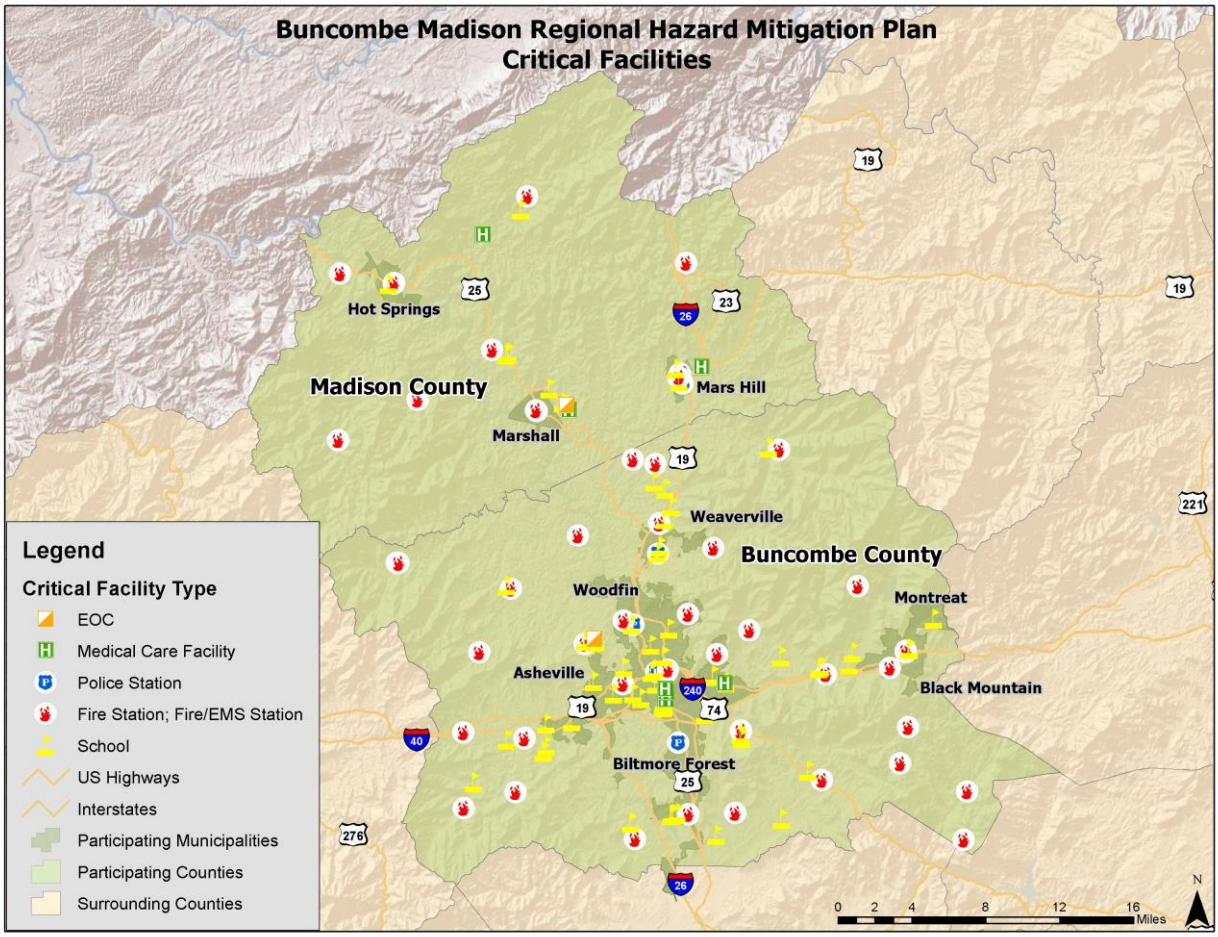
[3] Total assessed values for improvements is based on tax assessor records as joined to digital parcel data. This data does not include dollar figures for tax-exempt improvements such as publicly-owned buildings and facilities. It should also be noted that, due to record keeping, some duplication is possible thus potentially resulting in an inflated value exposure for an area.

TABLE 6.2: CRITICAL FACILITY INVENTORY IN THE BUNCOMBE MADISON REGION

Location	Fire/EMS Stations	Police Stations	Medical Care Facilities	EOC	Schools
Buncombe County	**38**	**6**	**4**	**1**	**55**
Asheville	6	2	4	0	23
Biltmore Forest	0	1	0	0	0
Black Mountain	3	1	0	0	2
Montreat	0	0	0	0	1
Weaverville	2	1	0	0	2
Woodfin	1	1	0	0	1
Unincorporated Area	26	0	0	1	26
Madison County	**11**	**5**	**4**	**1**	**8**
Hot Springs	1	1	0	0	1
Marshall	1	1	0	0	0
Mars Hill	1	3	1	0	1
Unincorporated Area	8	0	3	1	6
BUNCOMBE MADISON REGION TOTAL	**49**	**11**	**8**	**2**	**63**

Source: Hazus-MH

FIGURE 6.2: CRITICAL FACILITY LOCATIONS IN THE BUNCOMBE MADISON REGION



Source: Hazus-MH 2.1

6.4.2 Social Vulnerability

In addition to identifying those assets potentially at risk to identified hazards, it is important to identify and assess those particular segments of the resident population in the Buncombe Madison Region that are potentially at risk to these hazards.

Table 6.3 lists the population by jurisdiction according to U.S. Census 2010 population estimates. Unfortunately, estimates were not available at the census block level, limited the results to county-wide estimates. The total population in the Buncombe Madison Region according to Census data is 259,082 persons. Additional population estimates are presented in Section 3: *Community Profile*.

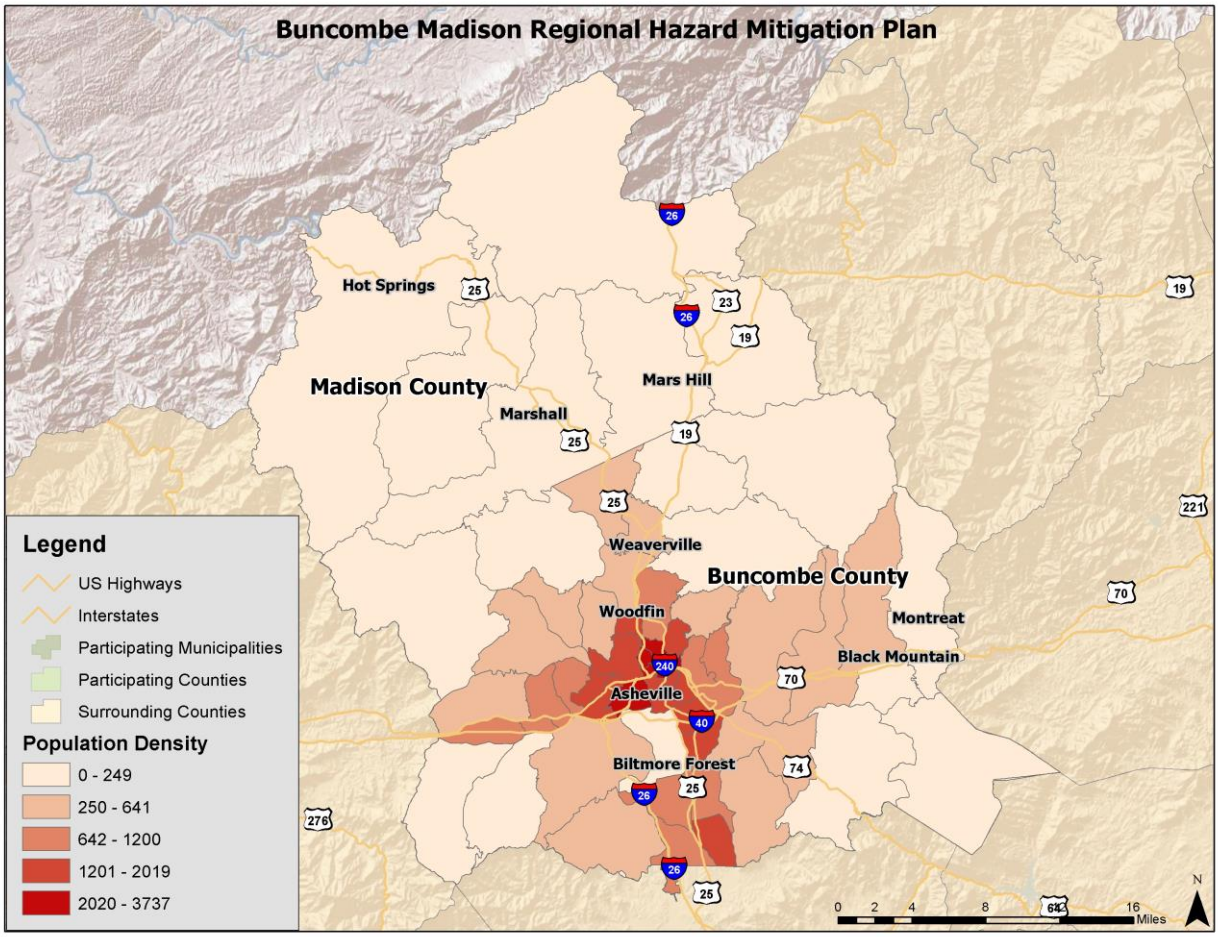
TABLE 6.3: TOTAL POPULATION IN THE BUNCOMBE MADISON REGION

Location	Total 2010 Population
Buncombe County	238,318
Madison County	20,764
BUNCOMBE MADISON REGION TOTAL	**259,082**

Source: United States Census 2010

In addition, **Figure 6.3** illustrates the population density by census tract as it was reported by the U.S. Census Bureau in 2010.[4]

FIGURE 6.3: POPULATION DENSITY IN THE BUNCOMBE MADISON REGION



Source: United States Census Bureau, 2010

6.4.3 Development Trends and Changes in Vulnerability

Since the previous county hazard mitigation plans were approved (in 2011 and 2012), the Buncombe Madison Region has experienced limited growth and development. **Table 6.4** shows the number of building units constructed since 2010 according to the US Census American Community Survey.

TABLE 6.4: BUILDING COUNTS FOR THE BUNCOMBE MADISON REGION

Jurisdiction	Total Housing Units (2012)	Units Built 2010 or later	% Building Stock Built Post-2010
Buncombe County	**113,409**	**428**	**0.4%**
Asheville	41,691	217	0.5%

[4] Population by census block was not available at the time this plan was completed.

Jurisdiction	Total Housing Units (2012)	Units Built 2010 or later	% Building Stock Built Post-2010
Biltmore Forest	685	0	0.0%
Black Mountain	3,912	12	0.3%
Montreat	707	0	0.0%
Weaverville	1,487	0	0.0%
Woodfin	2,762	0	0.0%
Unincorporated Area	62,165	199	0.3%
Madison County	**10,630**	**23**	**0.2%**
Hot Springs	308	0	0.0%
Marshall	598	0	0.0%
Mars Hill	815	0	0.0%
Unincorporated Area	8,909	23	0.3%
BUNCOMBE MADISON REGION TOTAL	**124,039**	**451**	**0.4%**

Source: United States Census Bureau

Table 6.5 shows population growth estimates for the region from 2010 to 2013 based on the US Census Annual Estimates of Resident Population.

TABLE 6.5: POPULATION GROWTH FOR THE BUNCOMBE MADISON REGION

Jurisdiction	Population Estimates (as of July 1)				% Change 2010-2013
	2010	2011	2012	2013	
Buncombe County	**238,822**	**241,463**	**244,461**	**247,912**	**3.8%**
Asheville	83,550	84,781	85,993	87,236	4.4%
Biltmore Forest	1,347	1,365	1,386	1,411	4.8%
Black Mountain	7,851	7,874	7,970	8,080	2.9%
Montreat	723	681	689	694	-4.0%
Weaverville	3,688	3,737	3,793	3,856	4.6%
Woodfin	6,056	6,089	6,149	6,220	2.7%
Unincorporated Area	135,607	136,936	138,481	140,415	3.5%
Madison County	**20,778**	**20,836**	**20,873**	**21,022**	**1.2%**
Hot Springs	560	560	559	563	0.5%
Marshall	874	875	873	879	0.6%
Mars Hill	1,962	2,041	2,134	2,145	9.3%
Unincorporated Area	17,382	17,360	17,307	17,435	0.3%
BUNCOMBE MADISON REGION TOTAL	**259,600**	**262,299**	**265,334**	**268,934**	**3.6%**

Source: United States Census Bureau

Based on the data above, there has been a low rate of residential development but a slightly higher rate of population growth in the region since 2010. Additionally, Asheville, Biltmore Forest, Weaverville, and Mars Hill have experienced higher rates of population growth compared to the other jurisdictions. Since population has increased in these jurisdictions, there are now greater numbers of people exposed to the identified hazards. Therefore, population growth has impact the region's vulnerability since the previous local hazard mitigation plans were approved and there has been a slight increase in the overall vulnerability.

It is also important to note that as development increases in the future, greater populations and more structures and infrastructure will be exposed to potential hazards if development occurs in the floodplains, moderate and high landside susceptibility areas, primary and secondary TRI site buffers, or high wildfire risk areas.

6.5 VULNERABILITY ASSESSMENT RESULTS

As noted earlier, only hazards with a specific geographic boundary, modeling tool, or sufficient historical data allow for further analysis. Those results are presented here. All other hazards are assumed to impact the entire planning region (drought, extreme heat, hailstorm, lightning, thunderstorm wind, tornado, and winter storm and freeze) or, due to lack of data, analysis would not lead to credible results (erosion, dam and levee failure). The total region exposure, and thus risk, was presented in **Table 6.1**.

The annualized loss estimate for all hazards is presented at the end of this section in **Table 6.15.**

The hazards presented in this subsection include: hurricane and tropical storm winds, earthquake, landslide, flood, hazardous materials incident, and wildfire.

6.5.1 Hurricane and Tropical Storm

Historical evidence indicates that the Buncombe Madison Region has a significant risk to the hurricane and tropical storm hazard. There have been three disaster declarations due to hurricanes (Hurricane Fran, Hurricane Ivan, and Tropical Storm Frances) in the region. Several tracks have come near or traversed through the Buncombe Madison Region, as shown and discussed in Section 5: *Hazard Profiles*.

Hurricanes and tropical storms can cause damage through numerous additional hazards such as flooding, erosion, tornadoes, and high winds and precipitation, thus it is difficult to estimate total potential losses from these cumulative effects. The current Hazus-MH hurricane model only analyzes hurricane winds and is not capable of modeling and estimating cumulative losses from all hazards associated with hurricanes; therefore only hurricane winds are analyzed in this section. It can be assumed that all existing and future buildings and populations are at risk to the hurricane and tropical storm hazard. Hazus-MH 2.1 was used to determine annualized losses for the region as shown below in **Table 6.6.** Only losses to buildings are reported, in order to best match annualized losses reported for other hazards. Hazus-MH reports losses at the U.S. Census tract level, so determining participating jurisdiction losses was not possible.

TABLE 6.6: ANNUALIZED LOSS ESTIMATIONS FOR HURRICANE WIND HAZARD

Location	Total Annualized Loss
Buncombe County	$237,000
Madison County	$13,000
BUNCOMBE MADISON REGION TOTAL	**$250,000**

Source: Hazus-MH 2.1

In addition, probable peak wind speeds were calculated in Hazus. These are shown below in **Table 6.7.**

TABLE 6.7: PROBABLE PEAK HURRICANE/TROPICAL STORM WIND SPEEDS (MPH)

Location	50-year event	100-year event	500-year event	1,000-year event
Buncombe County	**52.5**	**61.9**	**80.7**	**87.8**
Asheville	52.0	61.1	80.4	87.1
Biltmore Forest	52.0	60.9	80.1	87.1
Black Mountain	51.5	61.0	80.1	87.0
Montreat	51.5	61.0	79.7	87.0
Weaverville	50.4	60.2	78.8	85.6
Woodfin	50.7	60.2	79.5	86.0
Unincorporated Area	52.5	61.9	80.7	87.8
Madison County	**49.3**	**59.3**	**78.2**	**85.1**
Hot Springs	48.0	57.9	76.2	82.3
Marshall	48.7	58.5	77.2	83.4
Mars Hill	49.1	59.0	78.2	84.9
Unincorporated Area	49.3	59.3	78.2	85.1
MAXIMUM WIND SPEED REPORTED	**52.5**	**61.9**	**80.7**	**87.8**

Source: Hazus-MH 2.1

Social Vulnerability

Given some susceptibility across the entire Buncombe Madison Region, it is assumed that the total population is at risk to the hurricane and tropical storm hazard.

Critical Facilities

Given equal vulnerability across the Buncombe Madison Region, all critical facilities are considered to be at risk. Some buildings may perform better than others in the face of such an event due to construction and age, among other factors. Determining individual building response is beyond the scope of this plan. However, this plan will consider mitigation actions for vulnerable structures, including critical facilities, to reduce the impacts of the hurricane wind hazard. A list of specific critical facilities and their associated risk can be found in **Table 6.16** at the end of this section.

In conclusion, a hurricane event has the potential to impact many existing and future buildings, critical facilities, and populations in the Buncombe Madison Region. Hurricane events can cause substantial damage in their wake including fatalities, extensive debris clean-up, and extended power outages.

6.5.2 Earthquake

For the earthquake hazard vulnerability assessment, a probabilistic scenario was created to estimate the annualized loss for the region. The results of the analysis reported at the U.S. Census tract level do not make it feasible to estimate losses at the jurisdiction level. Since the scenario is annualized, no building counts are provided. Losses reported included losses due to building damage and do not include losses to contents, inventory, or business interruption. **Table 6.8** summarizes the findings.

TABLE 6.8: ANNUALIZED LOSS ESTIMATIONS FOR EARTHQUAKE HAZARD

Location	Total Annualized Loss
Buncombe County	$129,000

Location	Total Annualized Loss
Madison County	$10,000
BUNCOMBE MADISON REGION TOTAL	**$139,000**

Source: Hazus-MH 2.1

Social Vulnerability

It can be assumed that all existing and future populations are at risk to the earthquake hazard.

Critical Facilities

The Hazus probabilistic analysis indicated that no critical facilities would sustain measurable damage in an earthquake event. However, all critical facilities should be considered at-risk to minor damage, should an event occur. A list of individual critical facilities and their risk can be found in **Table 6.14**.

In conclusion, an earthquake has the potential to impact all existing and future buildings, facilities, and populations in the Buncombe Madison Region. Minor earthquakes may rattle dishes and cause minimal damage while stronger earthquakes will result in structural damage as indicated in the Hazus scenario above. Impacts of earthquakes include debris clean-up, service disruption and, in severe cases, fatalities due to building collapse. Specific vulnerabilities for assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available. Furthermore, mitigation actions to address earthquake vulnerability will be considered.

6.5.3 Landslide

In order to complete the vulnerability assessment for landslides in the Buncombe Madison Region, GIS analysis was used. The potential dollar value of exposed land and property total can be determined using the USGS Landslide Susceptibility Index (detailed in Section 5: *Hazard Profiles*), county level tax parcel data, and GIS analysis. **Table 6.9** presents the potential at-risk property where available. Nearly all areas of the Buncombe Madison Region are identified as moderate or high incidence areas by the USGS landslide data. All areas of both counties are also areas of high landslide susceptibility. The incidence levels (high and moderate) were used to identify different areas of concern for the analysis below.

TABLE 6.9: TOTAL POTENTIAL AT-RISK PARCELS FOR THE LANDSLIDE HAZARD

Location	Number of Parcels At Risk		Number of Improvements At Risk		Total Value of Improvements At Risk ($)	
Incidence Level	Moderate	High	Moderate	High	Moderate	High
Buncombe County	**90,092**	**30,284**	**$53,330**	**18,820**	**16,816,954,403**	**$3,482,213,000**
Asheville	31,519	3,858	$19,139	2,510	7,588,361,403	$586,924,900
Biltmore Forest	722	0	$623	0	412,272,900	$0
Black Mountain	4,358	0	$2,645	0	586,663,500	$0
Montreat	910	0	$442	0	178,898,100	$0
Weaverville	1,382	488	$684	377	218,253,400	$83,392,500
Woodfin	2,484	0	$1,287	0	278,079,600	$0
Unincorporated Area	48,717	25,938	$28,510	15,933	7,554,425,500	$2,811,895,600

Location	Number of Parcels At Risk		Number of Improvements At Risk		Total Value of Improvements At Risk ($)	
Incidence Level	Moderate	High	Moderate	High	Moderate	High
Madison County	**1**	**20,824**	**0**	**9,540**	**$0**	**$997,190,902**
Hot Springs	0	453	0	271	$0	$64,476,128
Marshall	0	579	0	344	$0	$49,630,874
Mars Hill	0	587	0	431	$0	$78,982,239
Unincorporated Area	1	19,205	0	8,494	$0	$2,169,030,525
BUNCOMBE MADISON REGION TOTAL	**90,093**	**51,108**	**$53,330**	**28,360**	**16,816,954,403**	**$4,479,403,902**

Source: United States Geological Survey

Social Vulnerability

Given high susceptibility across the entire Buncombe Madison Region, it is assumed that the total population is at risk.

Critical Facilities

All critical facilities are located in a high susceptibility area. In Madison County, all critical facilities are located in a high incidence area (high susceptibility). In addition, twenty-six facilities in Buncombe County are located in the high incidence area. All but two of the remaining critical facilities in Buncombe County are located in the moderate landslide incidence/high susceptibility area. A list of specific critical facilities and their associated risk can be found in **Table 6.14** at the end of this section.

In conclusion, a landslide has the potential to impact all existing and future buildings, facilities, and populations in the Buncombe Madison Region, though some areas are at a higher risk than others due to a variety of factors. For example, steep slopes and modified slopes bear a greater risk than flat areas. Specific vulnerabilities for Buncombe Madison assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available.

6.5.4 Flood

Historical evidence indicates that the Buncombe Madison Region is susceptible to flood events. A total of 62 flood events have been reported by the National Climatic Data Center resulting in $128.1 million dollars in damages and three fatalities. On an annualized level, these damages amounted to around $6.5 million for the Buncombe Madison Region.

In order to assess flood risk, a GIS-based analysis was used to estimate exposure to flood events using Digital Flood Insurance Rate Map (DFIRM) data in combination with local tax assessor records for each of the Buncombe Madison counties. The determination of assessed value at-risk (exposure) was calculated using GIS analysis by summing the total building values for only those improved properties that were confirmed to be located within an identified floodplain. **Table 6.10** presents the potential at-risk property. Both the number of parcels and the approximate value are presented.

TABLE 6.10: ESTIMATED EXPOSURE OF PARCELS TO THE FLOOD HAZARD

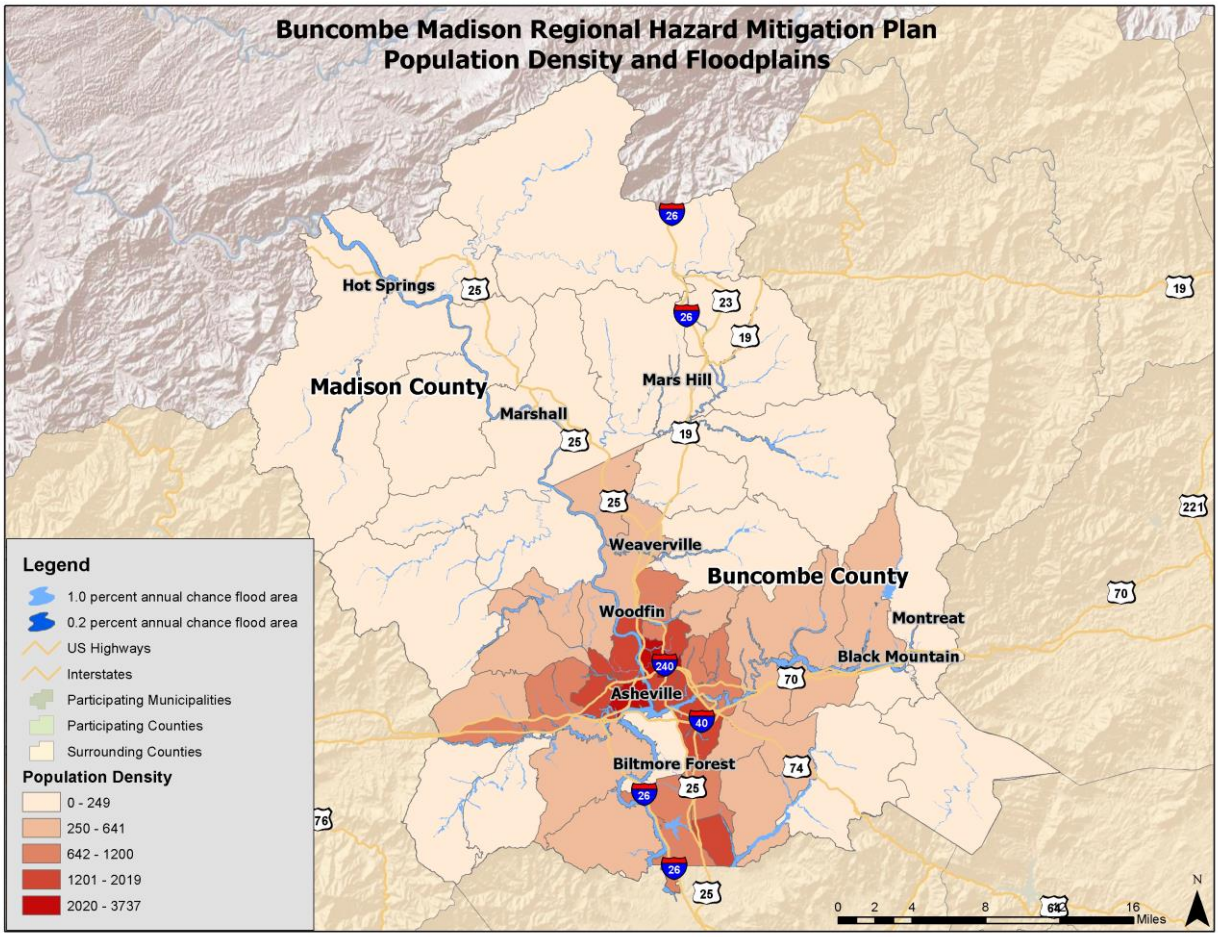
	1.0-percent ACF			0.2-percent ACF		
Location	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings
Buncombe County	**8,013**	**1,660**	**$628,655,800**	**5**	**0**	**$0**
Asheville	2,325	538	$252,184,700	0	0	$0
Biltmore Forest	11	0	$0	0	0	$0
Black Mountain	399	132	$33,338,900	0	0	$0
Montreat	50	12	$13,223,200	0	0	$0
Weaverville	43	9	$442,300	0	0	$0
Woodfin	123	49	$11,703,100	0	0	$0
Unincorporated Area	5,062	920	$317,763,600	5	0	$0
Madison County	**2,927**	**1,436**	**$152,244,716**	**3**	**0**	**$0**
Hot Springs	123	60	$8,676,167	0	0	$0
Marshall	257	163	$16,119,395	0	0	$0
Mars Hill	46	32	$4,174,548	0	0	$0
Unincorporated Area	2,501	1,181	$123,274,606	3	0	$0
BUNCOMBE MADISON REGION TOTAL	**10,940**	**3,096**	**$780,900,516**	**8**	**0**	**$0**

Source: Federal Emergency Management Agency DFIRM

Social Vulnerability

Since 2010 population was available at the tract level, it was difficult to determine a reliable figure on population at-risk to flood due to tract level population data. **Figure 6.4** is presented to gain a better understanding of at risk population.

FIGURE 6.4 : POPULATION DENSITY NEAR FLOODPLAINS



Source: Federal Emergency Management Agency DFIRM, United States Census 2010

Critical Facilities

The critical facility analysis revealed that there are no critical facilities located in the Buncombe Madison Region 1.0-percent annual chance floodplain and 0.2-percent annual chance floodplain based on FEMA DFIRM boundaries and GIS analysis. A list of specific critical facilities and their associated risk can be found in **Table 6.14** at the end of this section.

In conclusion, a flood has the potential to impact many existing and future buildings and populations in the Buncombe Madison Region, though some areas are at a higher risk than others. All types of structures in a floodplain are at-risk, though elevated structures will have a reduced risk. As noted, the floodplains used in this analysis include the 100-year and 500-year FEMA regulated floodplain boundaries. It is certainly possible that more severe events could occur beyond these boundaries or urban (flash) flooding could impact additional structures. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates. Furthermore, areas subject to repetitive flooding should be analyzed for potential mitigation actions.

6.5.5 Hazardous Materials Incident

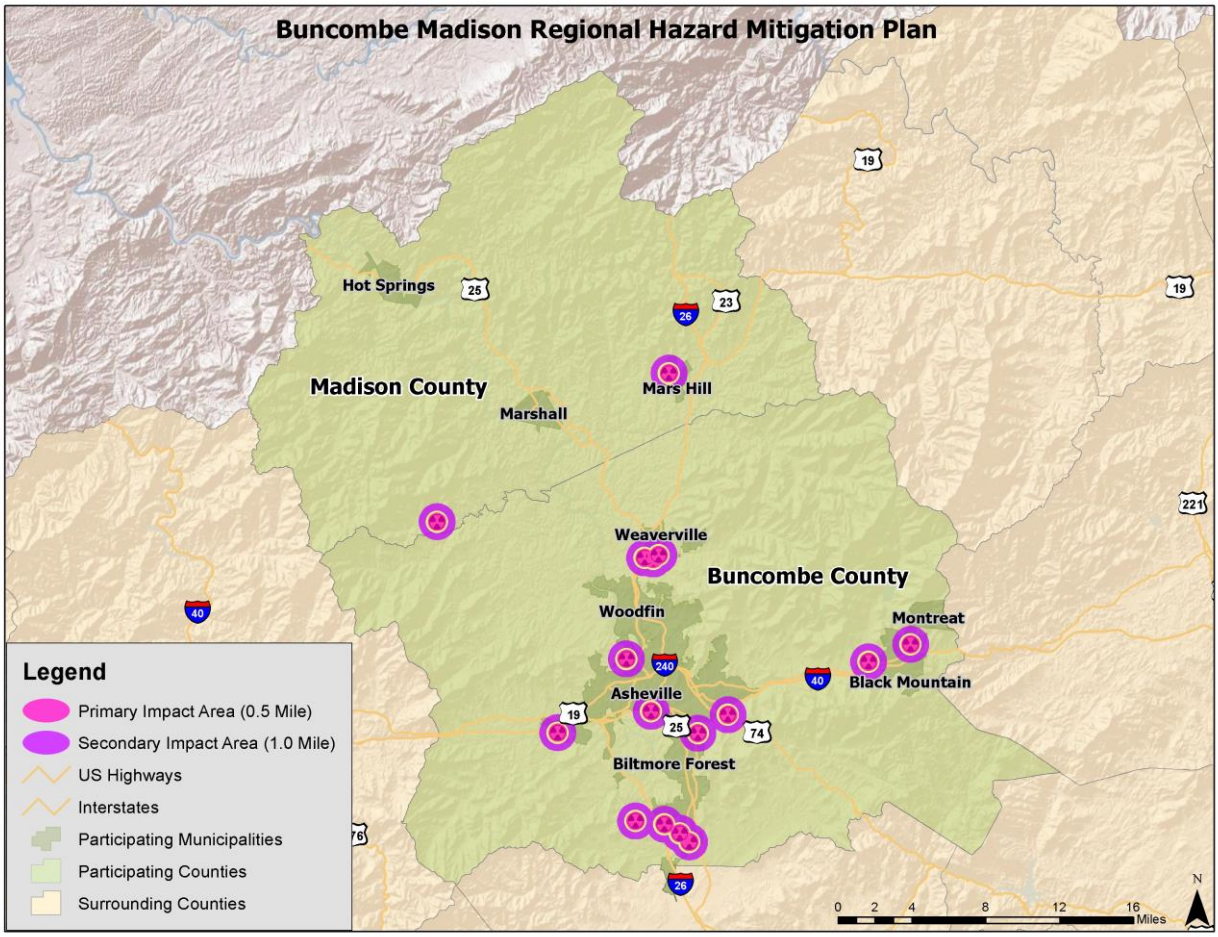
Although historical evidence and existing Toxic Release Inventory sites indicate that the Buncombe Madison Region is susceptible to hazardous materials events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. It is assumed that while one major event could result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for the Buncombe Madison Region.

Most hazardous materials incidents that occur are contained and suppressed before destroying any property or threatening lives. However, they can have a significant negative impact. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops. Certain chemicals may travel through the air or water, affecting a much larger area than the point of the incidence itself. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features, can substantially increase the damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

In order to conduct the vulnerability assessment for this hazard, GIS intersection analysis was used for fixed and mobile areas and parcels.[5] In both scenarios, two sizes of buffers—0.5 mile and 1.0 mile—were used. These areas are assumed to respect the different levels of effect: immediate (primary) and secondary. Primary and secondary impact sites were selected based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks against Buildings and engineering judgment. For the fixed site analysis, geo-referenced TRI listed toxic sites in the Buncombe Madison Region, along with buffers, were used for analysis as shown in **Figure 6.5.** For the mobile analysis, the major roads (Interstate highway, U.S. highway, and State highway) and railroads, where hazardous materials are primarily transported that could adversely impact people and buildings, were used for the GIS buffer analysis. **Figure 6.6** shows the areas used for mobile toxic release buffer analysis. The results indicate the approximate number of parcels, improved value, as shown in **Table 6.11** (fixed sites), **Table 6.12** (mobile road sites) and **Table 6.13** (mobile railroad sites).[6]

[5] This type of analysis will likely yield inflated results (generally higher than what is actually reported after an event).
[6] Note that parcels included in the 1.0-mile analysis are also included in the 0.5-mile analysis.

FIGURE 6.5 : TRI SITES WITH BUFFERS IN THE BUNCOMBE MADISON REGION



Source: Environmental Protection Agency

TABLE 6.11: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS (FIXED SITES)

	0.5-mile buffer			1.0-mile buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Buncombe County	**4,248**	**2,776**	**$787,912,900**	**18,005**	**11,698**	**$2,539,983,900**
Asheville	979	551	$285,977,000	6,094	4,012	$1,018,263,500
Biltmore Forest	0	0	$0	23	15	$2,615,700
Black Mountain	1,066	739	$171,797,800	2,729	1,792	$309,394,900
Montreat	0	0	$0	1	0	$0
Weaverville	402	272	$43,419,900	994	599	$97,287,000
Woodfin	0	0	$0	3	1	$1,701,000
Unincorporated Area	1,801	1,214	$286,718,200	8,161	5,279	$1,110,721,800
Madison County	**257**	**158**	**$22,166,740**	**910**	**596**	**$77,787,789**
Hot Springs	0	0	$0	0	0	$0
Marshall	0	0	$0	0	0	$0
Mars Hill	101	69	$8,575,004	434	323	$44,352,109
Unincorporated Area	156	89	$13,591,736	476	273	$33,435,680
BUNCOMBE MADISON REGION TOTAL	**4,505**	**2,934**	**$810,079,640**	**18,915**	**12,294**	**$2,617,771,689**

FIGURE 6.6 : MOBILE HAZMAT BUFFERS IN THE BUNCOMBE MADISON REGION

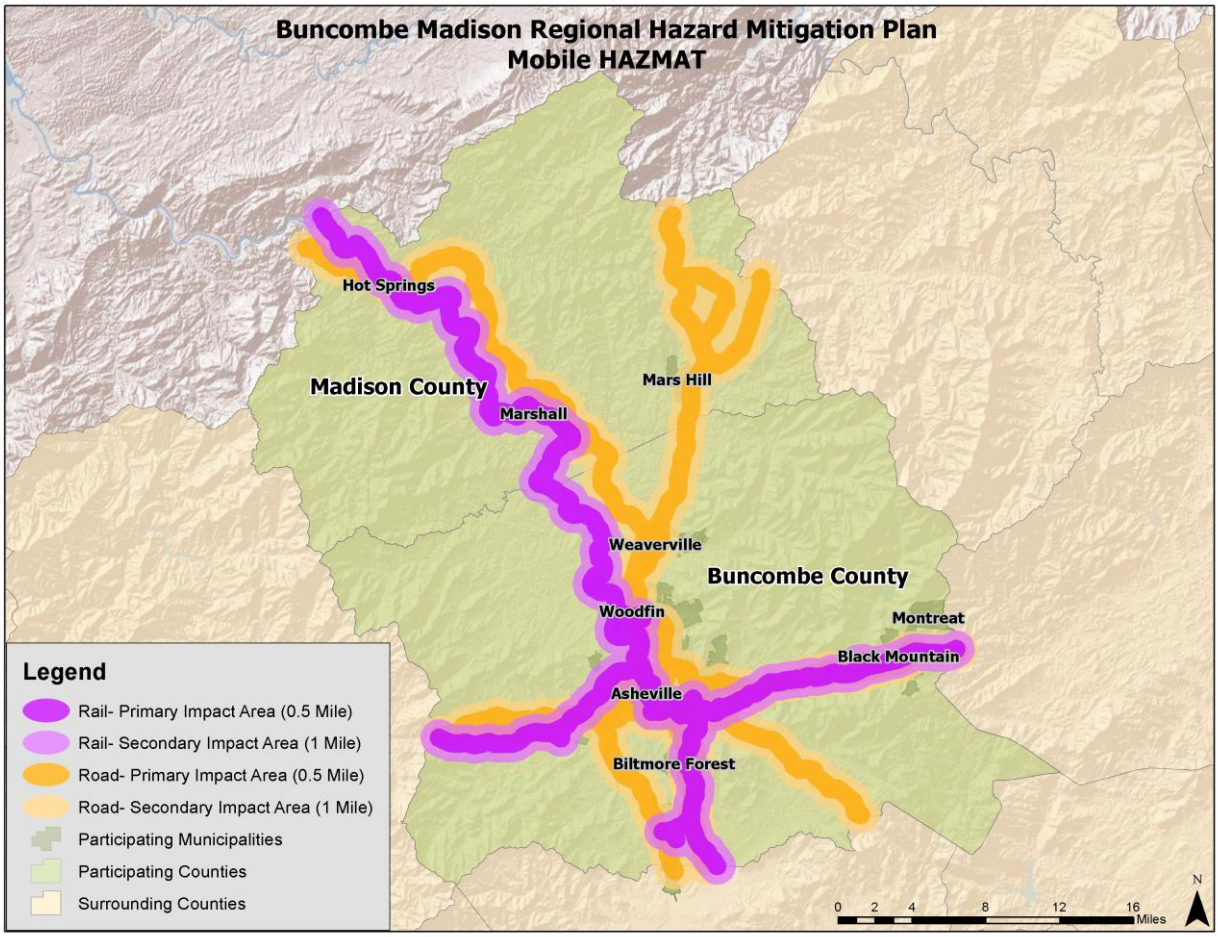


TABLE 6.12: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - ROAD)

	0.5-mile buffer			1.0-mile buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Buncombe County	**53,669**	**31,667**	**$8,649,032,203**	**74,014**	**44,544**	**$11,244,645,703**
Asheville	28,382	16,772	$5,182,669,403	33,576	20,196	$6,067,660,403
Biltmore Forest	496	439	$243,338,100	692	598	$350,283,600
Black Mountain	2,492	1,575	$306,134,200	3,833	2,445	$420,828,400
Montreat	0	0	$0	0	0	$0
Weaverville	1,311	892	$153,858,300	1,321	893	$154,164,500
Woodfin	1,697	995	$127,685,300	2,418	1,267	$162,655,300
Unincorporated Area	19,291	10,994	$2,635,346,900	32,174	19,145	$4,089,053,500
Madison County	**5,141**	**2,579**	**$289,794,895**	**7,642**	**3,835**	**$419,674,907**
Hot Springs	428	258	$25,662,549	453	271	$26,152,076
Marshall	551	330	$29,094,841	576	325	$29,911,968
Mars Hill	68	52	$10,590,755	442	342	$45,060,722
Unincorporated Area	4,094	1,939	$224,446,750	6,171	2,897	$318,550,141
BUNCOMBE MADISON REGION TOTAL	**58,810**	**34,246**	**$8,938,827,098**	**81,656**	**48,379**	**$11,664,320,610**

TABLE 6.13: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - RAILROAD)

	0.5-mile buffer			1.0-mile buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Buncombe County	**28,324**	**16,778**	**$4,517,006,153**	**52,027**	**30,872**	**$7,816,483,353**
Asheville	14,437	8,742	$2,538,366,053	25,028	14,732	$4,331,549,053
Biltmore Forest	279	240	$128,667,400	655	563	$325,660,000
Black Mountain	1,964	1,199	$258,706,200	3,503	2,254	$393,220,300
Montreat	0	0	$0	0	0	$0
Weaverville	0	0	$0	0	0	$0
Woodfin	1,468	810	$94,988,200	2,118	1,084	$133,522,200
Unincorporated Area	10,176	5,787	$1,496,278,300	20,723	12,239	$2,632,531,800
Madison County	**1,983**	**987**	**$91,583,645**	**3,307**	**1,654**	**$151,746,121**
Hot Springs	417	255	$25,224,582	453	271	$26,152,076
Marshall	490	286	$23,040,957	569	341	$29,253,538
Mars Hill	0	0	$0	0	0	$0
Unincorporated Area	1,076	446	$43,318,106	2,285	1,042	$96,340,507
BUNCOMBE MADISON REGION TOTAL	**30,307**	**17,765**	**$4,608,589,798**	**55,334**	**32,526**	**$7,968,229,474**

Social Vulnerability

Given high susceptibility across the entire Buncombe Madison Region, it is assumed that the total population is at risk to hazardous materials incidents. It should be noted that areas of population concentration may be at an elevated risk due to a greater burden to evacuate population quickly.

Critical Facilities

Fixed Site Analysis:

The critical facility analysis for fixed TRI sites revealed that there are 30 facilities located in a HAZMAT risk zone. The primary impact zone includes 10 facilities, 3 fire/EMS stations, 1 police station, and 6 schools. The remaining facilities are in the secondary, 1.0-mile zone. This includes 13 schools, 1 fire/EMS stations, 2 medical care facilities, and 4 police stations. A list of specific critical facilities and their associated risk can be found in **Table 6.14** at the end of this section.

Mobile Analysis:

The critical facility analysis for road and railroad transportation corridors revealed that there are 89 critical facilities located in the primary and secondary mobile HAZMAT buffer areas for roads and 57 critical facilities located in the railroad HAZMAT buffer areas. The 1.0-mile road buffer area (worst case scenario modeled) includes the following critical facilities: 1 EOC, 23 fire/EMS stations, 11 police stations, 7 medical care facilities, and 47 schools. Twenty-one of these facilities are located in Madison County and the remainder are located in Buncombe County. The 1.0-mile railroad buffer areas include the following critical facilities: 1 EOC, 13 fire/EMS stations, 7 police stations, 4 medical care facilities, and 32 schools. Only eight of these facilities are located in Madison County. It should be noted that many of the facilities located in the buffer areas for road are also located in the buffer areas for railroad and/or the fixed site analysis. A list of specific critical facilities and their associated risk can be found in **Table 6.14** at the end of this section.

In conclusion, a hazardous material incident has the potential to impact many existing and future buildings, critical facilities, and populations in the Buncombe Madison Region. Those areas in a primary buffer are at the highest risk, though all areas carry some vulnerability due to variations in conditions that could alter the impact area such direction and speed of wind, volume of release, etc.

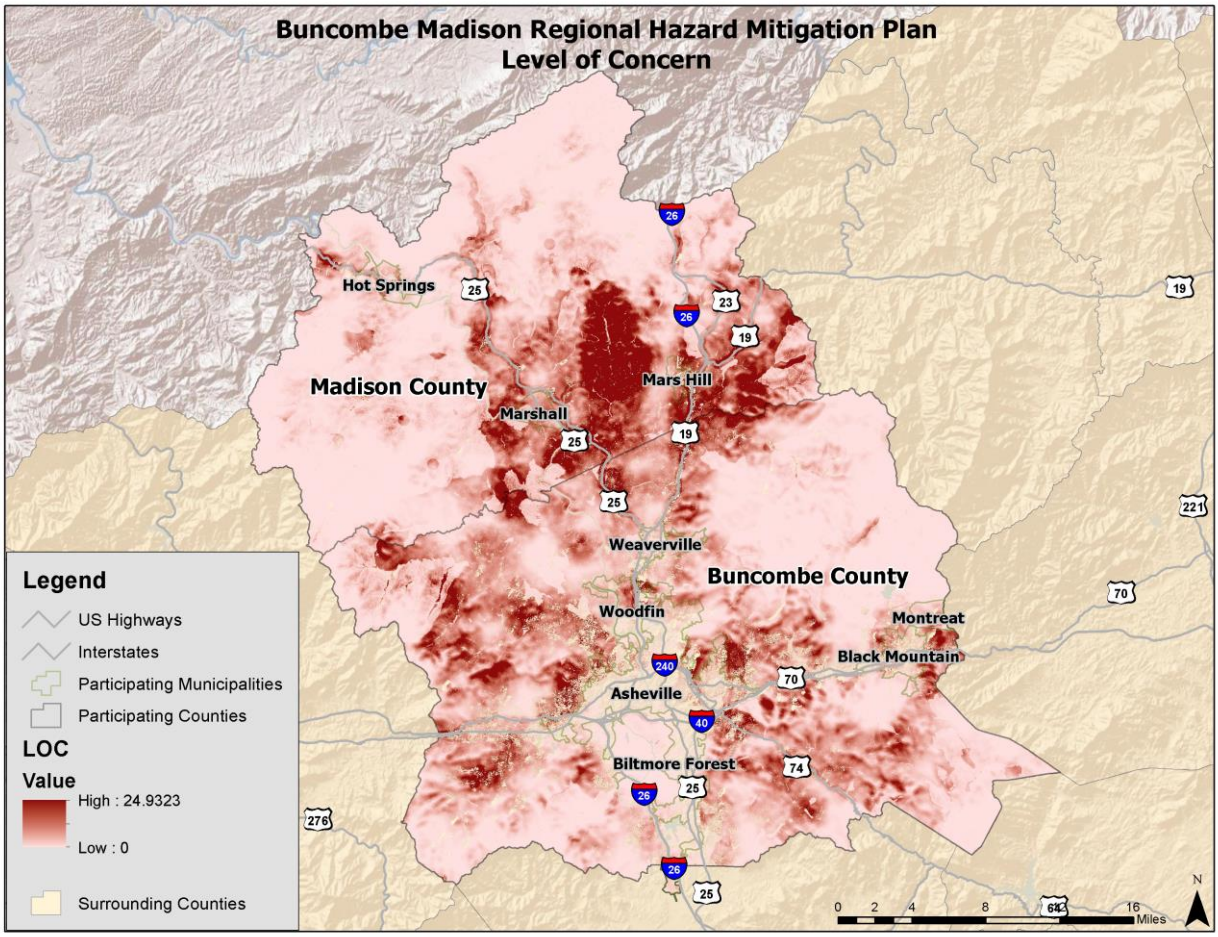
6.5.6 Wildfire

Although historical evidence indicates that the Buncombe Madison Region is susceptible to wildfire events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. Annualized loss is considered negligible though it should be noted that a single event could result in significant damages throughout the region.

To estimate exposure to wildfire, the approximate number of parcels and their associated improved value was determined using GIS analysis. For the critical facility analysis, areas of concern were intersected with critical facility locations. **Figure 6.7** shows the Level of Concern data. Initially provided as raster data, it was converted to a polygon to allow for analysis. The LOC data ranges from 1 to 100 with higher values being most severe (as noted previously, this is only a measure of relative risk). Twenty-five was the highest level recorded in the Buncombe Madison planning area. Therefore, areas with a value above 1 were chosen to be displayed as areas of risk. The region contains some large areas where the value falls into the at-risk category, making it somewhat more at-risk than many other regions of North Carolina. Since all of this land area is on the lower fourth of the overall LOC scale, there is likely somewhat less risk in the region than in other areas of the country.

Table 6.14 shows the results of the analysis.

FIGURE 6.7: WILDFIRE RISK AREAS IN THE BUNCOMBE MADISON REGION



Source: Southern Wildfire Risk Assessment Data

TABLE 6.14: EXPOSURE OF IMPROVED PROPERTY TO WILDFIRE AREAS OF CONCERN

	HIGH WILDFIRE RISK AREA		
Location	**Approx. Number of Parcels**	**Approx. Number of Buildings**	**Approx. Improved Value**
Buncombe County	**48,044**	**23,753**	**$4,233,969,700**
Asheville	4,363	1,957	$612,787,500
Biltmore Forest	0	0	$0
Black Mountain	1,583	681	$103,603,300
Montreat	157	49	$21,310,000
Weaverville	332	118	$25,043,300
Woodfin	959	314	$45,691,100
Unincorporated Area	40,650	20,634	$3,425,534,500
Madison County	**11,940**	**6,059**	**$657,555,807**
Hot Springs	264	163	$16,708,039
Marshall	523	307	$26,546,672
Mars Hill	489	360	$50,316,020

	HIGH WILDFIRE RISK AREA		
Location	Approx. Number of Parcels	Approx. Number of Buildings	Approx. Improved Value
Unincorporated Area	10,664	5,229	$563,985,076
BUNCOMBE MADISON REGION TOTAL	**59,984**	**29,812**	**$4,891,525,507**

Social Vulnerability

Although not all areas have equal vulnerability, there is some susceptibility across the entire Buncombe Madison Region. It is assumed that the total population is at risk to the wildfire hazard. Determining the exact number of people in certain wildfire zones is difficult with existing data and could be misleading.

Critical Facilities

The critical facility analysis revealed that there are 2 schools, 3 fire/EMS stations, 1 police station, 1 EOC, and 2 medical care facilities located in wildfire areas of concern in Madison County. In Buncombe County, there are 6 schools, 1 EOC, and 8 fire/EMS stations in the wildfire areas of concern. It should be noted, however, that several factors could impact the spread of a wildfire putting all facilities at risk. A list of specific critical facilities and their associated risk can be found in **Table 6.14** at the end of this section.

In conclusion, a wildfire event has the potential to impact many existing and future buildings, critical facilities, and populations in the Buncombe Madison Region.

6.6 CONCLUSIONS ON HAZARD VULNERABILITY

The results of this vulnerability assessment are useful in at least three ways:

- Improving our understanding of the risk associated with the natural hazards in the Buncombe Madison Region through better understanding of the complexities and dynamics of risk, how levels of risk can be measured and compared, and the myriad of factors that influence risk. An understanding of these relationships is critical in making balanced and informed decisions on managing the risk.
- Providing a baseline for policy development and comparison of mitigation alternatives. The data used for this analysis presents a current picture of risk in the Buncombe Madison Region. Updating this risk "snapshot" with future data will enable comparison of the changes in risk with time. Baselines of this type can support the objective analysis of policy and program options for risk reduction in the region.
- Comparing the risk among the natural hazards addressed. The ability to quantify the risk to all these hazards relative to one another helps in a balanced, multi-hazard approach to risk management at each level of governing authority. This ranking provides a systematic framework to compare and prioritize the very disparate natural hazards that are present in the Buncombe Madison Region. This final step in the risk assessment provides the necessary information for local officials to craft a mitigation strategy to focus resources on only those hazards that pose the most threat to the Buncombe Madison counties.

Exposure to hazards can be an indicator of vulnerability. Economic exposure can be identified through locally assessed values for improvements (buildings), and social exposure can be identified by estimating the population exposed to each hazard. This information is especially important for decision-makers to use in planning for evacuation or other public safety related needs.

The types of assets included in these analyses include all building types in the participating jurisdictions. Specific information about the types of assets that are vulnerable to the identified hazards is included in each hazard subsection (for example all building types are considered at risk to the winter storm hazard and commercial, residential, and government owned facilities are at risk to repetitive flooding, etc).

Table 6.15 presents a summary of annualized loss for each hazard in the Buncombe Madison Region. Due to the reporting of hazard damages primarily at the county level, it was difficult to determine an accurate annualized loss estimate for each municipality. Therefore, an annualized loss was determined through the damage reported through historical occurrences at the county level. These values should be used as an additional planning tool or measure risk for determining hazard mitigation strategies throughout the region.

TABLE 6.15: ANNUALIZED LOSS FOR THE BUNCOMBE MADISON REGION

Event	Buncombe County	Madison County	Total
Atmospheric Hazards			
Drought	Negligible	Negligible	Negligible
Extreme Heat	Negligible	Negligible	Negligible
Hailstorm	$407	$1,730	$2,137
Hurricane & Tropical Storm	$237,000	$13,000	$250,000
Lightning	$26,405	$23,658	$50,063
Severe Thunderstorm / High Wind	$78,391	$51,740	$130,132
Tornado	$108,278	$60,793	$169,072
Winter Storm & Freeze	$323,542	$319,567	$643,109
Geologic Hazards			
Earthquake	$129,000	$10,000	$139,000
Landslide	$2,906,534	Negligible	$2,906,534
Hydrologic Hazards			
Dam Failure	Negligible	Negligible	Negligible
Erosion	Negligible	Negligible	Negligible
Flood	$5,379,863	$1,160,697	$6,540,560
Other Hazards			
HAZMAT Incident	Negligible	Negligible	Negligible
Wildfire	Negligible	Negligible	Negligible

*In this table, the term "Negligible" is used to indicate that no records of dollar losses for the particular hazard were recorded. This could be the case either because there were no events that caused dollar damage or because documentation of that particular type of event is not well kept.

As noted previously, all existing and future buildings and populations (including critical facilities) are vulnerable to atmospheric hazards including drought, extreme heat, hailstorm, hurricane and tropical storm, lightning, thunderstorm wind, tornado, and winter storm and freeze. Some buildings may be more vulnerable to these hazards based on locations, construction, and building type. **Table 6.16** shows the critical facilities vulnerable to additional hazards analyzed in this section. The table lists those assets that are determined to be exposed to each of the identified hazards (marked with an "**X**").

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TABLE 6.16: AT-RISK CRITICAL FACILITIES

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
BUNCOMBE COUNTY																					
Buncombe County EOC	EOC	X	X	X	X	X	X	X	X	X		X									X
Asheville Police Department	Police Station	X	X	X	X	X	X	X	X	X		X					X	X		X	
Buncombe County Government Sheriff's Department	Police Station	X	X	X	X	X	X	X	X	X		X					X	X		X	
Haw Creek	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Skyland	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Beaverdam	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Asheville Fire and Rescue Station 3	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X		X	
NC USAR Task Force 2	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X			
Asheville Fire and Rescue Station 4	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
A-B Tech Community College	School	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	
Charles C. Bell Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X			
Enka Middle	School	X	X	X	X	X	X	X	X	X	X					X	X	X		X	X
Haw Creek Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X			
Johnston Elementary	School	X	X	X	X	X	X	X	X	X		X						X		X	

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
Oakley Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Sand Hill-Venable Elementary	School	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X	
T. C. Roberson High	School	X	X	X	X	X	X	X	X	X		X				X		X		X	
UNCA	School	X	X	X	X	X	X	X	X	X		X					X	X		X	
Valley Springs Middle	School	X	X	X	X	X	X	X	X	X		X				X		X		X	
William W. Estes Elementary	School	X	X	X	X	X	X	X	X	X		X				X		X		X	
Claxton Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X			
Asheville Middle	School	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Asheville High	School	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	
Accelerated Learning Center	School	X	X	X	X	X	X	X	X	X		X					X	X		X	
Hall Fletcher Elementary	School	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	
Isaac Dickson Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Jones Primary Middle	School	X	X	X	X	X	X	X	X	X		X					X	X			
Randolph Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X		X	
Vance Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X		X	
Charles T. Koontz Intermediate	School	X	X	X	X	X	X	X	X	X		X				X		X		X	
Buncombe County Early College	School	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	
Buncombe County Middle College	School	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
Mountain Area Cancer Center	Medical Care Facility	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	
Mission St. Joseph's Hospital	Medical Care Facility	X	X	X	X	X	X	X	X	X		X					X	X		X	
St Joseph's Hospital	Medical Care Facility	X	X	X	X	X	X	X	X	X		X					X	X		X	
Charles George US Veterans Medical Center	Medical Care Facility	X	X	X	X	X	X	X	X	X		X					X	X			
Weaverville Police Department	Police Station	X	X	X	X	X	X	X	X	X		X			X	X	X	X			
Weaverville	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X						X	X			X
Weaverville Company 8	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X						X	X			X
Weaverville	School	X	X	X	X	X	X	X	X	X		X			X	X	X	X			
Weaverville Primary	School	X	X	X	X	X	X	X	X	X		X			X	X	X	X			
Woodfin Police Department	Police Station	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Woodfin	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X						X	X	X	
Woodfin Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Montreat College	School	X	X	X	X	X	X	X	X	X		X									
Black Mountain Police Department	Police Station	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
Black Mountain	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	
Black Mountain Station 2	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X	X	X	X
Black Mountain Station 1	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	
Black Mountain Elementary	School	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	
Black Mountain Primary	School	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	
Biltmore Forest Police Department	Police Station	X	X	X	X	X	X	X	X	X		X					X	X		X	
Barnardsville	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Enka-Candler	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
Fairview	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X			
French Broad	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										X
Garren Creek	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Jupiter	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										
Leicester	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										
Reems Creek	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									X
Reynolds	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X			

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
Riceville	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Swannanoa	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Upper Hominy	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										
West Buncombe	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Leicester - Sandy Mush	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										X
Avery's Creek	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X			X	X					
Hominy	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										
Skyland	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Broad River	Fire/EMS Station	X	X	X	X	X	X	X	X	X											
Enka-Candler	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X						X	X		X	X
Black Mountain Station 3	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Broad River	Fire/EMS Station	X	X	X	X	X	X	X	X	X											
Garren Creek2	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Leicester - Newfound	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
West Buncombe Company 5	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									X
Enka-Candler Station 1	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
Reynolds VFD	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X			
Buncombe Community College	School	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Warren Wilson College	School	X	X	X	X	X	X	X	X	X		X									
A. C. Reynolds High	School	X	X	X	X	X	X	X	X	X		X					X	X			
A. C. Reynolds Middle	School	X	X	X	X	X	X	X	X	X		X					X	X			
Avery's Creek Elementary	School	X	X	X	X	X	X	X	X	X		X									
Barnardsville Elementary	School	X	X	X	X	X	X	X	X	X	X										X
Candler Elementary	School	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
Cane Creek Middle	School	X	X	X	X	X	X	X	X	X		X									
Charles D. Owen Middle	School	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Charles D. Owen High	School	X	X	X	X	X	X	X	X	X		X								X	
Clyde A. Erwin High	School	X	X	X	X	X	X	X	X	X		X									
Clyde A. Erwin Middle	School	X	X	X	X	X	X	X	X	X		X									
Emma Elementary	School	X	X	X	X	X	X	X	X	X		X			X	X		X	X	X	
Enka High	School	X	X	X	X	X	X	X	X	X	X										
Fairview Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X			X
Glen Arden Elementary	School	X	X	X	X	X	X	X	X	X		X						X		X	

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
Hominy Valley Elementary	School	X	X	X	X	X	X	X	X	X	X					X		X		X	
Leicester Elementary	School	X	X	X	X	X	X	X	X	X	X										
North Buncombe Middle	School	X	X	X	X	X	X	X	X	X	X						X	X			
North Buncombe High	School	X	X	X	X	X	X	X	X	X	X							X			
North Buncombe Elementary	School	X	X	X	X	X	X	X	X	X	X										X
Pisgah Elementary	School	X	X	X	X	X	X	X	X	X	X										
W. D. Williams Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X		X	
West Buncombe Elementary	School	X	X	X	X	X	X	X	X	X		X									
Joe P. Eblen Intermediate	School	X	X	X	X	X	X	X	X	X		X									X
North Windy Ridge Intermediate	School	X	X	X	X	X	X	X	X	X	X						X	X			X
MADISON COUNTY																					
Madison County EOC	EOC	X	X	X	X	X	X	X	X	X	X						X	X		X	X
TOWN OF HOT SPRGS-POLICE DEPT	Police Station	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
HOT SPRINGS	Fire Station	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
Hot Springs Elementary School	School	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
MARS HILL MEDICAL CENTER	Medical Care Facility	X	X	X	X	X	X	X	X	X	X					X		X			
STATE HIGHWAY PATROL	Police Station	X	X	X	X	X	X	X	X	X	X					X	X	X			

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
JARRETT BLDG - CAMPUS POLICE	Police Station	X	X	X	X	X	X	X	X	X	X					X		X			
MARS HILL POLICE	Police Station	X	X	X	X	X	X	X	X	X	X					X		X			
MARS HILL	Fire Station	X	X	X	X	X	X	X	X	X	X					X		X			
Mars Hill College	School	X	X	X	X	X	X	X	X	X	X					X		X			X
MADISON COUNTY JAIL	Police Station	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X
MARSHALL	Fire Station	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
ELDERBERRY HEALTH CARE	Medical Care Facility	X	X	X	X	X	X	X	X	X	X						X	X		X	
LAUREL MEDICAL CTR	Medical Care Facility	X	X	X	X	X	X	X	X	X	X										X
MADISON MANOR NURSING HOME	Medical Care Facility	X	X	X	X	X	X	X	X	X	X						X	X			X
BIG PINE	Fire Station	X	X	X	X	X	X	X	X	X	X										
COUNTRY	Fire Station	X	X	X	X	X	X	X	X	X	X						X	X			
EBBS CHAPEL	Fire Station	X	X	X	X	X	X	X	X	X	X							X			X
LAUREL	Fire Station	X	X	X	X	X	X	X	X	X	X										

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
SPRING CREEK	Fire Station	X	X	X	X	X	X	X	X	X	X										
WALNUT	Fire Station	X	X	X	X	X	X	X	X	X	X						X	X			X
JUPITER	Fire Station	X	X	X	X	X	X	X	X	X	X										
Leister	Fire Station	X	X	X	X	X	X	X	X	X	X										X
Brush Creek Elementary	School	X	X	X	X	X	X	X	X	X	X						X	X			
Laurel Elementary School	School	X	X	X	X	X	X	X	X	X	X										
Madison High School	School	X	X	X	X	X	X	X	X	X	X						X	X			
Madison Middle School	School	X	X	X	X	X	X	X	X	X	X						X	X			
Mars Hill Elementary School	School	X	X	X	X	X	X	X	X	X	X				X	X					
A-B Tech	School	X	X	X	X	X	X	X	X	X	X						X	X		X	X

SECTION 7
CAPABILITY ASSESSMENT

This section of the Plan discusses the capability of the communities in the Buncombe Madison Region to implement hazard mitigation activities. It consists of the following four subsections:

- 7.1 What is a Capability Assessment?
- 7.2 Conducting the Capability Assessment
- 7.3 Capability Assessment Findings
- 7.4 Conclusions on Local Capability

7.1 WHAT IS A CAPABILITY ASSESSMENT

The purpose of conducting a capability assessment is to determine the ability of a local jurisdiction to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects.[1] As in any planning process, it is important to try to establish which goals, objectives, and/or actions are feasible based on an understanding of the organizational capacity of those agencies or departments tasked with their implementation. A capability assessment helps to determine which mitigation actions are practical, and likely to be implemented over time, given a local government's planning and regulatory framework, level of administrative and technical support, amount of fiscal resources, and current political climate.

A capability assessment has two primary components: 1) an inventory of a local jurisdiction's relevant plans, ordinances, or programs already in place and 2) an analysis of its capacity to carry them out. Careful examination of local capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing government activities that could hinder proposed mitigation activities and possibly exacerbate community hazard vulnerability. A capability assessment also highlights the positive mitigation measures already in place or being implemented at the local government level, which should continue to be supported and enhanced through future mitigation efforts.

The capability assessment completed for the Buncombe Madison Region serves as a critical planning step and an integral part of the foundation for designing an effective hazard mitigation strategy. Coupled with the Risk Assessment, the Capability Assessment helps identify and target meaningful mitigation actions for incorporation in the Mitigation Strategy portion of the Hazard Mitigation Plan. It not only helps establish the goals and objectives for the region to pursue under this Plan, but it also ensures that those goals and objectives are realistically achievable under given local conditions.

[1] While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for local hazard mitigation plans, it is a critical step in developing a mitigation strategy that meets the needs of the region while taking into account their own unique abilities. The Rule does state that a community's mitigation strategy should be "based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools" (44 CFR, Part 201.6(c)(3)).

7.2 CONDUCTING THE CAPABILITY ASSESSMENT

In order to facilitate the inventory and analysis of local government capabilities within the Buncombe Madison counties, a detailed Capability Assessment Survey was completed for each of the participating jurisdictions based on the information found in existing hazard mitigation plans and local government websites. The survey questionnaire compiled information on a variety of "capability indicators" such as existing local plans, policies, programs, or ordinances that contribute to and/or hinder the region's ability to implement hazard mitigation actions. Other indicators included information related to the communities' fiscal, administrative, and technical capabilities, such as access to local budgetary and personnel resources for mitigation purposes. The current political climate, an important consideration for any local planning or decision making process, was also evaluated with respect to hazard mitigation.

At a minimum, survey results provide an extensive inventory of existing local plans, ordinances, programs, and resources that are in place or under development in addition to their overall effect on hazard loss reduction. However, the survey instrument can also serve to identify gaps, weaknesses, or conflicts that counties and local jurisdictions can recast as opportunities for specific actions to be proposed as part of the hazard mitigation strategy.

The information collected in the survey questionnaire was incorporated into a database for further analysis. A general scoring methodology was then applied to quantify each jurisdiction's overall capability.[2] According to the scoring system, each capability indicator was assigned a point value based on its relevance to hazard mitigation.

Using this scoring methodology, a total score and an overall capability rating of "high," "moderate," or "limited" could be determined according to the total number of points received. These classifications are designed to provide nothing more than a general assessment of local government capability. The results of this capability assessment provide critical information for developing an effective and meaningful mitigation strategy.

7.3 CAPABILITY ASSESSMENT FINDINGS

The findings of the capability assessment are summarized in this Plan to provide insight into the relevant capacity of the jurisdictions in the Buncombe Madison Region to implement hazard mitigation activities. All information is based upon the review of existing hazard mitigation plans and local government websites through the Capability Assessment Survey and input provided by local government officials during meetings of the Buncombe Madison Regional Hazard Mitigation Planning Team.

7.3.1 Planning and Regulatory Capability

Planning and regulatory capability is based on the implementation of plans, ordinances, and programs that demonstrate a local jurisdiction's commitment to guiding and managing growth, development, and redevelopment in a responsible manner while maintaining the general welfare of the community. It includes emergency response and mitigation planning, comprehensive land use planning, and transportation planning; the enforcement of zoning or subdivision ordinances and building codes that regulate how land is developed and structures are built; as well as protecting environmental, historic, and cultural resources in the community. Although some conflicts can arise, these planning initiatives

[2] The scoring methodology used to quantify and rank the region's capability can be found in Appendix B.

generally present significant opportunities to integrate hazard mitigation principles and practices into the local decision making process.

This assessment is designed to provide a general overview of the key planning and regulatory tools and programs that are in place or under development for the jurisdictions in the Buncombe Madison Region along with their potential effect on loss reduction. This information will help identify opportunities to address existing gaps, weaknesses, or conflicts with other initiatives in addition to integrating the implementation of this Plan with existing planning mechanisms where appropriate.

Table 7.1 provides a summary of the relevant local plans, ordinances, and programs already in place or under development for the jurisdictions in the Buncombe Madison Region. A checkmark (✓) indicates that the given item is currently in place and being implemented. An asterisk (*) indicates that the given item is currently being developed for future implementation. Each of these local plans, ordinances, and programs should be considered available mechanisms for incorporating the requirements of the Buncombe Madison Regional Hazard Mitigation Plan.

TABLE 7.1: RELEVANT PLANS, ORDINANCES, AND PROGRAMS

Planning / Regulatory Tool	BUNCOMBE COUNTY	Asheville	Biltmore Forest	Black Mountain	Montreat	Weaverville	Woodfin	MADISON COUNTY	Hot Springs	Marshall	Mars Hill
Hazard Mitigation Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Comprehensive Land Use Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Floodplain Management Plan											
Open Space Management Plan (Parks & Rec/Greenway Plan)	✓	✓	✓	✓	✓	✓	✓				
Stormwater Management Plan/Ordinance	✓	✓	✓	✓	✓	✓	✓			✓	
Natural Resource Protection Plan											
Flood Response Plan		✓									
Emergency Operations Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Continuity of Operations Plan	✓										
Evacuation Plan											
Disaster Recovery Plan											
Capital Improvements Plan	✓	✓		✓	✓	✓				✓	✓
Economic Development Plan	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Historic Preservation Plan											
Flood Damage Prevention Ordinance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Planning / Regulatory Tool	BUNCOMBE COUNTY	Asheville	Biltmore Forest	Black Mountain	Montreat	Weaverville	Woodfin	MADISON COUNTY	Hot Springs	Marshall	Mars Hill
Zoning Ordinance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Subdivision Ordinance	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Unified Development Ordinance		✓		✓		*				✓	
Post-Disaster Redevelopment Ordinance											
Building Code	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fire Code	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
National Flood Insurance Program (NFIP)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NFIP Community Rating System		*									

A more detailed discussion on the region's planning and regulatory capability follows.

7.3.2 Emergency Management

Hazard mitigation is widely recognized as one of the four primary phases of emergency management. The three other phases include preparedness, response, and recovery. In reality, each phase is interconnected with hazard mitigation, as **Figure 7.1** suggests. Opportunities to reduce potential losses through mitigation practices are most often implemented before disaster strikes, such as the elevation of flood prone structures or the continuous enforcement of policies that prevent and regulate development that is vulnerable to hazards due to its location, design, or other characteristics. Mitigation opportunities will also be presented during immediate preparedness or response activities, such as installing storm shutters in advance of a hurricane, and certainly during the long-term recovery and redevelopment process following a hazard event.

FIGURE 7.1: THE FOUR PHASES OF EMERGENCY MANAGEMENT

Planning for each phase is a critical part of a comprehensive emergency management program and a key to the successful implementation of hazard mitigation actions. As a result, the Capability Assessment Survey asked several questions across a range of emergency management plans in order to assess the Buncombe Madison Region's willingness to plan and their level of technical planning proficiency.

Hazard Mitigation Plan: A hazard mitigation plan represents a community's blueprint for how it intends to reduce the impact of natural and human-caused hazards on people and the built environment. The essential elements of a hazard mitigation plan include a risk assessment, capability assessment, and mitigation strategy.

- Both of the counties participating in this multi-jurisdictional plan have previously adopted hazard mitigation plans. Each participating jurisdiction was included in their respective county's plan.

Disaster Recovery Plan: A disaster recovery plan serves to guide the physical, social, environmental, and economic recovery and reconstruction process following a disaster. In many instances, hazard mitigation principles and practices are incorporated into local disaster recovery plans with the intent of capitalizing on opportunities to break the cycle of repetitive disaster losses. Disaster recovery plans can also lead to the preparation of disaster redevelopment policies and ordinances to be enacted following a hazard event.

- None of the counties or municipalities participating in this multi-jurisdictional plan have adopted a disaster recovery plan. They should consider developing a plan to guide the recovery and reconstruction process following a disaster.

Emergency Operations Plan: An emergency operations plan outlines responsibilities and the means by which resources are deployed during and following an emergency or disaster.

- Buncombe County and Madison County each maintain emergency operations plans through their respective Emergency Management Departments.
- All of the municipalities in Buncombe County have entered into a Civil Preparedness Agreement to implement the county emergency operations plan.
- Madison County's emergency operations plan addresses hazards which threaten the county and municipalities.

Continuity of Operations Plan: A continuity of operations plan establishes a chain of command, line of succession, and plans for backup or alternate emergency facilities in case of an extreme emergency or disaster event.

- Buncombe County has a Continuity of Operations Plan.

Flood Response Plan: A flood response plan establishes procedures for responding to a flood emergency including coordinating and facilitating resources to minimize the impacts of flood.

- The City of Asheville is the only jurisdiction that has adopted a flood response plan.

7.3.3 General Planning

The implementation of hazard mitigation activities often involves agencies and individuals beyond the emergency management profession. Stakeholders may include local planners, public works officials, economic development specialists, and others. In many instances, concurrent local planning efforts will help to achieve or complement hazard mitigation goals, even though they are not designed as such. Therefore, the Capability Assessment Survey also asked questions regarding general planning capabilities and the degree to which hazard mitigation is integrated into other on-going planning efforts in the Buncombe Madison Region.

Comprehensive Land Use Plan: A comprehensive land use plan establishes the overall vision for what a community wants to be and serves as a guide for future governmental decision making. Typically a comprehensive plan contains sections on demographic conditions, land use, transportation elements, and community facilities. Given the broad nature of the plan and its regulatory standing in many communities, the integration of hazard mitigation measures into the comprehensive plan can enhance the likelihood of achieving risk reduction goals, objectives, and actions.

- Buncombe County has adopted a comprehensive land use plan that includes all of its municipalities as well as the unincorporated county. The City of Asheville, the Town of Black Mountain, and the Town of Weaverville each have municipal comprehensive land use plans in place.
- Madison County, the Town of Hot Springs, the Town of Marshall, and the Town of Mars Hill have each adopted a comprehensive plan.

Capital Improvements Plan: A capital improvements plan guides the scheduling of spending on public improvements. A capital improvements plan can serve as an important mechanism for guiding future development away from identified hazard areas. Limiting public spending in hazardous areas is one of the most effective long-term mitigation actions available to local governments.

- Buncombe County and all of its municipalities, except the Town of Biltmore Forest and the Town of Woodfin, have capital improvements plans.
- Madison County does not have a capital improvements plan in place. However, the Town of Marshall and the Town of Mars Hill do have capital improvements programs.

Historic Preservation Plan: A historic preservation plan is intended to preserve historic structures or districts within a community. An often overlooked aspect of the historic preservation plan is the assessment of buildings and sites located in areas subject to natural hazards and the identification of ways to reduce future damages. This may involve retrofitting or relocation techniques that account for the need to protect buildings that do not meet current building standards or are within a historic district that cannot easily be relocated out of harm's way.

- None of the counties or municipalities participating in this multi-jurisdictional plan have a historic preservation plan.

Zoning Ordinance: Zoning represents the primary means by which land use is controlled by local governments. As part of a community's police power, zoning is used to protect the public health, safety, and welfare of those in a given jurisdiction that maintains zoning authority. A zoning ordinance is the mechanism through which zoning is typically implemented. Since zoning regulations enable municipal

governments to limit the type and density of development, a zoning ordinance can serve as a powerful tool when applied in identified hazard areas.

- All of the counties and municipalities participating in this plan have adopted zoning ordinances. The City of Asheville, the Town of Black Mountain, the Town of Weaverville, and the Town of Marshall include zoning regulations as part of their local unified development ordinance. The remaining municipalities and two counties have adopted stand-alone zoning ordinances.

Subdivision Ordinance: A subdivision ordinance is intended to regulate the development of residential, commercial, industrial, or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development. Subdivision design that accounts for natural hazards can dramatically reduce the exposure of future development.

- All of the counties and municipalities participating in this plan have adopted subdivision regulations, except the Town of Hot Springs. Again, the City of Asheville, the Town of Black Mountain, the Town of Weaverville, and the Town of Marshall include these regulations as part of their local unified development ordinance. The other municipalities and two counties with subdivision regulations have adopted stand-alone ordinances.

Building Codes, Permitting, and Inspections: Building codes regulate construction standards. In many communities, permits and inspections are required for new construction. Decisions regarding the adoption of building codes (that account for hazard risk), the type of permitting process required both before and after a disaster, and the enforcement of inspection protocols all affect the level of hazard risk faced by a community.

- North Carolina has a state compulsory building code, which applies throughout the state; however, jurisdictions may adopt codes if approved as providing adequate minimum standards. All of the participating counties and municipalities have adopted a building code. The building code is enforced by each county's building inspector.
- In Buncombe County, the City of Asheville, the Town of Black Mountain, and the Town of Montreat have their own inspections departments that enforce the building code within their town limits.

The adoption and enforcement of building codes by local jurisdictions is routinely assessed through the Building Code Effectiveness Grading Schedule (BCEGS) program developed by the Insurance Services Office, Inc. (ISO).[3] In North Carolina, the North Carolina Department of Insurance assesses the building codes in effect in a particular community and how the community enforces its building codes *with special emphasis on mitigation of losses from natural hazards*. The results of BCEGS assessments are routinely provided to ISO's member private insurance companies, which in turn may offer ratings credits for new buildings constructed in communities with strong BCEGS classifications. The concept is that communities with well-enforced, up-to-date codes should experience fewer disaster-related losses and, as a result, should have lower insurance rates.

In conducting the assessment, ISO collects information related to personnel qualification and continuing education as well as the number of inspections performed per day. This type of information combined with local building codes is used to determine a grade for that jurisdiction. The grades range from 1 to

[3] Participation in BCEGS is voluntary and may be declined by local governments if they do not wish to have their local building codes evaluated.

10 with a BCEGS grade of 1 representing exemplary commitment to building code enforcement and a grade of 10 indicating less than minimum recognized protection.

7.3.4 Floodplain Management

Flooding represents the greatest natural hazard facing the nation. At the same time, the tools available to reduce the impacts associated with flooding are among the most developed when compared to other hazard-specific mitigation techniques. In addition to approaches that cut across hazards such as education, outreach, and the training of local officials, the *National Flood Insurance Program* (NFIP) contains specific regulatory measures that enable government officials to determine where and how growth occurs relative to flood hazards. Participation in the NFIP is voluntary for local governments; however, program participation is strongly encouraged by FEMA as a first step for implementing and sustaining an effective hazard mitigation program. It is therefore used as part of this assessment as a key indicator for measuring local capability.

In order for a county or municipality to participate in the NFIP, they must adopt a local flood damage prevention ordinance that requires jurisdictions to follow established minimum building standards in the floodplain. These standards require that all new buildings and substantial improvements to existing buildings will be protected from damage by a 100-year flood event and that new development in the floodplain will not exacerbate existing flood problems or increase damage to other properties.

A key service provided by the NFIP is the mapping of identified flood hazard areas. Once completed, the Flood Insurance Rate Maps (FIRMs) are used to assess flood hazard risk, regulate construction practices, and set flood insurance rates. FIRMs are an important source of information to educate residents, government officials, and the private sector about the likelihood of flooding in their community.

Table 7.2 provides NFIP policy and claim information for each participating jurisdiction in the Buncombe Madison Region.

TABLE 7.2: NFIP POLICY AND CLAIM INFORMATION

Jurisdiction	Date Joined NFIP	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Closed Claims	Total Payments to Date
BUNCOMBE COUNTY†	08/01/80	04/03/12	429	$99,682,700	133	$3,299,684
Asheville	07/16/80	01/06/10	456	$127,704,800	227	$13,850,453
Biltmore Forest	03/26/10	01/06/10	3	$395,400	0	$0
Black Mountain	04/15/80	01/06/10	65	$14,309,000	12	$35,989
Montreat	09/19/05	01/06/10	12	$4,210,000	0	$0
Weaverville	05/06/97	01/06/10	14	$3,615,000	0	$0
Woodfin	02/01/80	01/06/10	17	$6,361,700	1	$1,008
MADISON COUNTY†	09/02/82	01/06/10	54	$14,328,800	11	$416,269
Hot Springs	07/05/82	01/06/10	7	$854,300	1	$2,361

Jurisdiction	Date Joined NFIP	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Closed Claims	Total Payments to Date
Marshall	05/15/78	01/06/10	30	$6,865,300	36	$517,815
Mars Hill	08/19/87	01/06/10	1	$42,000	0	$0

†Includes unincorporated areas of county only
Source: NFIP Community Status information as of 10/3/13; NFIP claims and policy information as of 7/31/13

Community Rating System: An additional indicator of floodplain management capability is the active participation of local jurisdictions in the Community Rating System (CRS). The CRS is an incentive-based program that encourages counties and municipalities to undertake defined flood mitigation activities that go beyond the minimum requirements of the NFIP by adding extra local measures to provide protection from flooding. All of the 18 creditable CRS mitigation activities are assigned a range of point values. As points are accumulated and reach identified thresholds, communities can apply for an improved CRS class rating. Class ratings, which range from 10 to 1, are tied to flood insurance premium reductions as shown in **Table 7.3**. As class rating improves (the lower the number the better), the percent reduction in flood insurance premiums for NFIP policyholders in that community increases.

TABLE 7.3: CRS PREMIUM DISCOUNTS, BY CLASS

CRS Class	Premium Reduction
1	45%
2	40%
3	35%
4	30%
5	25%
6	20%
7	15%
8	10%
9	5%
10	0

Source: *FEMA*

Community participation in the CRS is voluntary. Any community that is in full compliance with the rules and regulations of the NFIP may apply to FEMA for a CRS classification better than class 10. The CRS application process has been greatly simplified over the past several years based on community comments. Changes were made with the intent to make the CRS more user-friendly and make extensive technical assistance available for communities who request it.

- None of the jurisdictions currently participate in the CRS. As of December 2013, the City of Ashville had prepared an application to join the CRS. Participation in the CRS program should be considered as a mitigation action by the other counties and municipalities. The program would be most beneficial to the City of Asheville and Buncombe County, which have 456 and 429 NFIP policies, respectively.

Flood Damage Prevention Ordinance: A flood damage prevention ordinance establishes minimum building standards in the floodplain with the intent to minimize public and private losses due to flood conditions.

- All communities participating in the NFIP are required to adopt a local flood damage prevention ordinance. All counties and municipalities participating in this hazard mitigation plan also participate in the NFIP and they all have adopted flood damage prevention regulations.

Floodplain Management Plan: A floodplain management plan (or a flood mitigation plan) provides a framework for action regarding corrective and preventative measures to reduce flood-related impacts.

- None of the counties or municipalities participating in this multi-jurisdictional plan have adopted floodplain management plans.

Open Space Management Plan*:* An open space management plan is designed to preserve, protect, and restore largely undeveloped lands in their natural state and to expand or connect areas in the public domain such as parks, greenways, and other outdoor recreation areas. In many instances, open space management practices are consistent with the goals of reducing hazard losses, such as the preservation of wetlands or other flood-prone areas in their natural state in perpetuity.

- Buncombe County has adopted the Buncombe County Greenways and Trails Master Plan which also includes all of its municipalities. The City of Asheville, the Town of Black Mountain, and the Town of Montreat have each adopted a municipal-level parks or greenways master plan.
- Neither Madison County nor its municipalities have adopted an open space management plan.

Stormwater Management Plan: A stormwater management plan is designed to address flooding associated with stormwater runoff. The stormwater management plan is typically focused on design and construction measures that are intended to reduce the impact of more frequently occurring minor urban flooding.

- The Town of Black Mountain is the only jurisdiction with a stormwater management plan in place. However, several jurisdictions have stormwater management ordinances in place.
- Buncombe County has adopted a stormwater management ordinance that is administered by the county throughout the unincorporated area as well as within the municipal boundaries of the following towns: Biltmore Forest, Montreat, Weaverville, and Woodfin, through interlocal agreement. The City of Asheville, the Town of Black Mountain, and the Town of Montreat administer their own stormwater management ordinances.
- The Town of Marshall is the only Madison County jurisdiction that has adopted stormwater regulations. These regulations are included in the town's unified development ordinance.

7.3.6 Administrative and Technical Capability

The ability of a local government to develop and implement mitigation projects, policies, and programs is directly tied to its ability to direct staff time and resources for that purpose. Administrative capability can be evaluated by determining how mitigation-related activities are assigned to local departments and if there are adequate personnel resources to complete these activities. The degree of

intergovernmental coordination among departments will also affect administrative capability for the implementation and success of proposed mitigation activities.

Technical capability can generally be evaluated by assessing the level of knowledge and technical expertise of local government employees, such as personnel skilled in using Geographic Information Systems (GIS) to analyze and assess community hazard vulnerability. The Capability Assessment Survey was used to capture information on administrative and technical capability through the identification of available staff and personnel resources.

Table 7.4 provides a summary of the capability assessment results for the Buncombe Madison Region with regard to relevant staff and personnel resources. A checkmark (✓) indicates the presence of a staff member(s) in that jurisdiction with the specified knowledge or skill.

TABLE 7.4: RELEVANT STAFF / PERSONNEL RESOURCES

Staff / Personnel Resource	BUNCOMBE COUNTY	Asheville	Biltmore Forest	Black Mountain	Montreat	Weaverville	Woodfin	MADISON COUNTY	Hot Springs	Marshall	Mars Hill
Planners with knowledge of land development / land management practices	✓	✓		✓		✓					
Engineers or professionals trained in construction practices related to buildings and/or infrastructure	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Planners or engineers with an understanding of natural and/or human-caused hazards	✓			✓							
Emergency Manager	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Floodplain Manager	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Land Surveyors											
Scientists familiar with the hazards of the community	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Staff with education or expertise to assess the community's vulnerability to hazards	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Personnel skilled in GIS and/or Hazus	✓	✓	✓	✓	✓	✓	✓	✓			
Resource development staff or grant writers											

Credit for having a floodplain manager was given to those jurisdictions that have a flood damage prevention ordinance, and therefore an appointed floodplain administrator, regardless of whether the appointee was dedicated solely to floodplain management. Credit was given for having a scientist familiar with the hazards of the community if a jurisdiction has a Cooperative Extension Service or Soil and Water Conservation Department. Credit was also given for having staff with education or expertise

to assess the community's vulnerability to hazards if a staff member from the jurisdiction was a participant on the existing hazard mitigation plan's planning committee.

7.3.7 Fiscal Capability

The ability of a local government to take action is often closely associated with the amount of money available to implement policies and projects. This may take the form of outside grant funding awards or locally-based revenue and financing. The costs associated with mitigation policy and project implementation vary widely. In some cases, policies are tied primarily to staff time or administrative costs associated with the creation and monitoring of a given program. In other cases, direct expenses are linked to an actual project, such as the acquisition of flood-prone homes, which can require a substantial commitment from local, state, and federal funding sources.

The Capability Assessment Survey was used to capture information on the region's fiscal capability through the identification of locally available financial resources.

Table 7.5 provides a summary of the results for the Buncombe Madison Region with regard to relevant fiscal resources. A checkmark (✓) indicates that the given fiscal resource is locally available for hazard mitigation purposes (including match funds for state and federal mitigation grant funds) according to the previous county hazard mitigation plans.

TABLE 7.5: RELEVANT FISCAL RESOURCES

Fiscal Tool / Resource	BUNCOMBE COUNTY	Asheville	Biltmore Forest	Black Mountain	Montreat	Weaverville	Woodfin	MADISON COUNTY	Hot Springs	Marshall	Mars Hill
Capital Improvement Programming	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Community Development Block Grants (CDBG)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Special Purpose Taxes (or taxing districts)								✓	✓	✓	✓
Gas / Electric Utility Fees											
Water / Sewer Fees											
Stormwater Utility Fees		✓									
Development Impact Fees											
General Obligation, Revenue, and/or Special Tax Bonds											
Partnering Arrangements or Intergovernmental Agreements	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Other: HMGP, FMAP, other Federal and state funding sources, etc.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

7.3.8 Political Capability

One of the most difficult capabilities to evaluate involves the political will of a jurisdiction to enact meaningful policies and projects designed to reduce the impact of future hazard events. Hazard mitigation may not be a local priority or may conflict with or be seen as an impediment to other goals of the community, such as growth and economic development. Therefore, the local political climate must be considered in designing mitigation strategies as it could be the most difficult hurdle to overcome in accomplishing their adoption and implementation.

The Capability Assessment Survey was used to capture information on political capability of the Buncombe Madison Region. Previous county-level hazard mitigation plans were reviewed for general examples of local political capability, such as guiding development away from identified hazard areas, restricting public investments or capital improvements within hazard areas, or enforcing local development standards that go beyond minimum state or federal requirements (i.e., building codes, floodplain management, etc.).

- The previous county hazard mitigation plans identified existing ordinances that address natural hazards or are related to hazard mitigation such as emergency management, flood damage prevention, watershed protection, stormwater management, erosion and sedimentation control, steep slope development, zoning, and subdivision.
- Buncombe County is currently a participant in the NFIP and has adopted the required ordinances related to Flood Damage Prevention, Soil Erosion and Sedimentation Control, Watershed Protection, and Stormwater Management. This demonstrates to some extent both favorable political support and a willingness to adopt hazard mitigation efforts in an active manner.
- In Madison County, as with many municipalities, major changes will likely be met with resistance. However, incremental changes stand a better chance of success over the long term. In terms of changes to hazard mitigation, there are numerous opportunities for Madison County, however, public education and progressive steps are essential for the success of any new initiatives. If the public is supportive of proposed changes, the elected officials who are responsible for adopting them are more likely to show their support. Building a disaster-resistance community depends primarily on involving the public and achieving participation. As required by FEMA for the local hazard mitigation plan, public participation is a must and to make it true, the political climate ought to be suitable.

7.4 CONCLUSIONS ON LOCAL CAPABILITY

In order to form meaningful conclusions on the assessment of local capability, a quantitative scoring methodology was designed and applied to results of the Capability Assessment Survey. This methodology, further described in Appendix B, attempts to assess the overall level of capability of the Buncombe Madison Region to implement hazard mitigation actions.

The overall capability to implement hazard mitigation actions varies little among the participating jurisdictions. For planning and regulatory capability, the majority of the jurisdictions are in the moderate range with a few falling in the limited range. There is also some variation in the administrative and technical capability among the jurisdictions with larger jurisdictions generally having

greater staff and technical resources. All of jurisdictions are in the limited to moderate range for fiscal capability.

Table 7.6 shows the results of the capability assessment using the designed scoring methodology. The capability score is based solely on the information found in existing hazard mitigation plans and readily available on the jurisdictions' government websites. According to the assessment, the average local capability score for all jurisdictions is 31.0, which falls into the moderate capability ranking.

TABLE 7.6: CAPABILITY ASSESSMENT RESULTS

Jurisdiction	Overall Capability Score	Overall Capability Rating
BUNCOMBE COUNTY	40	High
Asheville	39	Moderate
Biltmore Forest	26	Moderate
Black Mountain	37	Moderate
Montreat	30	Moderate
Weaverville	31	Moderate
Woodfin	24	Moderate
MADISON COUNTY	32	Moderate
Hot Springs	25	Moderate
Marshall	30	Moderate
Mars Hill	27	Moderate

As previously discussed, one of the reasons for conducting a Capability Assessment is to examine local capabilities to detect any existing gaps or weaknesses within ongoing government activities that could hinder proposed mitigation activities and possibly exacerbate community hazard vulnerability. These gaps or weaknesses have been identified for each jurisdiction in the tables found throughout this section. The participating jurisdictions used the Capability Assessment as part of the basis for the Mitigation Actions that are identified in Section 9; therefore, each jurisdiction addresses their ability to expand on and improve their existing capabilities through the identification of their Mitigation Actions.

7.4.1 Linking the Capability Assessment with the Risk Assessment and the Mitigation Strategy

The conclusions of the Risk Assessment and Capability Assessment serve as the foundation for the development of a meaningful hazard mitigation strategy. During the process of identifying specific mitigation actions to pursue, the BMRHMPT considered not only each jurisdiction's level of hazard risk, but also their existing capability to minimize or eliminate that risk.

SECTION 8
MITIGATION STRATEGY

This section of the Plan provides the blueprint for the participating jurisdictions in the Buncombe Madison Region to follow in order to become less vulnerable to its identified hazards. It is based on general consensus of the Buncombe Madison Regional Hazard Mitigation Planning Committee and the findings and conclusions of the *Capability Assessment* and *Risk Assessment*. It consists of the following five subsections:

- 8.1 Introduction
- 8.2 Mitigation Goals
- 8.3 Identification and Analysis of Mitigation Techniques
- 8.4 Selection of Mitigation Techniques for the Buncombe Madison Region
- 8.5 Plan Update Requirement

8.1 INTRODUCTION

The intent of the Mitigation Strategy is to provide the Buncombe Madison Region communities with the goals that will serve as guiding principles for future mitigation policy and project administration, along with an analysis of mitigation techniques available to meet those goals and reduce the impact of identified hazards. It is designed to be comprehensive, strategic, and functional in nature:

- In being *comprehensive*, the development of the strategy includes a thorough review of all hazards and identifies extensive mitigation measures intended to not only reduce the future impacts of high risk hazards, but also to help the region achieve compatible economic, environmental, and social goals.
- In being *strategic*, the development of the strategy ensures that all policies and projects proposed for implementation are consistent with pre-identified, long-term planning goals.
- In being *functional,* each proposed mitigation action is linked to established priorities and assigned to specific departments or individuals responsible for their implementation with target completion deadlines. When necessary, funding sources are identified that can be used to assist in project implementation.

The first step in designing the Mitigation Strategy includes the identification of mitigation goals. Mitigation goals represent broad statements that are achieved through the implementation of more specific mitigation actions. These actions include both hazard mitigation policies (such as the regulation of land in known hazard areas through a local ordinance) and hazard mitigation projects that seek to address specifically targeted hazard risks (such as the acquisition and relocation of a repetitive loss structure).

The second step involves the identification, consideration, and analysis of available mitigation measures to help achieve the identified mitigation goals. This is a long-term, continuous process sustained through the development and maintenance of this Plan. Alternative mitigation measures will continue

to be considered as future mitigation opportunities are identified, as data and technology improve, as mitigation funding becomes available, and as this Plan is maintained over time.

The third and last step in designing the Mitigation Strategy is the selection and prioritization of specific mitigation actions for the Buncombe Madison Region (provided separately in Section 9: *Mitigation Action Plan*). Each county and participating jurisdiction has its own Mitigation Action Plan (MAP) that reflects the needs and concerns of that jurisdiction. The MAP represents an unambiguous and functional plan for action and is considered to be the most essential outcome of the mitigation planning process.

The MAP includes a prioritized listing of proposed hazard mitigation actions (policies and projects) for the participating jurisdictions to complete. Each action has accompanying information, such as those departments or individuals assigned responsibility for implementation, potential funding sources, and an estimated target date for completion. The MAP provides those departments or individuals responsible for implementing mitigation actions with a clear roadmap that also serves as an important tool for monitoring success or progress over time. The cohesive collection of actions listed in the MAP can also serve as an easily understood menu of mitigation policies and projects for those local decision makers who want to quickly review the recommendations and proposed actions of the Regional Hazard Mitigation Plan.

In preparing each Mitigation Action Plan for the Buncombe Madison Region, officials considered the overall hazard risk and capability to mitigate the effects of hazards as recorded through the risk and capability assessment process, in addition to meeting the adopted mitigation goals and unique needs of the community.

8.1.1 Mitigation Action Prioritization

In the previous versions of the participating jurisdictions' hazard mitigation plans, not all actions were prioritized. In addition, there needed to be consistency among the counties and jurisdiction regarding how they prioritized their actions. Therefore, for the 2014 Buncombe Madison Regional plan, the Regional Hazard Mitigation Planning Committee members were tasked with establishing a priority for each action at the second Regional Hazard Mitigation Planning Committee meeting. Prioritization of the proposed mitigation actions was based on the following six factors:

- Effect on overall risk to life and property
- Ease of implementation
- Political and community support
- A general economic cost/benefit review[1]
- Funding availability

[1] Only a general economic cost/benefit review was considered by the Regional Hazard Mitigation Planning Committee through the process of selecting and prioritizing mitigation actions. Mitigation actions with "high" priority were determined to be the most cost effective and most compatible with the participating jurisdictions' unique needs. Actions with a "moderate" priority were determined to be cost-effective and compatible with jurisdictional needs, but may be more challenging to complete administratively or fiscally than "high" priority actions. Actions with a "low" priority were determined to be important community needs, but the community likely identified several potential challenges in terms of implementation (e.g. lack of funding, technical obstacles). A more detailed cost/benefit analysis will be applied to particular projects prior to the application for or obligation of funding, as appropriate.

- Continued compliance with the NFIP

The point of contact for each county and for the Tribe helped coordinate the prioritization process by reviewing each action and working with the lead agency/department responsible to determine a priority for each action using the six factors listed above.

Using these criteria, actions were classified as high, moderate, or low priority by the participating jurisdiction officials.

8.2 MITIGATION GOALS

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

The primary goal of all local governments is to promote the public health, safety, and welfare of its citizens. In keeping with this standard, the Buncombe Madison counties and the participating municipalities have developed eleven goal statements for local hazard mitigation planning in the region. In developing these goals, the previous county hazard mitigation plans were reviewed to determine areas of consistency. The project consultant reviewed the goals from each of the existing plans that were combined to form this regional plan. Many of the goals were similar and regional goals were formulated based on commonalities found between the goals in each plan. These proposed regional goals and their corresponding goals or objectives from the previous plans are presented in **Table 8.1**.

The proposed regional goals were presented, reviewed, voted on, and accepted by the Planning Committee at the second Regional Hazard Mitigation Planning Committee meeting. This process of combining goals from the previous plans served to highlight the planning process that had occurred in both counties prior to joining this regional planning effort. Each goal, purposefully broad in nature, serves to establish parameters that were used in developing more mitigation actions. The Buncombe Madison Regional Mitigation Goals are presented in **Table 8.2**. Consistent implementation of actions over time will ensure that community goals are achieved.

TABLE 8.1: PROPOSED MITIGATION GOALS

	Proposed Goal	Former Plan Reference	
		Buncombe County	Madison County
Goal #1	Incorporate hazard mitigation into the planning process of each jurisdiction and continue to carry out hazard mitigation by seeking funding when available.	Goal 1, Goal 7	
Goal #2	Evaluate, strengthen, and enforce ordinances.	Goal 2, Goal 3	
Goal #3	Increase and enhance public education and awareness regarding disasters and hazard mitigation.	Goal 4	Goal 7
Goal #4	Address stormwater management and impervious surface issues.	Goal 5	
Goal #5	Continue participation in the National Flood Insurance Program and investigate participation in the NFIP's Community Rating System.	Goal 6	

	Proposed Goal	Former Plan Reference	
		Buncombe County	Madison County
Goal #6	Conduct future development (including infrastructure) in a way that protects human life and property through management of natural features such as floodplains and wetlands and avoids development in known hazard areas. This will also reduce the risk to emergency workers.		Goal 1, Goal 2, Goal 4, Goal 5
Goal #7	Ensure that population growth does not exceed the capacity of evacuation routes.		Goal 3
Goal #8	Protect existing structures through retrofitting or other means.		Goal 6
Goal #9	Enhance the community's capability through the use of mutual aid agreements and sharing of resources at the county and regional level.		Goal 8
Goal #10	Ensure that community officials are well-educated and aware of existing resources, regulations, and procedures related to disasters.		Goal 9
Goal #11	Maintain and monitor the current plan and renew and revise as necessary.		Goal 10

TABLE 8.2: BUNCOMBE MADISON REGIONAL MITIGATION GOALS

	Goal
Goal #1	Incorporate hazard mitigation into the planning process of each jurisdiction and continue to carry out hazard mitigation by seeking funding when available.
Goal #2	Evaluate, strengthen, and enforce ordinances.
Goal #3	Increase and enhance public education and awareness regarding disasters and hazard mitigation.
Goal #4	Address stormwater management and impervious surface issues.
Goal #5	Continue participation in the National Flood Insurance Program and investigate participation in the NFIP's Community Rating System.
Goal #6	Conduct future development (including infrastructure) in a way that protects human life and property through management of natural features such as floodplains and wetlands and avoids development in known hazard areas. This will also reduce the risk to emergency workers.
Goal #7	Ensure that population growth does not exceed the capacity of evacuation routes.
Goal #8	Protect existing structures through retrofitting or other means.
Goal #9	Enhance the community's capability through the use of mutual aid agreements and sharing of resources at the county and regional level.
Goal #10	Ensure that community officials are well-educated and aware of existing resources, regulations, and procedures related to disasters.
Goal #11	Maintain and monitor the current plan and renew and revise as necessary.

8.3 IDENTIFICATION AND ANALYSIS OF MITIGATION TECHNIQUES

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

In formulating the Mitigation Strategy for the Buncombe Madison Region, a wide range of activities were considered in order to help achieve the established mitigation goals, in addition to addressing any specific hazard concerns. These activities were discussed during the Buncombe Madison Regional Hazard Mitigation Planning Committee meetings. In general, all activities considered by the Regional Hazard Mitigation Planning Committee can be classified under one of the following six broad categories of mitigation techniques: Prevention, Property Protection, Natural Resource Protection, Structural Projects, Emergency Services, and Public Awareness and Education. These are discussed in detail below.

8.3.1 Prevention

Preventative activities are intended to keep hazard problems from getting worse, and are typically administered through government programs or regulatory actions that influence the way land is developed and buildings are built. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning
- Building codes
- Open space preservation
- Floodplain regulations
- Stormwater management regulations
- Drainage system maintenance
- Capital improvements programming
- Riverine / fault zone setbacks

8.3.2 Property Protection

Property protection measures involve the modification of existing buildings and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include:

- Acquisition
- Relocation
- Building elevation
- Critical facilities protection
- Retrofitting (e.g., windproofing, floodproofing, seismic design techniques, etc.)

- Safe rooms, shutters, shatter-resistant glass
- Insurance

8.3.3 Natural Resource Protection

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, steep slopes, and sand dunes. Parks, recreation, or conservation agencies and organizations often implement these protective measures. Examples include:

- Floodplain protection
- Watershed management
- Riparian buffers
- Forest and vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.)
- Erosion and sediment control
- Wetland preservation and restoration
- Habitat preservation
- Slope stabilization

8.3.4 Structural Projects

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Reservoirs
- Dams / levees / dikes / floodwalls
- Diversions / detention / retention
- Channel modification
- Storm sewers

8.3.5 Emergency Services

Although not typically considered a “mitigation” technique, emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems
- Evacuation planning and management
- Emergency response training and exercises
- Sandbagging for flood protection
- Installing temporary shutters for wind protection

8.3.6 Public Education and Awareness

Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Outreach projects
- Speaker series / demonstration events
- Hazard map information
- Real estate disclosure
- Library materials
- School children educational programs
- Hazard expositions

8.4 SELECTION OF MITIGATION TECHNIQUES FOR THE BUNCOMBE MADISON REGION

In order to determine the most appropriate mitigation techniques for the communities in the Buncombe Madison Region, the Regional Hazard Mitigation Planning Committee members thoroughly reviewed and considered the findings of the *Capability Assessment* and *Risk Assessment* to determine the best activities for their respective communities. Other considerations included the effect of each mitigation action on overall risk to life and property, its ease of implementation, its degree of political and community support, its general cost-effectiveness, and funding availability (if necessary).

8.5 PLAN UPDATE REQUIREMENT

In keeping with FEMA requirements for plan updates, the Mitigation Actions identified in the previous Buncombe Madison Region county plans were evaluated to determine their 2014 implementation status. Updates on the implementation status of each action are provided. The mitigation actions provided in Section 9: *Mitigation Action Plan* include the mitigation actions from the previous plans as well as any new mitigation actions proposed through the 2014 planning process.

SECTION 9
MITIGATION ACTION PLAN

This section includes the listing of the mitigation actions proposed by participating jurisdictions in the Buncombe Madison Region. It consists of the following two subsections:

- 9.1 Overview
- 9.2 Mitigation Action Plans

44 CFR Requirement
44 CFR Part 201.6(c)(3)(iii): The mitigation strategy shall include an action plan describing how the actions identified in paragraph (c)(2)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction.

9.1 OVERVIEW

As described in the previous section, the Mitigation Action Plan, or MAP, provides a functional plan of action for each jurisdiction. It is designed to achieve the mitigation goals established in Section 8: *Mitigation Strategy* and will be maintained on a regular basis according to the plan maintenance procedures established in Section 10: *Plan Maintenance*.

Each proposed mitigation action has been identified as an effective measure (policy or project) to reduce hazard risk for the Buncombe Madison Region. Each action is listed in the MAP in conjunction with background information such as hazard(s) addressed and relative priority. Other information provided in the MAP includes potential funding sources to implement the action should funding be required (not all proposed actions are contingent upon funding). Most importantly, implementation mechanisms are provided for each action, including the designation of a lead agency or department responsible for carrying the action out as well as a timeframe for its completion. These implementation mechanisms ensure that the Buncombe Madison Regional Hazard Mitigation Plan remains a functional document that can be monitored for progress over time. The proposed actions are not listed in priority order, though each has been assigned a priority level of "high," "moderate," or "low" as described below and in Section 8 (page 8.2).

The Mitigation Action Plan is organized by mitigation strategy category (Prevention, Property Protection, Natural Resource Protection, Structural Projects, Emergency Services, or Public Education and Awareness). The following are the key elements described in the Mitigation Action Plan:

- Hazard(s) Addressed—Hazard which the action addresses.
- Relative Priority—High, moderate, or low priority as assigned by the jurisdiction.
- Lead Agency/Department—Department responsible for undertaking the action.
- Potential Funding Sources—Local, State, or Federal sources of funds are noted here, where applicable.
- Implementation Schedule—Date by which the action the action should be completed. More information is provided when possible.

- Implementation Status (2014)—Indication of completion, progress, deferment, or no change since the previous plan. If the action is new, that will be noted here.

9.2 MITIGATION ACTION PLANS

The mitigation actions proposed by each of the participating jurisdictions are listed in 11 individual MAPs on the following pages. **Table 9.1** shows the location of each jurisdiction's MAP within this section as well as the number of mitigation actions proposed by each jurisdiction.

TABLE 9.1: INDIVIDUAL MAP LOCATIONS

Location	Page	Number of Mitigation Actions
Buncombe County	**9:3**	**11**
Asheville	9:15	10
Biltmore Forest	9:18	7
Black Mountain	9:20	12
Montreat	9:23	33
Weaverville	9:29	7
Woodfin	9:31	7
Madison County	**9:33**	**26**
Hot Springs	9:43	6
Marshall	9:46	6
Mars Hill	9:49	6

Buncombe County Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Incorporate hazard mitigation into the planning process of each jurisdiction.	All	Moderate	Local	County EM	2015, Annual review	In May 2012, Buncombe County adopted the Sustainability Plan. The Plan outlined a five year plan for the County and its residents to make improvements in our community, environment and economy. One of the fourteen goal areas in the Plan is Resistance to Natural and Manmade Hazards". The two objectives under this goal are to: 1) locate critical facilities outside high hazard areas; and 2) Ensure local preparedness for emergencies (floods, fuel shortages, climate change, fire, droughts, earthquakes, food shortages, landslides, hazardous materials incidents, medical epidemics, etc.). In each year's Plan update, current indicators are tracked and strategies for looking forward are shown.
P-2	Continue to carry out the hazard mitigation planning process and seek funding for emerging needs.	All	Moderate	Local	County EM	2015, Annual review	On-going currently as evidenced by update of existing actions and move toward regional plan.
Property Protection							
PP-1	Strengthen the road design and construction as it pertains to the Manufactured Home Park Ordinance.	All	Moderate	Local	County EM/Planning Dept.	Completed	Buncombe County adopted the Manufactured Home Park Ordinance in April 1996. The purpose of the Ordinance is to protect the health, safety and general welfare of citizens of the County, particularly those who are residents of manufactured home parks. New parks and expansions of current parks are required to apply for a manufactured home park permit for construction. Plans are required to contain title block information; project data including the number of lots and acreage disturbed; road and utility information; location of natural features affecting the site, including the location of the 100-year floodplain and floodway; and other information specified in Section 46-65.5 in the Buncombe County Code of Ordinances. In 2006, the

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							requirement was added that all plans or requests must comply with the Buncombe County Fire Prevention Ordinance, and that the County fire marshal provide approval prior to a permit being issued. There are specific street construction standards required in the Ordinance, including a minimum drive width of 16', with all weather surface. Other street considerations include road intersection standards; minimum number of parking spaces per unit; minimum recorded access road right-of-way width; required turnarounds for street lengths over 500'; and road standards determined by road grade. Manufactured home spaces are required to have certain square footage depending on whether the park is served by sewer or septic systems. Each new home space must be located on ground not susceptible to flooding and graded so as to prevent any water from ponding. Each home shall be located at least 20' from any other home, at least 15' from the manufactured home park boundary, and at least 10' from the edge of any interior street. The Ordinance has requirements for all manufactured home parks, related to the provision of solid waste receptacles;the maintenance and safety of the park; adequate potable water supply; and responsibility for ensuring that each home be equipped with anchored steps or stairs from at least two exits. Finally, the Ordinance has penalties for violation and procedures for enforcement. At this time, there is no plan for further amending the road design standards in this Ordinance.
PP-2	Consider strengthening the requirements for road construction for special subdivision through the Subdivision Ordinance	All	Moderate	Local	Planning Dept.	2019	In recent years, Buncombe County has made revisions to its Subdivision Ordinance. The changes to the Subdivision Ordinance included strengthening the requirements for road construction and turn-around specifications to help provide adequate access for emergency vehicles. These changes apply to minor and

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							major subdivisions, and do not apply to subdivisions proposed with three lots or fewer (special subdivisions), or to family subdivisions. Prior to any subdivision being recorded, the Fire Marshal is required to approve the subdivision for emergency services access if the lot is not accessed off a state maintained road. In 2005 requirements were added to require geotechnical reports, soils maps, and compaction testing for roads. Hillside developments on 25% or greater slope were restricted within the 2006 changes. Density is decreased and lot sizes are increased within these areas. Limitations on maximum impervious and disturbed surfaces was added which apply to individual lots with 25% or greater slope within hillside subdivisions. In 2007 changes were made which require that builders on lots subject to the maximum impervious and disturbed areas submit a scaled site plan showing the areas of disturbance and impervious cover. Provisions were included to allow and encourage cluster development in hillside subdivisions. In 2010, additional revisions were made to the Subdivision Ordinance. Pre-application conferences for major subdivisions became a requirement prior to submission of plans. Slope analysis maps became a requirement for all major subdivisions and any subdivision subject to Hillside Development standards. Requirements for minor and major subdivisions during the preliminary plan review to submit proof of permission for waste system and water system were instituted. Also through the 2010 revisions, subdivision roads designated public or private became subject to final approval by the Buncombe County Fire Marshal; the minimum minor subdivision road right-of-way width was increased from 15 feet to 20 feet; and access roads standards to both major and minor subdivisions became eight-inch minimum aggregated base course No. 7 stone

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							with a minimum of 16 feet, subject to Buncombe County Fire Prevention Ordinance and approval by the Buncombe County Fire Marshal. The horizontal centerline design standards for both minor and major subdivisions T-turnaround became a minimum required length of perpendicular cord of 60 feet. Major subdivision road standards minimum pavement width became 18 feet, with two feet of additional drivable surface required capable of supporting the imposed load of fire apparatus weighing at least 75,000 pounds. Any request for variance for road width is now required to be accompanied by a letter from the Fire Marshal approving the alternate method. For minor subdivision roads, and any features such as cul-de-sacs and T-turnarounds, standards for roads less than or equal to ten percent grade began to be required to have an eight-inch minimum aggregated base course. All roads exceeding ten percent grade became required to meet major subdivision road construction standards. Final plan approval is now contingent upon the requirement than an engineer certify compliance with these standards. Within the Hillside Development Standards section of the Subdivision Ordinance (Sec. 70-68), changes were made to the density table for disturbance and minimum lot size. Changes were added to disturbed and impervious surfaces for communal infrastructure. Vegetation removal and re-vegetation requirements were included. Cluster development provisions became one of the types of development within the new Alternative Path Hillside Development standards, which allows for the additional design flexibility and preservation of environmentally sensitive features. The alternative path also recognizes Building and Grading Envelope Conservation development. The alternative path is encouraged in order to limit disturbed areas and

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							preserve ridge tops, woodlands, open spaces, floodplains, moderate and high risk landslide hazard areas and other environmentally sensitive areas. Since the 2010 changes were implemented, road requirements and standards are now being considered for special and family subdivisions. Consideration could be given for a minimum required road width and right-of-way width; road grade and required minimum distance for pull outs for emergency vehicles; requirements for T-turnarounds or cul-desacs; private driveway standards; and minimum access road width standards.
PP-3	Continue to implement the recommendations of the Comprehensive Land Use Plan	All	Moderate	Local	Planning Dept./Board of Commissioners	2015, Annual review	The latest Comprehensive Land Use Plan Update was adopted in September 2013. The Update provides a current assessment of the County while also providing an outlook for future land use patterns and potential strategies to address the County's needs. There is a section in the Comprehensive Land Use Plan Update dedicated to Hazards and the Hazard Mitigation Plan (pages 55-57). The hazards and risks within the County are listed from the Hazard Mitigation Plan. The main regulations identified that the County employs to mitigate these hazards and risks are identified as the zoning overlays, including the Steep Slope/High Elevation Overlay District and the Protected Ridge Overlay District within the Zoning Ordinance, and the Flood Damage Prevention Ordinance. Specific recommendations from the Comprehensive Land Use Plan Update include the following: -Commercial districts should allow a specific height by right, while requests for additional height would be regulated as a Planned Unit Development/Conditional Use Permit. Heights which require a Planned Unit Development/Conditional Use Permit should be subject to specific conditions which protect residential properties, viewsheds, transportation corridors, and

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							regulated airspace; -Modify current land use policies to allow for consideration of potential exemptions and variances as they relate to the Americans with Disability Act; -Align lot sizes to the surrounding land use context including the availability of infrastructure. In areas where public sewer is not available, lot size should be adjusted to allow adequate space for septic facilities. Setbacks should be adjusted to allow for greater flexibility in areas with access to urban infrastructure; -Modify the Zoning Ordinance to create a clear separation between manufactured homes and manufactured home parks within residential districts which are not constrained by environmental factors; -Adopt a policy that defines a permanent single family dwelling as any structure which is utilized as a place of dwelling for more than 180 days each calendar year. Any structure or vehicle which is used in a permanent capacity should adhere to all applicable sections of the North Carolina Building Code or should have the appropriate certifications for HUD-labeled manufactured homes. Structures which are not inspected as permanent single family dwellings should be road ready in order to be utilized as a temporary dwelling. The Zoning Ordinance should prohibit those dwellings which cannot be classified as permanent single-family dwellings or temporary single family dwellings with the exception of tents or other similar amenities that are temporary and incidental to outdoor recreation; -Integrate concepts from cohousing and intentional community models in order to allow for more flexibility in residential options; -Develop a Resort/Conference Center Zoning District in order to accommodate large-scale resort, retreat, or conference facilities;

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							-Adopt a Zoning Overlay District which establishes the limitations required for compliance with Federal Aviation Regulations Part 77, which establishes standards and notification requirements for objects affecting navigable airspace; -Provide an Airport Industrial District which accounts for the land use needs of the Asheville Regional Airport, while allowing industrial and commercial uses which are related to the operation of an airport; -Create incentives for workforce and affordable housing projects through the Planned Unit Development process; -Create a new class of Planned Unit Developments specifically associated with residential development; -Create a new class of Planned Unit Developments specifically associated with Commercial and Mixed Use Developments; -Consider the development of a Conservation District for classification purposes; -Modify the Zoning Ordinance to separate public utility stations and energy generation facilities according to their impact on surrounding neighborhoods; -Continue to encourage and promote the practice of collocation on existing wireless telecommunications towers, and minimize the aesthetic impact by allowing antennas to be added to existing structures and buildings as a means of minimizing the construction of new towers; -Consider incorporating an assessment of a project's connectivity with existing multimodal networks and potential Complete Streets Improvements during the project's review; -Consider incorporating an assessment of a project's interconnectivity potential to the surrounding transportation network, and the potential for coordination with other scheduled projects, during the

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							project's review; -Partner with regional planning initiatives in order to understand efficiencies in service delivery and ensuring citizens needs are met. The Comprehensive Land Use Plan Update addresses the general direction of the County's growth and development; identifies other planning efforts; directs the County's growth and development while considering topographic constraints; and addresses objectives through the specific recommendations which can be made within standing land use policies and regulations.
PP-4	Revise the Erosion Control Ordinance.	FL	Moderate	Local	Planning Dept.	Completed	The County's Soil Erosion and Sedimentation Control Ordinance has been in existence since 1993, and was adopted pursuant to the authority granted in the North Carolina Sedimentation Pollution Control Act of 1973. The purpose of the Ordinance is to regulate certain land disturbing activity to control accelerated erosion and sedimentation in order to prevent the pollution of water and other damage to lakes, watercourses, and other public and private property. The general requirements of the Ordinance include requiring a plan for any land disturbing activity which uncovers one or more acres on a tract of land. In addition, a plan is required for any residential land disturbing activity which uncovers one-quarter acre or more on a lot, parcel, or tract with an average slope of 25% or greater in its natural state, or any residential land disturbing activity which uncovers one-half acre or more on a lot, parcel or tract with an average slope of 15-25% in its natural state, and applies to the Subdivision Ordinance, section 70-68. An additional requirement is that all persons conducting land-disturbing activity shall take all reasonable measures to protect all public and private property from damage caused by such activities. Plans are required to identify critical areas; limit time of exposure; limit exposed areas; control surface water;

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							control sedimentation; and manage stormwater runoff. A notarized statement of financial responsibility and ownership is also required. Maintenance of ground cover following development is required. Civil penalties can be assessed for various violations, with a daily charge, and injunctive relief procedures are outlined. The Ordinance was revised in 2006, and the fee schedule changed in 2011. There are no plans to further revise this Ordinance.
PP-5	Continue to evaluate and revise the stormwater management ordinance in accordance with changes as mandated by state law.	FL	Moderate	Local	Planning Dept.	2015, Annually	Buncombe County adopted the Stormwater Management Ordinance on September 27, 2006. It was adopted to establish minimum requirements for the control of adverse impacts due to stormwater runoff associated with new development. Managing stormwater runoff protects property, lessens stream channel erosion, prevents increased flooding and provides additional protection of floodplains, wetlands and water resources, riparian and aquatic ecosystems. The Ordinance requires permits for residential development activity disturbing one acre or more. Commercial activity requires permits for activities that are on tracts one acre or larger. The Ordinance requires developers to install permanent measures to control the rate of runoff to that which existed prior to development for the 1 year 24 hour storm events.
PP-6	Ensure enforcement of ordinances.	All	Moderate	Local	Planning Dir., Fire Marshal, Erosion Control officer, Storm Water engineer, Building Permits and Inspections Dir.,	2015, Annual review	Each Ordinance is enforced through an individual department. However, the permitting software system Accela can link cases and approvals based on parcel number. There is an order for approval for development activities. The Accela software controls the order for approval of cases and prevents permits from being issued until approvals from other relevant Ordinance administrators is provided. Through this system, for example, building permits are not issued until subdivision approval has been provided, or a building permit for a structure in the floodplain is not issued

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
					Floodplain Ordinance Administrator, Subdivision Ordinance Administrator, Zoning Staff		until floodplain approval has been provided. Another way that Ordinance administrators remain connected is through the Technical Review Committee. The Technical Review Committee consists of representatives from the Fire Marshal's office, Building Permits and Inspections, Planning (Zoning, Subdivision, Floodplain, Stormwater, Erosion Control), and Environmental Health. The Committee meets on a regular basis to review plans before they are presented to the Planning Board, and to discuss changes that are occurring within each of their departments related to Ordinance enforcement.
PP-7	Address the issues of storm water management and impervious surfaces.	FL/ER	Moderate	Local	Stormwater Ordinance Administrator	2015, Annually	This is addressed through the Stormwater Ordinance, see PP-5
PP-8	Continue participation in the National Flood Insurance Program and investigate participation in the NFIP's Community Ratings System.	FL	High	Local	Floodplain Ordinance Administrator	2015, Annual review	The County's Flood Damage Prevention Ordinance regulates development within the 100-year floodplain. The County first adopted the Ordinance in August of 1980 when the County agreed to participate in the National Flood Insurance Program (NFIP). By the joining the NFIP, flood insurance and federal assistance became available to the County and its residents. The Ordinance regulates development within the 100-year floodplain with the purpose of promoting public health, safety, and general welfare and to minimize public and private losses due to flood conditions within flood prone areas. As a condition of continued eligibility in the NFIP, the County must maintain floodplain management regulations that meet the standards of the NFIP regulations. In conjunction with adopting the revised floodplain maps that became effective in January 2010, the County adopted revisions to the Ordinance aimed at improving safety of residents and businesses within and surrounding the 100-year floodplain. Revisions included requiring an additional foot of freeboard

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							(i.e., requiring elevations 2 feet above the base flood elevation) for new structures and utilities within the 100-year floodplain; prohibiting new habitable structures within the floodway; and requiring submission of an elevation certificate for new structures constructed in the 100-year floodplain. Procedurally, when the new maps and revised ordinance were adopted, the Planning Board and subsequently the Board of Commissioners found that these revisions and updates were reasonable, in the public interest, and consistent with the Comprehensive Land Use Plan because they furthered the principles of managing sensitive environmental areas and conservation of critical environmental resources by restricting activities within the 100-year floodplain. It is anticipated that within this Hazard Mitigation Plan Update period, the floodplain maps for Buncombe County will again be updated, and our Ordinance reviewed for compliance with the NFIP requirements and compared with the State's model ordinance for floodplain management standards. With each new remapping, opportunities become available for communicating risk to persons whose property borders rivers and streams. Through public meetings and established communication channels (television, web, Twitter, e-zines, newspaper, etc.), many residents can be reached. For those properties within the 100-year floodplain, and especially for those properties that will be newly placed in the 100-year floodplain through the remapping effort, direct mail notices will be sent, informing residents of the new maps and proposed changes. The continued goals for floodplain management in the County include the following: -Effectively communicate risk for persons who are considering buying or building on properties within the

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							100-year floodplain; -Locate critical facilities and large scale development outside the 100-year floodplain; -Protect water resources and ecological systems/wildlife through the enforcement of the Flood Damage Prevention Ordinance; -Restore the natural resources and function of floodplains by promoting and working in collaboration with stream restoration and hazard mitigation grant programs; and -Educate the public to help them reduce their environmental footprints by locating businesses and residences outside the 100-year floodplain when possible.
Public Education and Awareness							
PEA-1	Educate the public regarding hazard mitigation.	All	High	Local	County EM	2015, Annual review and update	Public education is a continuous effort. Information is provided during key time periods such as severe weather awareness week, winter storm season, and severe storm/hurricane season as well as throughout the year as requested by various community groups. Information is provided via brochures and information on the county website regarding grant programs and preparedness efforts individual citizens can take to be ready when a hazard impacts the community.

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City of Asheville Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Incorporate hazard mitigation into the planning process.	All	Moderate	Local	Stormwater Services Manager/ Assistant Fire Chief/Development Services Department	2015, Annual review	Ordinances are developed to address stormwater and flood for new developments, city staff is working with the Army Corps of Engineers in the Swannanoa River Valley to potentially identify and address flood mitigation projects.
P-2	Continue to carry out the hazard mitigation planning process and seek funding for emerging needs.	All	Moderate	Local	Public Works Director/Fire Chief/Planning Director/Chief Code Enforcement Officer	2015	City Staff is working with the Corps of Engineers in identifying future flood mitigation projects and seeking funding for these projects will continue. The city has not received any funding from mitigation programs in the last 5 years.
Property Protection							
PP-1	Ensure enforcement of ordinances.	All	Moderate	Local	Planning, Fire Marshal, Erosion Control Officer, Stormwater Engineer, Building Permits and Inspections, Floodplain Ordinance Administrator , Zoning Staff	2015, Annual review	City Staff actively pursues enforcement issues and maintains records & metrics and will continue to do so going forward.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-2	Address the issues of storm water management and impervious surfaces.	FL/ER	Moderate	Local	Director Public Works and staff	2015, Annually	City Staff has an active stormwater program to identify projects and maintain current public infrastructure. Many improvements have been made to the stormwater system in the past 5 years including drain upgrades, pipe replacements, etc. The city will continue to implement that program going forward.
PP-3	Continue participation in the National Flood Insurance Program and investigate participation in the NFIP's Community Ratings System.	FL	High	Local	Public Relations Staff/Public Works Staff/Development Services Staff	2015, Annual review	Participation in NFIP is on-going. CRS Application filed (score pending). Once achieved, the city will work to enhance rating where possible.
PP-4	Revise the flood hazard ordinance.	FL	High	Local	Chief Code Enforcement Officer/Public Works Staff/Development Services Staff	Completed 1/6/2010	Enforce the current ordinance (no revisions planned at this time)
PP-5	Administer & enforce International Building Codes and Fire Codes for new construction.	All	Moderate	City's General Fund	Chief Code Enforcement Officer	Completed NC State Building Code was adopted in 2012; The International Building Code was adopted in 2009	The city has adopted the NC State Building Code and International Building Code. This action is complete.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Public Education and Awareness Activities							
PEA-1	Educate the public regarding hazard mitigation.	All	High	Local staff	City Public Information Staff	2015, Annually review program	The city has made many efforts to reach out to and educate the public and will continue to do so going forward. Information is provided via brochures and information on the city website regarding grant programs and preparedness efforts individual citizens can take to be ready when a hazard impacts the community.
PEA-2	Manually disperse and have a website plus social media posting which provides information about relevant emergency response and preparedness actions the public can take.	All	High	Local staff	City and Fire Public Information Officer	2015, Annual review and update	New Action
PEA-3	Manually disperse and have a website plus social media posting which provides information about Buncombe County's Hazard Mitigation Plan and relevant mitigation measures the public can take.	All	High	Local staff	City and Fire Public Information Officer	2015, Annual review and update	New Action

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Town of Biltmore Forest Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Incorporate hazard mitigation into the planning process.	All	Moderate	Local	Assistant to Town Administrator	2015, Annual review	In May 2012, Buncombe County adopted the Sustainability Plan. The Plan outlined a five year plan for the County and its residents to make improvements in our community, environment and economy. One of the fourteen goal areas in the Plan is Resistance to Natural and Manmade Hazards". The two objectives under this goal are to: 1) locate critical facilities outside high hazard areas; and 2) Ensure local preparedness for emergencies (floods, fuel shortages, climate change, fire, droughts, earthquakes, food shortages, landslides, hazardous materials incidents, medical epidemics, etc.). In each year's Plan update, current indicators are tracked and strategies for looking forward are shown.
P-2	Continue to carry out the hazard mitigation planning process and seek funding for emerging needs.	All	Moderate	Local	Director of Public Works	2015	This is happening currently as evidenced by update of existing actions and move toward regional plan. The town was a part of applying for funding for this regional plan.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Property Protection							
PP-1	Ensure enforcement of ordinances.	All	Moderate	Local	Zoning Administrator	2015, Annual review	Town Staff actively pursues enforcement issues and maintains records & metrics and will continue to do so going forward.
PP-2	Address the issues of storm water management and impervious surfaces.	FL/ER	Moderate	Local	Director Public Works	2015, Annually	Town Staff has an active stormwater program to identify projects and maintain current public infrastructure. The town will continue to implement that program going forward.
PP-3	Adopt the Stormwater Management Ordinance.	FL	High	Local	Board of Commissioners	Completed	The town has adopted a Stormwater Management Ordinance.
PP-4	Adopt the Flood Damage Prevention Ordinance.	FL	High	Local	Board of Commissioners	Completed	The town has adopted a Flood Damage Prevention Ordinance.
Public Education and Awareness Activities							
PEA-1	Educate the public regarding hazard mitigation.	All	High	Local	Assistant to Town Admin./Town Administrator	2015, Annually review program	The town has made many efforts to reach out to and educate the public and will continue to do so going forward. Information is provided via brochures and information on the county/town websites regarding grant programs and preparedness efforts individual citizens can take to be ready when a hazard impacts the community.

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Town of Black Mountain Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Incorporate hazard mitigation into the Black Mountain planning process by continuing to Integrate HM planning into development plan review processes within the Planning and Development Department.	All	Moderate	Local	Building & Zoning Dept/Planning & Development Dept	2015, Annual review	This is done as the projects develop. For instance, if a developer wants to build in an area that is prone to flooding, the P&D Department will work with the developer to look at different options for construction such as relocating or elevating. The town will continue to work to incorporate hazard mitigation into the overall planning process.
P-2	Update the Land Use Ordinances (including building regulations, subdivision ordinances and zoning regulations) to be consistent with the 2005 NCGS updates to authorizing statutes and to better incorporate HM and public safety needs into land use policies.	All	Moderate	Local	Building & Zoning Dept/Planning & Development Dept	2015, Annual review	Our land use code was updated in 2010. We will continue to incorporate HM planning into development process
P-3	Establish/Continue to implement Best Management Practices and Measurable Goals for each of the six required components for the Black Mountain Stormwater Plan.	FL	Moderate	Local	Stormwater Manager	2015, Annual review	The town has made great strides towards implementing best practices and continues to work on this. Any new projects are subject to our storm water ordinance. Among other requirements, this ordinance requires larger development projects to include a plan for retaining the first inch of rainwater runoff.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-4	Participate in regional work to mitigate flooding through Senate Bill 7 funding.	FL	Moderate	Local	Building & Zoning Dept/Planning & Development Dept	2019	Thus far, the town has not participated in regional work to mitigate flooding due to lack of staff time. This will continue to be a goal going forward.
P-5	Record and maintain all tax parcel information and floodplain locations in a GIS system in order to build the Town's capability to identify areas needing future mitigation.	FL	Moderate	Local	GIS	Completed	This has been done and is in our on-site GIS.
p-6	Develop a database that identifies each property that has received damage due to hazards identified within this mitigation plan. The database should also include a tax identification number of the property, a description of the property damage, the value of the damage, and links to photographs of the damage. Developing this database will allow the Town to easily identify properties at high risk of damage from certain hazards as well as properties, which receive repetitive damage from multiple hazards.	All	Moderate	Local	Building & Zoning Dept/Planning & Development Dept	2019	The town has been w/o a planning director since 2010, so this hasn't been done. This action will remain in the plan going forward.
Property Protection							
PP-1	Ensure consistency in zoning and building inspections enforcement and continue to enforce the International Building Code. Involve local emergency staff and HM principles in development and permitting review.	All	Moderate	Local	Building & Zoning Dept/Planning & Development Dept	2015, Annual review	This is done on a daily basis and as projects develop. The town will continue to ensure consistency in zoning and building inspections in the future.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-2	Investigate participation in the National Flood Insurance Programs Community Ratings System.	FL	Moderate	Local	County Project Impact Coord./EM Planner/Town Floodplain Administrator	2019	The town does not currently participate in the CRS but it will continue to evaluate the viability of participating in the future. There has not been sufficient staff availability to pursue this action.
Public Education and Awareness Activities							
PEA-1	Educate contractors, developers and designers on code changes and new development issues.	All	High	Local	Building & Zoning Dept/Planning & Development Dept	2019	Our building inspector does a good job with this and will continue to do so as part of his job duties. The town will continue to outreach to contractors/developers
PEA-2	Provide new homebuilders with information on quality redevelopment and safe housing development.	All	High	Local	Building Inspections Dept.	2019	We do provide builders with information via our website as well as in office materials. The town will continue to outreach to its citizens.
PEA-3	Manually disperse and have a website posting which provides information about relevant emergency response and preparedness actions the public can take.	All	High	Local	Fire Prevention Officer	2019	This has been done to some extent w/Code Red. Code Red is the town's emergency notification system. The town will continue to outreach to its citizens.
PEA-4	Manually disperse and have a website posting which provides information about Buncombe County's Project Impact and the County's Hazard Mitigation Plan and relevant mitigation measures the public can take.	All	High	Local	Town Manager/Fire Chief/Police Chief	2019	This hasn't been done due to lack of staff time, but we do provide a link to Buncombe County's on our website. The town will continue to outreach to its citizens.

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Town of Montreat Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Appoint a representative to the Hazard Mitigation Plan Evaluation and Revision Committee. Continue to meet as needed.	All	High	Local	Town Administrator /Public Works Director	2015, Annual review	The town has appointed a representative to the Hazard Mitigation Plan Committee and that representative participated in the plan update process. The town will continue to provide a representative to HMP Committee going forward.
P-2	Review resources discussing hazard mitigation concepts.	All	High	Local	Town Administrator	2015, Annual review	The town has annually reviewed all resources discussing hazard mitigation concepts. The town will continue to review these resources and integrate new resources as necessary.
P-3	Develop a mechanism that will ensure review of appropriate policies and procedures following a natural disaster event.	All	High	Local	Town Administrator	Completed	The town has developed a mechanism in conjunction with the county to ensure appropriate policies and procedures are followed in the wake of a disaster event. In the future, the town will continue to follow these policies. This action will be removed from the next update as a capability.
P-4	Develop a checklist in our zoning and building inspections department to ensure consistency in zoning enforcement and to prevent omissions in the evaluation of projects.	All	High	Local	Building Inspector/ Code Administrator	2015, Annual review	The town has developed a building/zoning checklist to ensure consistency in zoning enforcement. This checklist will need to be reviewed and updated annually to ensure applicability of checklist.
P-5	Develop a tracking system in the building inspections department to record the number of plans accepted and rejected and the number of warning and citation issued.	All	High	Local	Building Inspector/ Code Administrator	Completed	The town has developed a tracking system for building inspections to record plans that were accepted/rejected. Since this system is in place, this action will be removed from the next update as a capability.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-6	Report results of inspection/enforcement measures to the Project Impact Coordinator/Emergency Management Planner on a semi-annual basis.	All	High	Local	Town Administrator	2015, Semi-Annual review	On a semi-annual basis, the town has reported the results of inspection/enforcement measures to the PIC or EM Planner. In the future, this reporting process will continue to take place semi-annually.
P-7	Continue to enforce the International Building Code.	All	High	Local	Building Inspector/ Code Administrator	Completed	The International Building Code has been adopted and will continue to be enforced. This action will be removed from the next update as a capability.
P-8	Continue to update the Town of Montreat Emergency Response Ordinance on an annual basis including relevant positions and contact information changes.	All	High	Local	Building Inspector/ Code Administrator	2015, Annual review	The town has worked on updating its ERO an annual basis and will continue to make updates and changes to the ordinance during an annual review period.
P-9	Create a storm sewer system map that identifies and locates stormwater drainage components that include outfalls and receiving streams.	FL	High	Local	Town	Completed	The stormwater sewer system map has been created, so this action will be removed from the next update as a capability.
P-10	Establish a system for inspecting illicit discharges, which shall include employee cross-training for town staff on detecting and reporting illicit discharges.	FL	High	Local	Town	Completed	A system for inspecting illicit discharges has been established, so this action will be removed from the next update as a capability.
P-11	Establish a reporting mechanism for the public to report illicit discharges.	FL	High	Local	Town	Completed	A mechanism has been established for the public to report illicit discharges, so this action will be removed from the next update as a capability.
P-12	Provide a reporting mechanism for the public to notify the appropriate authorities of observed erosion and sedimentation problems.	ER	High	Local	Town	Completed	A reporting mechanism for the public to report erosion/sedimentation problems has been put in place, so this action will be removed from the next update as a capability.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-13	Conduct annual review and update plans for permitted facilities as needed for the Stormwater Management Plan.	FL	High	Local	Town	Completed	The town has developed a list of facilities that need to have plans updated for the Stormwater Management Plan, so this action will be removed from the next update as a capability.
P-14	Purchase a complete GPS setup and provide training on said setup to all pertinent town personnel.	All	High	General Fund Revenue/ Grants	Town	2019	Although some GPS technology is available, the town would like to look into additional components. The town will continue to work to train all pertinent town staff in the latest updates in GPS technology.
Property Protection							
PP-1	Update the zoning ordinance to reflect mitigation planning and safety factors.	All	High	Local	Town Administrator	2019	The zoning ordinance has been updated in many ways to reflect mitigation planning, however there are additional measures that could be added to improve mitigation so the town will work to include those going forward.
PP-2	Develop, implement and enforce an Illicit Discharge Ordinance.	FL	High	Local	Town	Completed	An Illicit Discharge Ordinance has been implemented, so this action will be removed from the next update as a capability.
PP-3	Develop an ordinance to implement and enforce post-construction runoff controls for new development and redevelopment.	FL	High	Local	Town	Completed	An ordinance has been developed to regulate post-construction runoff, so this action will be removed from the next update as a capability.
PP-4	Inspect all facilities and operations with the potential for generating polluted stormwater runoff. Document deficiencies and corrective actions.	FL	High	Local	Town	Completed	A system is in place to have regular inspections for stormwater runoff, so this action will be removed from the next update as a capability.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-5	Investigate participation in the National Flood Insurance Programs Community Ratings System.	FL	High	Local	Town	2019	The town has not joined the CRS, but it will continue to look into the program and work towards developing the necessary programs to join. There has not been sufficient staff availability to pursue this action.
PP-6	Maintain all tax parcel information and floodplain locations in a GIS system in order to build the Towns capability to identify areas needing future mitigation.	All	High	Local	Town	Completed	All tax parcel information is maintained in GIS, so this action will be removed from the next update as a capability.
PP-7	Develop a database that identifies each property that has received damage due to hazards identified within this mitigation plan. The database should also include a tax identification number of the property, a description of the property damage, the value of the damage, and links to photographs of the damage.	All	High	Local	Town	2017	The town has not fully developed a database that identifies properties that have been damaged by past events, in large part because there have not been enough historic events to gain a full perspective of risk. The town will work to continue to develop this database over the next several years.
Natural Resource Protection							
NRP-1	Develop post-construction runoff control measures for protecting Trout Waters in accordance with 15A NCAC .0126	FL	High	Local	Town	Completed	An ordinance has been developed to regulate post-construction runoff, so this action will be removed from the next update as a capability
Public Education and Awareness Activities							
PEA-1	Educate contractors, developers and designers on code changes and new development issues.	All	High	Local	Planning and Inspections Department	2015, Annually	The town has worked to ensure developers and contractors are well-educated on code changes and will continue to keep these interests up to date as new information is developed.
PEA-2	Provide new homebuilders with information on quality redevelopment and safe housing development.	All	High	Local	Planning and Inspections Department	2015, Annual review	The town has provided information on quality redevelopment and safe housing to homebuilders over the past several years and will continue to provide this information. Updates to information will be integrated as well.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PEA-3	Manually disperse and have a website posting which provides information about relevant emergency response and preparedness actions the public can take.	All	High	Local	Planning and Inspections Department	2015, Annual review and update	The town has developed a number or resources for the public to utilize to help with preparedness and these have been dispersed both manually and through the website. The town will work to reach out in new ways going forward, such as through social media, and will also maintain current outreach strategies.
PEA-4	Manually disperse and have a website posting which provides information on Buncombe County's Project Impact and the County's HMP and relevant mitigation measures the public can take.	All	High	Local	Planning and Inspections Department	2015, Annual review and update	The town has developed a number or resources for the public to utilize to help with understanding Project Impact and mitigation and these have been dispersed both manually and through the website. The town will work to reach out in new ways going forward, such as through social media, and will also maintain current outreach strategies.
PEA-5	Prepare a public education program for the Stormwater Management Plan.	FL	High	Local	Regional Stormwater Planning Committee	Completed	The town has implemented the public education program for the Stormwater Management Plan, so this action will be removed from the next update as a capability
PEA-6	Develop and maintain a web site that will offer information on water quality, stormwater projects and activities and ways to contact stormwater program staff.	FL	High	Local	Regional Stormwater Planning Committee	Completed	The town has developed a website on water quality and stormwater projects, so this action will be removed from the next update as a capability
PEA-7	Develop general stormwater educational material targeting school children, homeowners and business.	FL	High	Local	Regional Stormwater Planning Committee	Completed	Educational information on stormwater has been developed, so this action will be removed from the next update as a capability
PEA-8	Distribute written material on stormwater management through utility mail outs and at special events.	FL	High	Local	Regional Stormwater Planning Committee	Completed	Material on stormwater has been distributed through a number of ways, so this action will be removed from the next update as a capability

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PEA-9	Conduct at least one public meeting during the application process to explain the Phase II program. Allow the public an opportunity to review and comment on the stormwater management program.	FL	High	Local	Regional Stormwater Planning Committee	Completed	Public meetings were held during the application process for Phase II to allow review and comment, so this action will be removed from the next update as a capability
PEA-10	Develop educational materials for local developers explaining the local post-construction approval process for stormwater management.	FL	High	Local	Town	Completed	Educational materials have been developed for local developers, so this action will be removed from the next update as a capability
PEA-11	Conduct training on pollution prevention and good housekeeping procedures for the Stormwater Management Plan.	L	High	Local	Town	Completed	Training on pollution prevention and housekeeping procedures for the Stormwater Management Plan have taken place, so this action will be removed from the next update as a capability

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Town of Weaverville Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Incorporate hazard mitigation into the planning process.	All	High	Local	Town Manager	2015, Annual review	In May 2012, Buncombe County adopted the Sustainability Plan. The Plan outlined a five year plan for the County and its residents to make improvements in our community, environment and economy. One of the fourteen goal areas in the Plan is Resistance to Natural and Manmade Hazards". The two objectives under this goal are to: 1) locate critical facilities outside high hazard areas; and 2) Ensure local preparedness for emergencies (floods, fuel shortages, climate change, fire, droughts, earthquakes, food shortages, landslides, hazardous materials incidents, medical epidemics, etc.). In each year's Plan update, current indicators are tracked and strategies for looking forward are shown.
P-2	Identify storm water management best practices, develop a storm water management program, and adopt a stormwater ordinance.	FL	High	Local	Town Manager	Completed	The town has developed a stormwater management program and ordinance and enforces on a regular basis, so this action will be removed from the next update as a capability.
P-3	Refine the Stormwater Management Program and enforce the regulations.	FL	High	Local	Town Manager	2015, Annual review	The town is always working to enforce the regulations of the Stormwater Management Program and will look at refining the program on an annual basis. No major refinements have been made over the past 5 years.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-4	Continue to carry out the hazard mitigation planning process and seek funding for emerging needs.	All	High	Local	Town Manager	2015	This is happening currently as evidenced by update of existing actions and move toward regional plan. The town was a part of applying for funding for this regional plan.
Property Protection							
PP-1	Evaluate and strengthen existing ordinances as needed.	All	High	Local	Town Manager	2015, Annual review	The town has attempted to provide strong ordinances to reduce risk and will continue to look at how it can integrate more mitigation-oriented practices going forward. No major changes to ordinances were made during the past 5 years.
PP-2	Ensure enforcement of ordinances.	All	High	Local	Town Manager	2015, Annual review	Town Staff actively pursues enforcement issues and maintains records & metrics and will continue to do so going forward.
Public Education and Awareness Activities							
PEA-1	Educate the public regarding hazard mitigation using newsletters and special alerts, etc.	All	High	Local	Town Manager	2015, Annually review program	The town has made many efforts to reach out to and educate the public and will continue to do so going forward. Information is provided via brochures and information on the county/town websites regarding grant programs and preparedness efforts individual citizens can take to be ready when a hazard impacts the community.

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Town of Woodfin Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Incorporate hazard mitigation into the planning process.	All	High	Local	Town Administrator/ Board of Aldermen	2015, Annual review	In May 2012, Buncombe County adopted the Sustainability Plan. The Plan outlined a five year plan for the County and its residents to make improvements in our community, environment and economy. One of the fourteen goal areas in the Plan is Resistance to Natural and Manmade Hazards". The two objectives under this goal are to: 1) locate critical facilities outside high hazard areas; and 2) Ensure local preparedness for emergencies (floods, fuel shortages, climate change, fire, droughts, earthquakes, food shortages, landslides, hazardous materials incidents, medical epidemics, etc.). In each year's Plan update, current indicators are tracked and strategies for looking forward are shown.
P-2	Identify storm water management best practices will be and develop a storm water management program and adopt a stormwater ordinance.	FL	High	Local	Town Administrator/ Board of Aldermen	Completed	The town has developed a stormwater management program and ordinance and enforces on a regular basis, so this action will be removed from the next update as a capability.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-3	Refine the Stormwater Management Program and enforce the regulations.	FL	High	Local	Town Administrator/ Board of Aldermen	2015, Annual review	The town is always working to enforce the regulations of the Stormwater Management Program and will look at refining the program on an annual basis. No major changes to stormwater management were made over the past 5 years.
P-4	Continue to carry out the hazard mitigation planning process and seek funding for emerging needs.	All	High	Local	Town Administrator/ Board of Aldermen	2015	This is happening currently as evidenced by update of existing actions and move toward regional plan. The town was a part of applying for funding for this regional plan.
Property Protection							
PP-1	Evaluate and strengthen existing ordinances as needed.	All	High	Local	Town Administrator/ Board of Aldermen	2015, Annual review	The town has attempted to provide strong ordinances to reduce risk and will continue to look at how it can integrate more mitigation-oriented practices going forward.
PP-2	Ensure enforcement of ordinances.	All	High	Local	Town Administrator/ Board of Aldermen	2015, Annual review	Town Staff actively pursues enforcement issues and maintains records & metrics and will continue to do so going forward.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Public Education and Awareness Activities							
PEA-1	Educate the public regarding hazard mitigation. Woodfin should have readily available information on floodplain location, flood insurance, soil conditions, zoning, and long range planning available at Town Hall. The Town can refer citizens to the County's web site which includes information on hazard mitigation. Buncombe County has also supplied hazard mitigation information for airing on its Government Access cable television channel.	All	High	Local	Town Administrator/ Board of Aldermen	2015, Annually review program	The town has made many efforts to reach out to and educate the public and will continue to do so going forward. Information is provided via brochures and information on the county/town websites regarding grant programs and preparedness efforts individual citizens can take to be ready when a hazard impacts the community.

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Madison County Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Continue participation in the National Flood Insurance Program without suspension.	FL	High	Local	EM	2015, Annual review	The county is currently a participant in the NFIP and will continue to work to maintain compliance going forward.
P-2	Inventory of residential and commercial properties in the 100 year floodplain to mitigate the hazards of flooding– In addition to clearing debris in County creeks and the work now being considered by the US Army Corps of Engineers in the French Broad River in the vicinity of Marshall to reduce future flood impacts, it is recommended that an inventory of those public and private structures located in the floodplain be conducted and list of priority properties be identified for acquisition and relocation, or if appropriate, elevation of structures.	FL	Moderate	Local	EM	2015, Annual review	During this plan update, an inventory of properties in the 100 year floodplain was estimated. However, this list will need to be updated when future map updates occur and as mitigation actions are taken.
P-3	Inventory of dams in the County to mitigate the hazards of dam failure and flooding. – Conduct a full inventory of all publicly and privately maintained dams in the County. The information collected will identify problem areas and opportunities for rehabilitation or removal of decaying dams.	D/FL	Moderate	Local	EM	2015, Annual review	During this plan update, an inventory of dams was created. However, this list does not include all privately owned smaller dams and the list will need to be updated periodically so there is still some work to be completed on this action.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-4	Terrorism assessment and public health survey to mitigate the hazards of terrorism– By all accounts, the risk of a terrorist attack occurring in Madison County is small but it cannot be totally ignored. It is recommended that the County conduct a full assessment of its terrorist risk and of the capabilities of the public health system. Included in the appendices to this report is a community terrorism assessment. Public health system terrorism assessment tools are currently under development. The results of these two surveys should identify opportunities to reduce the impact of both a terrorist incident but also natural hazards such as floods, hurricanes, tornadoes, etc.	TR	Moderate	Local	EM	2018	The county will need to carry out a full assessment of its risk to a terrorist attack and the threats to the public health system.
P-5	Prepare a needs assessment for a second hazmat team to mitigate the hazards of hazmat.	HZ	Moderate	Local	EM	Completed	The county has developed a needs assessment and will look at investing in a second HazMat team. See ES-8
P-6	Link County, municipal and other computer systems and networks for use in mitigation and response efforts – It is recommended that County officials explore linking existing County computer systems to collect and process hazard data in order to provide information on hazard mitigation opportunities and to assist in disaster response and recovery efforts. There are numerous computer software products on the market or in development that could be used to integrate multiple data sources and assess the data collected.	All	Moderate	Local	IT/EM	2017	The county has looked into ways to integrate its computer systems and has done so in many ways to support productivity including having a countywide GIS layer of critical facilities. Although some of these initiatives have supported mitigation activities, additional integration is needed to fully support mitigation efforts.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-7	Establish a local funding source for mitigation projects – Consideration should be given to establishing a local funding source designed to provide incentives to developers to build disaster resistant homes and subdivisions. Funds from this account could also be used to provide loans and/or grants to homeowners and businesses for hazard mitigation projects. Funding mechanisms to be considered should include but not be limited to: sales tax increase, real estate tax, bond issue, utility charge and others.	All	Moderate	Local	EM	2019	The county has not established a local funding source to incentivize builders to develop disaster-resistant homes and businesses because it was not economically feasible. The county will look to establish this going forward.
P-8	Creative initiatives already under consideration to take advantage of tourist revenues should continue and other opportunities explored. Opportunities represented by the increase in market of second/vacation homes need to be explored.	All	Moderate	Local	County Board	2016	Thus far, the county has not looked into utilizing additional funding from tourist revenues to support mitigation initiatives to any great degree because those funds were needed for other projects/initiatives. The county will investigate whether this would be a viable option going forward.
P-9	Staffing for first responders – Staffing levels at some of the County fire installations. Priority should be given to finding ways to attract additional staff and resources.	All	Moderate	Local	EM	2019	The county has worked hard to ensure adequate staffing at its first responder facilities, but more staff is needed to have a sufficient coverage for all response needs.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-10	Ambulance Shortfall – Severe concerns were raised over the lack of ambulance capacity within the County. The distances within the County and potential for multiple incidents, in addition to the more routine medical emergencies requires the County to explore means to increase the number of ambulances available to serve the County, even in non-disaster circumstances.	All	Moderate	Local	EM	2019	The county has worked hard to ensure adequate ambulances, but this capacity remains an issue and additional funding will need to be pursued.
P-11	Application for emergency funds from the US Department of Transportation for impacts in I-26 corridor – County officials should approach the US Department of Transportation (DOT) to inquire if DOT emergency funds may be available to address flooding issues in the new I-26 corridor.	FL	Moderate	Federal	EM	2018	Many of the flooding issues in the new I-26 corridor remain and so the county will continue to pursue funding and efforts to try to address these issues. This type of funding has been discussed over the past 5 years, but there has been minimal advancement in terms of applying those funds to I-26.
Property Protection							
PP-1	Remove debris from streams across County.	FL	High	Grants	EM	2015, After events	The county has worked to remove debris from streams and ensure adequate flow of water. The county will continue to address any debris issues in streams and will seek funding to do so, especially in the wake of a disaster event.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-2	Update and enforce Land Use Ordinances and Building Codes to mitigate the hazards of structure fires, flooding, and landslides. Critical segments of this ordinance are the requirements for transportation ingress and egress to subdivisions and the grade of subdivision roadways. These requirements must be properly enforced to ensure that emergency vehicles will have adequate access to hazards in subdivisions and that floodplain restrictions are met.	WF/FL/LS	Moderate	Local	Planning and Zoning	2015, Annual review	The county has enforced its land use ordinances and building codes and will continue to update these codes as necessary to improve the county's resilience and mitigate the impacts of hazards.
PP-3	Clear fire fuel from forest floor in Wolf Laurel and other targeted areas in the County to mitigate the hazards of wildfire– The recent drought and the southern pine beetle epidemic has resulted in significant levels of additional fuel on the forest floor in several areas in the County. Removing this fuel should be a priority for fire prevention efforts in the County in the coming months.	WF	Moderate	Local	EM	2015, Annual process	The county has worked with staff at NC Forestry to clear fire fuel from the forest floor and reduce the potential impacts from wildfire. This will continue to be a priority going forward, especially in dry times when wildfires are more likely.
PP-4	Actively buyout targeted residential and commercial properties in the 100-year floodplain – Based on the priorities established as part of the countywide inventory, begin the acquisition, relocation or elevation of structures. This is a voluntary involvement project. It is further noted that the Town of Marshall is opposed to the demolition of any historical buildings in the Downtown area.	FL	Low	FEMA/Federal Grants	EM	2019	In recent years, the county has not acquired or elevated many homes due to a combination of factors including lack of funding and lack of interest, but it would like to look at implementing more voluntary buyouts and elevations in the future to reduce flood risk.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Emergency Services							
ES-1	Assess the need and seek funds to acquire warning systems – It is recommended that the County assess the need for various warning systems to address the hazards in the County. These systems would include a siren based system to alert residents to wildfire activities and threats, a series of stream gauges to alert residents and public officials to flood threats and conditions in the creeks in the County and in the French Broad River and a reverse 911 systems capability for use by County officials in alerting residents to threats and evacuation orders.	All	Moderate	Local	EM	2018	The county has installed some warning system capability, but in many ways it is not sufficient in terms of its total coverage due to some populations not being reached. The county would like to work to continue expanding its warning system capability.
ES-2	It is also recommended that the County sponsor Community Emergency Response Training (CERT) for individuals and business owners.	All	Moderate	Local	EM	2019	The county has not had as much success as it would like in developing a CERT team so it will continue to work to improve this resource in the future by training more individuals.
ES-3	Training for first responders – County police, fire, EMS and public health officers require additional training in responding to hazardous materials transportation incidents and biological and chemical incidents.	HM	Moderate	Local	EM	2019	Although first responders have been well trained in the county, there are always new strategies for improving this capability so additional training will be pursued.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-4	Improved operations and communications- It is recommended that County officials regularly exercise their response plan to natural and manmade disasters in order to maintain and refine coordination and communications among first responders. The County should hold at least one full exercise annually followed by a full debriefing of participants. Consideration should also be given to conducting 1-2 tabletop exercises annually including at least one tabletop exercise with a terrorism scenario.	All	Moderate	Local	EM	2015, Annual exercise	The county has held an annual exercise to practice and train for major disaster events. It will continue to hold an exercise at least annually going forward.
ES-5	Seek agreements with hospitals outside of the County on mass casualty requirements – County officials should approach hospitals located outside the County, including Tennessee, to establish mutual aid agreements concerning protocols if a mass casualty event occurs in the County. It is recommended that these new agreements build on existing agreements and expand to new facilities in order to achieve a reasonable capacity for mass casualties should an event occur in Madison County.	All	Moderate	Local	EM	2018	The county has worked to expand its capability in terms of hospitals and medical care with regard to mass casualty events. The county will continue to work on maintaining existing resources while expanding to new resources.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-6	Seek agreements with rail carriers in the County on notification requirements for HZM transported in and through the County – County officials should contact the Norfolk Southern railway concerning the shipment of hazardous materials on the rail line in the County and to determine roles and responsibilities of notification and response requirements for incidents involving a rail incident involving hazardous materials in the County.	HM	Moderate	Local	County Officials/EM	2016	The county has worked with rail carriers on notification requirements for materials passing through the county, but increased coordination is likely going to be necessary to maintain and improve the system of coordination and ensure safety.
ES-7	Acquire HZM equipment for fire, police and EMS – Each of the volunteer fire departments in the County consider the acquisition of additional hazardous materials response equipment a top priority. This equipment will provide needed protection to County first responders and improve their response capabilities. As a result, threat of injury and death to first responders and accident victims in hazardous materials incidents will be reduced which also result in reduced insurance costs and improved public safety.	All	Low	Federal and Private Grants	EM	2019	The county has provided adequate equipment and resources for responders, but this capability could be improved with additional resources.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-8	Establish a second HazMat response team – Based on a needs assessment and the increased traffic in hazardous materials expected in the County in the future when the I-26 corridor is completed requires that the County consider establishing a second HazMat response team. Establishing this new team will require additional training for fire, police and EMS personnel, additional HazMat equipment for first responders and revisions to existing response protocols among volunteer fire departments. Consideration must also be given to where to locate this new team.	HM	Low	Federal and Private Grants	EM	2018	The county has not established a second HazMat team due to lack of funding, but it will look into funding for one in the future.
ES-9	Acquire fire equipment – Each of the volunteer fire departments in the County has fire equipment needs including fire vehicles, turnout gear, breathing apparatus and other equipment.	WF	Low	FEMA/Federal Grants	EM	2018	Although fire equipment has been provided, staff are always in need of the latest resources that can be acquired to respond to wildfire events.
Structural Projects							
SP-1	Construct County Emergency Operations Center (EOC) – The County should consider building an Emergency Operations Center (EOC) that would allow centralization of communications equipment, consolidation on command and control functions and a mitigation and preparedness planning and education center.	All	Low	FEMA/Federal Grants	EM	2019	The county has not established a specific building to act as an EOC, but it will continue to look into funding and constructing this facility.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Public Education and Awareness							
PEA-1	Citizen Program – Design and implement a public education campaign designed to inform County residents about hazard and terrorism mitigation efforts. This campaign would also outline County response capabilities and plans and identify the role individual citizens can play in a disaster incident.	All	Moderate	Local	EM	2019	The county is constantly reaching out to citizens to inform them of best practices in hazard mitigation and preparedness for emergency events. However, as new ways of communicating become available (such as social media), the county will expand its practices to attempt to reach as many citizens as possible. Information is provided via brochures and information on the county website regarding grant programs and preparedness efforts individual citizens can take to be ready when a hazard impacts the community.

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Town of Hot Springs Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Continue participation in the National Flood Insurance Program without suspension.	FL	High	Local	Town Admin	2015, Annual review	The town is currently a participant in the NFIP and will continue to work to maintain compliance going forward.
Property Protection							
PP-1	Remove debris from streams across County.	FL	High	Grants	EM	Deleted	This action was deleted because it is more or less the same as Action PP-3.
PP-2	Flood proof commercial buildings on Main Street.	FL	High	PDM/HMGP Grants	EM	2019	The town has encouraged local business owners to flood proof their structures but this action is not complete as the town is looking into ways that it could help commercial property owners with this process.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-3	Clear creeks of debris to mitigate the hazards of flooding – Creek flooding is an issue in several areas in the County and one potential strategy for reducing creek flooding is removing debris directly from the creeks that reduces water flows in the creeks. This is not the only solution to creek flooding and will likely need to be repeated in the future. However, if done properly, clearing the debris can reduce flooding impacts in the future and provide additional protection to the County's natural resources. In order to reduce flooding problems in Madison County, debris will be regularly removed from the French Broad River in Hot Springs.	FL	High	Local	Public Works Dept.	2015, After events	The county/town have worked to remove debris from creeks and ensure adequate flow of water. The county/town will continue to address any debris issues in creeks and will seek funding to do so, especially in the wake of a disaster event.
Structural Projects							
SP-1	Construct County Emergency Operations Center (EOC) – The County should consider building an Emergency Operations Center (EOC) that would allow centralization of communications equipment, consolidation on command and control functions and a mitigation and preparedness planning and education center.	All	Low	FEMA/Federal Grants	EM	2019	New Action

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Public Education and Awareness Activities							
PEA-1	Citizen Program – Design and implement a public education campaign designed to inform County residents about hazard and terrorism mitigation efforts. This campaign would also outline County response capabilities and plans and identify the role individual citizens can play in a disaster incident.	All	Moderate	Local	EM	2019	New Action

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Town of Marshall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Continue participation in the National Flood Insurance Program without suspension.	FL	High	Local	EM	2015, Annual review	The town is currently a participant in the NFIP and will continue to work to maintain compliance going forward.
Property Protection							
PP-1	Remove debris from streams across County.	FL	High	Grants	EM	Deleted	This action was deleted because it is more or less the same as Action PP-3.
PP-2	Flood proof commercial buildings on Main Street.	FL	High	PDM/HMGP Grants	EM	2019	The town has encouraged local business owners to flood proof their structures but this action is not complete as the town is looking into ways that it could help commercial property owners with this process.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-3	Clear creeks of debris to mitigate the hazards of flooding – Creek flooding is an issue in several areas in the County and one potential strategy for reducing creek flooding is removing debris directly from the creeks that reduces water flows in the creeks. This is not the only solution to creek flooding and will likely need to be repeated in the future. However, if done properly, clearing the debris can reduce flooding impacts in the future and provide additional protection to the County's natural resources. In order to reduce flooding problems in Madison County, debris will be regularly removed from the French Broad River in Marshall.	FL	High	Local	Public Works Dept.	2015, After events	The county/town has worked to remove debris from creeks and ensure adequate flow of water. The county/town will continue to address any debris issues in creeks and will seek funding to do so, especially in the wake of a disaster event.
Structural Projects							
SP-1	Construct County Emergency Operations Center (EOC) – The County should consider building an Emergency Operations Center (EOC) that would allow centralization of communications equipment, consolidation on command and control functions and a mitigation and preparedness planning and education center.	All	Low	FEMA/Federal Grants	EM	2019	New Action

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Public Education and Awareness Activities							
PEA-1	Citizen Program – Design and implement a public education campaign designed to inform County residents about hazard and terrorism mitigation efforts. This campaign would also outline County response capabilities and plans and identify the role individual citizens can play in a disaster incident.	All	Moderate	Local	EM	2019	New Action

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Town of Mars Hill Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Continue participation in the National Flood Insurance Program without suspension.	FL	High	Local	Town Admin	2015, Annual review	The town is currently a participant in the NFIP and will continue to work to maintain compliance going forward.
P-2	Staffing for first responders – Staffing levels at some of the County fire installations, such as Mars Hill are considered inadequate. Priority should be given to finding ways to attract additional staff and resources.	All	Moderate	Local	EM	2019	The county has worked hard to ensure adequate staffing at its first responder facilities, but more staff is needed to have a sufficient coverage for all response needs.
P-3	Work with county to develop an inventory of residential and commercial properties in the 100 year floodplain to mitigate the hazards of flooding and create list of priority properties that may be identified for voluntary acquisition, relocation, or elevation of structures if appropriate.	FL	Moderate	Local	EM	2015, Annual review	During this plan update, an inventory of properties in the 100 year floodplain was estimated. However, this list will need to be updated when future map updates occur and as mitigation actions are taken.
Property Protection							
PP-1	Remove debris from streams across County.	FL	High	Grants	EM	Deleted	This action was deleted because it is more or less the same as Action PP-2.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-2	Clear creeks of debris to mitigate the hazards of flooding – Creek flooding is an issue in several areas in the County and one potential strategy for reducing creek flooding is removing debris directly from the creeks that reduces water flows in the creeks. This is not the only solution to creek flooding and will likely need to be repeated in the future. However, if done properly, clearing the debris can reduce flooding impacts in the future and provide additional protection to the County's natural resources. In order to reduce flooding problems in Madison County, debris will be regularly removed from the Ivy River in Mars Hill.	FL	High	Local	Public Works Dept.	2015, After events	The county/town have worked to remove debris from creeks and ensure adequate flow of water. The county/town will continue to address any debris issues in creeks and will seek funding to do so, especially in the wake of a disaster event.
Structural Projects							
SP-1	Construct County Emergency Operations Center (EOC) – The County should consider building an Emergency Operations Center (EOC) that would allow centralization of communications equipment, consolidation on command and control functions and a mitigation and preparedness planning and education center.	All	Low	FEMA/Federal Grants	EM	2019	New Action

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Public Education and Awareness Activities							
PEA-1	Citizen Program – Design and implement a public education campaign designed to inform County residents about hazard and terrorism mitigation efforts. This campaign would also outline County response capabilities and plans and identify the role individual citizens can play in a disaster incident.	All	Moderate	Local	EM	2019	New Action

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees TS = Thunderstorms EM = Madison County Emergency Management Town = Town of Mars Hill

SECTION 10
PLAN MAINTENANCE

This section discusses how the Buncombe Madison Regional Mitigation Strategy and Mitigation Action Plan will be implemented and how the Regional Hazard Mitigation Plan will be evaluated and enhanced over time. This section also discusses how the public will continue to be involved in a sustained hazard mitigation planning process. It consists of the following four subsections:

- 10.1 Monitoring and Evaluating the Previous Plan
- 10.2 Implementation and Integration
- 10.3 Monitoring, Evaluation, and Enhancement
- 10.4 Continued Public Involvement

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44 CFR Requirement
44 CFR Part201.6(c)(4)(i): The plan shall include a plan maintenance process that includes a section describing the method and schedule of monitoring, evaluating and updating the mitigation plan within a five-year cycle. ***44 CFR Part 201.6(c)(4)(ii):*** The plan maintenance process shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

10.1 MONITORING AND EVALUATING THE PREVIOUS PLAN

Since the previous two plans were adopted (Buncombe County in 2011 and Madison County in 2013), each county has worked to ensure that mitigation was integrated into local activities and that the mitigation plan was appropriately implemented. Each of the counties outlined a process in their previous county-level mitigation plans for monitoring and evaluating the plan throughout the interim period between plan updates.

Each county was ultimately successful in implementing the monitoring and evaluation processes that were outlined in previous plans as both counties held annual meetings to discuss the mitigation plan and the priorities that were outlined in it. Each county's specific process is outlined below with an explanation of how the monitoring and evaluating process was carried out as well as any changes that were identified by the county or its jurisdictions that would be useful to implement during the next update.

Buncombe County

The Buncombe County Hazard Mitigation Plan (2011) included an annual review process. This review process was carried out by the Hazard Mitigation Plan Evaluation and Revision Committee, which includes the County Director of Emergency Management, the Emergency Management Planner, and representatives from either the Administration or Planning Department from the county and each incorporated jurisdiction, every year since the previous plan was approved. During this annual review process, the Committee reviewed the plan a minimum of one time per year or more often if changing

conditions so dictated. Plan review also occurred as part of a "debriefing" following the occurrence of any disaster event.

Although there were some minor revisions made to the plan during interim update period, there were few major revisions identified during these annual reviews and the Hazard Mitigation Plan Evaluation and Review Committee generally agreed that the plan was on course and that the monitoring and evaluating process itself was sufficient to ensure implementation of the plan.

Madison County

The Madison County Hazard Mitigation Plan (2013) included an annual review process and progress report on the plan. This review process was carried out by the Madison County Local Emergency Planning Committee every year since the previous plan was approved. During this annual review process, the Local Emergency Planning Committee developed a progress report depicting the implementation status of the plan, the effectiveness of the proposed measures, and, if needed, recommendations of change or amendment for future works. These reports were addressed to the County Manager and County Board of Commissioners.

Although there were some minor revisions made to the plan during interim update period, there were few major revisions identified during these annual reviews and the Local Emergency Planning Committee generally agreed that the plan was on course and that the monitoring and evaluating process itself was sufficient to ensure implementation of the plan.

10.2 IMPLEMENTATION AND INTEGRATION

Each agency, department, or other partner participating under the Buncombe Madison Regional Hazard Mitigation Plan is responsible for implementing specific mitigation actions as prescribed in the Mitigation Action Plan. Every proposed action listed in the Mitigation Action Plan is assigned to a specific "lead" agency or department in order to assign responsibility and accountability and increase the likelihood of subsequent implementation.

In addition to the assignment of a local lead department or agency, an implementation time period or a specific implementation date has been assigned in order to assess whether actions are being implemented in a timely fashion. Buncombe and Madison counties, and the participating municipalities will seek outside funding sources to implement mitigation projects in both the pre-disaster and post-disaster environments. When applicable, potential funding sources have been identified for proposed actions listed in the Mitigation Action Plan.

The participating jurisdictions will integrate this Hazard Mitigation Plan into relevant city and county government decision-making processes or mechanisms, where feasible. This includes integrating the requirements of the Hazard Mitigation Plan into other local planning documents, processes, or mechanisms, such as comprehensive or capital improvement plans, when appropriate. The members of the Buncombe Madison Regional Hazard Mitigation Planning Team will remain charged with ensuring that the goals and mitigation actions of new and updated local planning documents for their agencies or departments are consistent, or do not conflict with, the goals and actions of the Hazard Mitigation Plan, and will not contribute to increased hazard vulnerability in the Buncombe Madison Region.

Since the previous plans were adopted, each county and participating jurisdiction have worked to integrate the hazard mitigation plan into other planning mechanisms where applicable/feasible.

Examples of how this integration has occurred have been documented in the Implementation Status discussion provided for each of the mitigation actions found in Section 9. Specific examples of how integration has occurred include:

- Integrating the mitigation plan into reviews and updates of floodplain management ordinances;
- Integrating the mitigation plan into reviews and updates of County emergency operations plans;
- Integrating the mitigation plan into review and updates of building codes; and
- Integrating the mitigation plan into the capital improvements plan through identification of mitigation actions that require local funding

Opportunities to further integrate the requirements of this Plan into other local planning mechanisms shall continue to be identified through future meetings of the Regional Hazard Mitigation Planning Team, individual county meetings, municipal staff meetings and the annual review process described herein. Although it is recognized that there are many possible benefits to integrating components of this Plan into other local planning mechanisms, the development and maintenance of this stand-alone Regional Hazard Mitigation Plan is deemed by the Buncombe Madison Regional Hazard Mitigation Planning Team to be the most effective and appropriate method to implement local hazard mitigation actions at this time.

10.3 MONITORING, EVALUATION, AND ENHANCEMENT

Periodic revisions and updates of the Regional Hazard Mitigation Plan are required to ensure that the goals of the Plan are kept current, taking into account potential changes in hazard vulnerability and mitigation priorities. In addition, revisions may be necessary to ensure that the Plan is in full compliance with applicable federal and state regulations. Periodic evaluation of the Plan will also ensure that specific mitigation actions are being reviewed and carried out according to the Mitigation Action Plan.

When determined necessary, the Buncombe Madison Regional Hazard Mitigation Planning Team shall meet in March of every year to evaluate the progress attained and to revise, where needed, the activities set forth in the Plan. The findings and recommendations of the Regional Hazard Mitigation Planning Team shall be documented in the form of a report that can be shared with interested City, County, and other stakeholders. The Regional Hazard Mitigation Planning Team will also meet following any disaster events warranting a reexamination of the mitigation actions being implemented or proposed for future implementation. This will ensure that the Plan is continuously updated to reflect changing conditions and needs within the Buncombe Madison Region. The Madison County Emergency Management Director will be responsible for reconvening the Regional Hazard Mitigation Planning Team for these reviews.

Five Year Plan Review

The Plan will be thoroughly reviewed by the Regional Hazard Mitigation Planning Team every five years to determine whether there have been any significant changes in the Buncombe Madison Region that may, in turn, necessitate changes in the types of mitigation actions proposed. New development in identified hazard areas, an increased exposure to hazards, an increase or decrease in capability to address hazards, and changes to federal or state legislation are examples of factors that may affect the necessary content of the Plan.

The plan review provides Buncombe and Madison county officials with an opportunity to evaluate those actions that have been successful and to explore the possibility of documenting potential losses avoided due to the implementation of specific mitigation measures. The plan review also provides the opportunity to address mitigation actions that may not have been successfully implemented as assigned. The Madison County Emergency Management Director will be responsible for reconvening the Regional Hazard Mitigation Planning Team and conducting the five-year review.

During the five-year plan review process, the following questions will be considered as criteria for assessing the effectiveness and appropriateness of the Plan:

- Do the goals address current and expected conditions?
- Has the nature or magnitude of risks changed?
- Are the current resources appropriate for implementing the Plan?
- Are there implementation problems, such as technical, political, legal or coordination issues with other agencies?
- Have the outcomes occurred as expected?
- Did County departments participate in the plan implementation process as assigned?

Following the five-year review, any revisions deemed necessary will be summarized and implemented according to the reporting procedures and plan amendment process outlined herein. Upon completion of the review and update/amendment process, the Buncombe Madison Regional Hazard Mitigation Plan will be submitted to the State Hazard Mitigation Officer at the North Carolina Division of Emergency Management (NCDEM) for final review and approval in coordination with the Federal Emergency Management Agency (FEMA).

Because the plan update process can take several months to complete, and because Federal funding may be needed to update the plan, it is recommended that the five-year review process begin at the beginning of the third year after the plan was last approved. This will allow the participants in the Buncombe Madison Regional Hazard Mitigation Plan to organize in order to seek Federal funding if necessary and complete required plan update documentation before the plan expires at the end of the fifth year.

Disaster Declaration

Following a disaster declaration, the Buncombe Madison Regional Hazard Mitigation Plan will be revised as necessary to reflect lessons learned, or to address specific issues and circumstances arising from the event. It will be the responsibility of the Madison County Emergency Management Director to reconvene the Regional Hazard Mitigation Planning Team and ensure the appropriate stakeholders are invited to participate in the plan revision and update process following declared disaster events.

Reporting Procedures

The results of the five-year review will be summarized by the Regional Hazard Mitigation Planning Team in a report that will include an evaluation of the effectiveness of the Plan and any required or recommended changes or amendments. The report will also include an evaluation of implementation progress for each of the proposed mitigation actions, identifying reasons for delays or obstacles to their completion along with recommended strategies to overcome them.

Plan Amendment Process

Upon the initiation of the amendment process, representatives from Buncombe and Madison counties will forward information on the proposed change(s) to all interested parties including, but not limited to, all directly affected County departments, residents, and businesses. Information will also be forwarded to the North Carolina Division of Emergency Management. This information will be disseminated in order to seek input on the proposed amendment(s) for no less than a 45-day review and comment period.

At the end of the 45-day review and comment period, the proposed amendment(s) and all comments will be forwarded to the Regional Hazard Mitigation Planning Team for final consideration. The Planning Team will review the proposed amendment along with the comments received from other parties, and if acceptable, the committee will submit a recommendation for the approval and adoption of changes to the Plan.

In determining whether to recommend approval or denial of a Plan amendment request, the following factors will be considered by the Regional Hazard Mitigation Planning Team:

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

Upon receiving the recommendation from the Regional Hazard Mitigation Planning Team, and prior to adoption of the Plan, the participating jurisdictions will hold a public hearing, if deemed necessary. The governing bodies of each participating jurisdiction will review the recommendation from the Regional Hazard Mitigation Planning Team (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, the governing bodies will take one of the following actions:

- Adopt the proposed amendments as presented;
- Adopt the proposed amendments with modifications;
- Refer the amendments request back to the Regional Hazard Mitigation Planning Team for further revision; or
- Defer the amendment request back to the Regional Hazard Mitigation Planning Team for further consideration and/or additional hearings.

10.4 CONTINUED PUBLIC INVOLVEMENT

44 CFR Requirement
44 CFR Part 201.6(c)(4)(iii): The plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process.

Public participation is an integral component to the mitigation planning process and will continue to be essential as this Plan evolves over time. As described above, significant changes or amendments to the Plan shall require a public hearing prior to any adoption procedures.

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

- Advertising meetings of the Regional Hazard Mitigation Planning Team in local newspapers, public bulletin boards and/or County and municipal office buildings;
- Designating willing and voluntary citizens and private sector representatives as official members of the Regional Hazard Mitigation Planning Team;
- Utilizing local media to update the public on any maintenance and/or periodic review activities taking place;
- Utilizing the websites of participating jurisdictions to advertise any maintenance and/or periodic review activities taking place; and
- Keeping copies of the Plan in public libraries.

Annex A
Buncombe County

This annex includes jurisdiction-specific information for Buncombe County and its participating municipalities. It consists of the following five subsections:

- A.1 Buncombe County Community Profile
- A.2 Buncombe County Risk Assessment
- A.3 Buncombe County Vulnerability Assessment
- A.4 Buncombe County Capability Assessment
- A.5 Buncombe County Mitigation Strategy

A.1 BUNCOMBE COUNTY COMMUNITY PROFILE

A.1.1 Geography and the Environment

Buncombe County is a western county in the state of North Carolina. It comprises the City of Asheville, the Towns of Biltmore Forest, Black Mountain, Montreat, Weaverville, and Woodfin, as well as many small unincorporated communities.

The county is situated in the Blue Ridge Mountains and its land is covered by mountains, valleys, rivers, and lakes. The county's highest elevation reaches 6,373 feet and its lowest elevation is 1,305 feet. The total area of the county is 660 square miles, 3 square miles of which is water.

Summer temperatures in the valley portion of the county range from highs around 85˚Farenheit to lows in the 60s. Winter temperatures in the valley range from highs around 50˚F to lows around 30˚F. Year round, average temperatures in the mountainous areas of the county are typically 10˚F lower than the valley. The county averages about four inches of rainfall each month.

A.1.2 Population and Demographics

According to the 2010 Census, Buncombe County has a population of 238,318 people. The county has seen almost 16% growth between 2000 and 2010, and the average population density is 363 people per square mile. Population counts from the US Census Bureau for 1990, 2000, and 2010 for the county and all of the participating jurisdictions are presented in **Table A.1**.

TABLE A.1: POPULATION COUNTS FOR BUNCOMBE COUNTY

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Buncombe County	**174,821**	**206,330**	**238,318**	**15.5%**
City of Asheville	61,607	68,889	83,393	21.1%
Town of Biltmore Forest	1,327	1,440	1,343	-6.7%
Town of Black Mountain	5,418	7,511	7,848	4.5%

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Town of Montreat	693	630	723	14.8%
Town of Weaverville	2,107	2,416	3,210	29.1%
Town of Woodfin	2,736	3,162	6,123	93.6%

Source: United States Census Bureau

Based on the 2010 Census, the median age of residents of Buncombe County is 40.6 years. The racial characteristics of the county are presented in **Table A.2**. Whites make up the majority of the population in the county, accounting for around 87 percent of the population.

TABLE A.2: DEMOGRAPHICS OF BUNCOMBE COUNTY

Jurisdiction	White, Percent (2010)	Black or African American, Percent (2010)	American Indian or Alaska Native, Percent (2010)	Asian, Percent (2010)	Native Hawaiian or Other Pacific Islander, Percent (2010)	Other Race, Percent (2010)	Two or More Races, percent (2010)	Persons of Hispanic Origin, Percent (2010)*
Buncombe County	**87.4%**	**6.4%**	**0.4%**	**1.0%**	**0.1%**	**2.6%**	**2.1%**	**6.0%**
City of Asheville	79.3%	13.4%	0.3%	1.4%	0.2%	2.9%	2.6%	6.5%
Town of Biltmore Forest	98.4%	0.4%	0.0%	0.3%	0.0%	0.1%	0.8%	1.0%
Town of Black Mountain	90.0%	6.0%	0.3%	0.6%	0.0%	0.8%	2.3%	2.5%
Town of Montreat	91.3%	5.1%	0.0%	0.7%	0.1%	1.4%	1.4%	2.8%
Town of Weaverville	95.2%	0.9%	0.0%	0.4%	0.3%	0.6%	2.7%	2.1%
Town of Woodfin	87.3%	4.9%	0.6%	0.9%	0.0%	3.8%	2.5%	8.7%

*Hispanics may be of any race, so also are included in applicable race categories
Source: United States Census Bureau

A.1.3 Housing

According to the 2010 US Census, there are 113,365 housing units in Buncombe County, the majority of which are single family homes or mobile homes. Housing information for the county and municipalities is presented in **Table A.3**. As shown in the table, Montreat has a significantly higher percentage of seasonal units compared to the rest of the county.

TABLE A.3: HOUSING CHARACTERISTICS OF BUNCOMBE COUNTY

Jurisdiction	Housing Units (2000)	Housing Units (2010)	Seasonal Units, Percent (2010)	Median Home Value (2007-2011)
Buncombe County	**93,973**	**113,365**	**3.4%**	**$192,200**
City of Asheville	33,567	41,626	2.4%	$195,300
Town of Biltmore Forest	653	689	10.3%	$825,000
Town of Black Mountain	3,703	4,141	5.3%	$165,200
Town of Montreat	572	666	64.1%	$438,700
Town of Weaverville	1,081	1,582	3.9%	$253,300

Jurisdiction	Housing Units (2000)	Housing Units (2010)	Seasonal Units, Percent (2010)	Median Home Value (2007-2011)
Town of Woodfin	1,521	2,698	1.6%	$154,800

Source: United States Census Bureau

A.1.4 Infrastructure

Transportation

There are several US and state highways that serve Buncombe County and link it with other regions of North Carolina. These include Interstates 26, 40, and 240 and US Highways 19, 23, 25, 70, and 74. Interstate 40 runs east to west through the county and is located just south of Asheville. Interstate 26 runs north and south beginning in Asheville southward toward Henderson County. Interstate 240 is a 9-mile loop around the northern section of Asheville's downtown district between Interstate 40 to the east and Interstate 26 to the west.

Buncombe County is also served by one airport. The Asheville Regional Airport is a city-owned public-use airport located in Fletcher. The airport currently offers non-stop commercial flights on four airlines to six major cities.

The City of Asheville operates the Asheville Transit System consisting of several bus lines connection parts of the city and surrounding areas. The Norfolk Southern Railway also passes through Asheville; however, passenger service is currently not available in the area. The Craggy Mountain Line, Inc., located in Woodin, is a tourist attraction offering a historic ride of approximately 3.45 miles of rail lines known as the Asheville to Craggy Branch portion.

Utilities

Electric power is provided by Duke Progress Energy and natural gas is provided by PSNC Energy.

Water is provided to residents of the area by Woodfin Water District, Asheville Water Authority, and Weaverville Water Department. Sewer services are provided by the Metropolitan Sewerage District of Buncombe County.

Community Facilities

There are a number of buildings and community facilities located throughout Buncombe County. According to the data collected for the vulnerability assessment (6.4.1), there are 38 fire/EMS stations, 6 police stations, 4 medical care facilities, and 55 public schools located within the county.

Several of the medical facilities are concentrated in the Asheville area; including Mission Hospital and Asheville Surgery Center; a 744-bed general medical and surgical provider; Asheville Specialty Hospital, a 34-bed facility offering long-term acute care; and CarePartners Rehabilitation Hospital, an 80-bed rehabilitation facility. Additionally, Asheville is home to the Charles George VA Medical Center which provides care for veterans. Other medical facilities in the county include Mountain Area Health Education Center (MAHEC), in Asheville, which provides healthcare education and services and The Sisters of Mercy Urgent Care with facilities in West Asheville, South Asheville, and Weaverville.

Buncombe County has several recreation areas. This includes five outdoor pool locations at the Cane Creek, Erwin, Hominy Valley, North Buncombe, and the Charles D. Owen Park. Other parks and notable features include:

- Buncombe County Sports Park—Pavilions available for rent, areas for soccer, volleyball and bocce ball, a picnic area, walking trail, and playground. The Sand Hill Community Garden and Sand Hill Community Fruit and Nut Orchard are also included in this park.
- Charles D. Owen Park—Located next to the Swannanoa River, offers pavilions for rent, baseball fields, basketball courts, outdoor pool, playground, picnic area, walking trail, and two lakes for fishing.
- Hominy Valley Park—Five baseball/softball fields, basketball courts, outdoor sand volleyball court, swimming pool, playground, and picnic area.
- Lake Julian Park—Picnicking, boating, fishing, playground, outdoor games (horseshoes, sand volleyball court, nine-hole disc golf course), and special events.
- Zeugner Center—Indoor pool, large multi-purpose activity room with a kitchen area and a smaller activity/meeting room.

A.1.5 Land Use

The population centers in Buncombe County are concentrated in the lower-lying areas within closer proximity to transportation corridors. Despite the economic downturn, development has continued in these areas. New residential and commercial development has been especially noticed in Candler, Leicester, Swannanoa, Reems Creek, South Asheville, and Fairview as they are near areas comprised of a variety of uses and denser residential development. Currently, there are still over 116,000 acres classified as vacant land in Buncombe County. Vacant, privately-held property represents over 38% of the unincorporated portion of the county.

In recent years, Buncombe County expanded zoning efforts throughout the county. The purpose was to implement comprehensive planning policies to ensure orderly growth and development while protecting and preserving rural communities, agricultural land, scenic beauty, natural resources, parks, and open spaces. Each municipality within Buncombe County also has their own land use standards they enforce.

A.1.6 Employment and Industry

According to the North Carolina Employment Security Commission, in 2012, Buncombe County had an average annual employment of 117,664 workers and an average unemployment rate of 7.5 percent (compared to 9.5 for the state). In 2012, the Education and Health Services industry employed 27.4 percent of the County's workforce followed by Trade, Transportation, and Utilities (20.3%); Leisure and Hospitality (14.7%); Professional and Business Services (10.7%); and Manufacturing (9.5%). From 2010 to 2012, the average annual median household income in Buncombe County was $43,177 compared to $45,215 for the state of North Carolina.

A.2 BUNCOMBE COUNTY RISK ASSESSMENT

This subsection includes hazard profiles for each of the significant hazards identified in Section 4: *Hazard Identification* as they pertain to Buncombe County. Each hazard profile includes a description of the

hazard's location and extent, notable historical occurrences, and the probability of future occurrences. Additional information can be found in Section 5: *Hazard Profiles*.

A.2.1 Drought

Location and Spatial Extent

Drought typically covers a large area and cannot be confined to any geographic or political boundaries. Local areas may experience much more severe and/or frequent drought events than what is represented on the Palmer Drought Severity Index map. Furthermore, it is assumed that the county would be uniformly exposed to drought, making the spatial extent potentially widespread. It is also notable that drought conditions typically do not cause significant damage to the built environment.

Historical Occurrences

According to the North Carolina Drought Monitor, Buncombe County has had drought occurrences in thirteen of the last fourteen years (2000-2013). **Table A.4** shows the most severe drought classification for each year, according to North Carolina Drought Monitor classifications. It should be noted that the North Carolina Drought Monitor also estimates what percentage of the county is in each classification of drought severity. For example, the most severe classification reported may be exceptional but a majority of the county may actually be in a less severe condition.

TABLE A. 4: HISTORICAL DROUGHT OCCURRENCES IN BUNCOMBE COUNTY

Abnormally Dry **Moderate Drought** **Severe Drought** **Extreme Drought** **Exceptional Drought**

	Buncombe County
2000	EXCEPTIONAL
2001	EXTREME
2002	EXTREME
2003	NORMAL
2004	ABNORMAL
2005	ABNORMAL
2006	SEVERE
2007	EXCEPTIONAL
2008	EXCEPTIONAL
2009	SEVERE
2010	MODERATE
2011	MODERATE
2012	MODERATE
2013	ABNORMAL

Source: North Carolina Drought Monitor

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that Buncombe County has a probability level of likely (10 to 100 percent annual probability) for future drought events. This hazard may vary slightly by location but each area has an equal probability of experiencing a drought. However, historical information also indicates that there is a much lower probability for extreme, long-lasting drought conditions.

A.2.2 Extreme Heat

Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. All of Buncombe County is susceptible to extreme heat conditions.

Historical Occurrences

Data from the National Climatic Data Center was used to determine historical extreme heat and heat wave events in Buncombe County. There were no events reported.

In addition, information from the State Climate Office of North Carolina was reviewed to obtain historical temperatures in the county. Temperature information has been reported since 1900. The recorded maximum for Buncombe County can be found below in **Table A.5**:

TABLE 5.5: HIGHEST RECORDED TEMPERATURE IN BUNCOMBE COUNTY

Location	Date	Temperature (F)
Montreat	7/20/1926	103
BUNCOMBE COUNTY MAXIMUM	--	**103**

Source: State Climate Office of North Carolina

The State Climate Office also reports average maximum temperatures in various locations in the county. The most centralized location is Asheville. **Table A.6** shows the average maximum temperatures from 1971 to 2000 at the Asheville observation station which can be used as a general comparison for the county.

TABLE A.6: AVERAGE MAXIMUM TEMPERATURE IN ASHEVILLE, BUNCOMBE COUNTY

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Avg. Max (°F)	46.1	50.3	58.0	66.8	74.3	80.8	84.3	82.9	76.9	67.7	57.8	49.6

Source: State Climate Office of North Carolina

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Buncombe County has a probability level of unlikely (less than 1 percent annual probability) for future extreme heat events to impact the county.

A.2.3 Hailstorm

Location and Spatial Extent

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. It is assumed that Buncombe County is uniformly exposed to severe thunderstorms; therefore, all areas of the county are equally exposed to hail which may be produced by such storms.

Historical Occurrences

According to the National Climatic Data Center, 159 recorded hailstorm events have affected Buncombe County since 1962.[1] **Table A.7** is a summary of the hail events in Buncombe County. **Table A.8** provides detailed information about each event that occurred in the county. In all, hail occurrences resulted in nearly $7,000 (2013 dollars) in property damages. Hail ranged in diameter from 0.25 inches to 2.0 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Climatic Data Center. Therefore, it is likely that damages are greater than the reported value.

TABLE A.7: SUMMARY OF HAIL OCCURRENCES IN BUNCOMBE COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Asheville	33	0/0	$6,921
Biltmore Forest	1	0/0	$0
Black Mountain	9	0/0	$0
Montreat	2	0/0	$0
Weaverville	19	0/0	$0
Woodfin	0	0/0	$0
Unincorporated Area	95	0/0	$0
BUNCOMBE COUNTY TOTAL	**159**	**0/0**	**$6,921**

Source: National Climatic Data Center

TABLE A.8: HISTORICAL HAIL OCCURRENCES IN BUNCOMBE COUNTY

	Date	Magnitude	Deaths / Injuries	Property Damage*
Asheville				
ASHEVILLE	20-APR-96	0.75 in.	0/0	$0
ASHEVILLE	15-JUN-96	0.75 in.	0/0	$0
ASHEVILLE	15-JUN-96	1.00 in.	0/0	$0
ASHEVILLE	24-JUN-96	1.75 in.	0/0	$0
ASHEVILLE	26-JUL-96	1.50 in.	0/0	$0
ASHEVILLE	02-JUN-97	0.75 in.	0/0	$0
ASHEVILLE	02-JUN-97	0.88 in.	0/0	$0
ASHEVILLE	06-MAY-99	0.75 in.	0/0	$0
ASHEVILLE	07-MAY-99	0.88 in.	0/0	$0
ASHEVILLE	07-MAY-99	1.25 in.	0/0	$0
ASHEVILLE	07-MAY-99	1.25 in.	0/0	$0
ASHEVILLE	04-SEP-00	0.75 in.	0/0	$0
ASHEVILLE	25-OCT-00	0.25 in.	0/0	$0
ASHEVILLE	22-JUN-01	1.75 in.	0/0	$0
ASHEVILLE	04-JUN-02	1.25 in.	0/0	$6,921
ASHEVILLE	04-JUN-02	0.75 in.	0/0	$0
ASHEVILLE	04-JUN-02	0.75 in.	0/0	$0
ASHEVILLE	15-MAY-03	1.00 in.	0/0	$0

[1] These hail events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional hail events have affected Buncombe County. In addition to NCDC, the North Carolina Department of Insurance office was contacted for information. As additional local data becomes available, this hazard profile will be amended.

	Date	Magnitude	Deaths / Injuries	Property Damage*
ASHEVILLE	15-MAY-03	1.00 in.	0/0	$0
ASHEVILLE	15-MAY-03	1.75 in.	0/0	$0
ASHEVILLE	21-JUL-03	0.75 in.	0/0	$0
ASHEVILLE	05-JUN-05	0.88 in.	0/0	$0
ASHEVILLE	27-JUL-05	0.88 in.	0/0	$0
ASHEVILLE	03-APR-06	0.75 in.	0/0	$0
ASHEVILLE	11-JUN-06	0.88 in.	0/0	$0
ASHEVILLE	11-JUN-06	0.75 in.	0/0	$0
ASHEVILLE	12-JUN-07	0.88 in.	0/0	$0
ASHEVILLE	12-JUN-07	1.75 in.	0/0	$0
ASHEVILLE	15-JUN-07	1.00 in.	0/0	$0
ASHEVILLE	24-AUG-07	0.88 in.	0/0	$0
ASHEVILLE	10-JUN-08	0.75 in.	0/0	$0
ASHEVILLE	05-APR-12	1.00 in.	0/0	$0
ASHEVILLE	17-APR-12	0.88 in.	0/0	$0
Biltmore Forest				
BILTMORE FOREST	22-JUN-12	0.88 in.	0/0	$0
Black Mountain				
BLACK MTN	09-MAY-04	0.88 in.	0/0	$0
BLACK MTN	03-APR-06	0.75 in.	0/0	$0
BLACK MTN	13-MAY-06	0.75 in.	0/0	$0
BLACK MTN	20-JUL-06	0.75 in.	0/0	$0
BLACK MTN	19-APR-07	1.00 in.	0/0	$0
BLACK MTN	07-JUN-08	0.75 in.	0/0	$0
BLACK MTN	09-JUN-09	0.75 in.	0/0	$0
BLACK MTN	26-APR-12	0.88 in.	0/0	$0
BLACK MTN	22-JUN-12	1.00 in.	0/0	$0
Montreat				
MONTREAT	04-JUN-02	0.75 in.	0/0	$0
MONTREAT	10-AUG-12	0.88 in.	0/0	$0
Weaverville				
Weaverville	17-JUN-95	1.75 in.	0/0	$0
WEAVERVILLE	04-JUN-02	1.75 in.	0/0	$0
WEAVERVILLE	15-MAY-03	1.75 in.	0/0	$0
WEAVERVILLE	15-MAY-03	0.75 in.	0/0	$0
WEAVERVILLE	04-AUG-03	0.75 in.	0/0	$0
WEAVERVILLE	03-APR-06	0.88 in.	0/0	$0
WEAVERVILLE	10-AUG-06	0.75 in.	0/0	$0
WEAVERVILLE	28-MAR-07	0.75 in.	0/0	$0
WEAVERVILLE	12-JUN-07	1.00 in.	0/0	$0
WEAVERVILLE	15-JUN-07	0.88 in.	0/0	$0
WEAVERVILLE	10-JUL-07	0.75 in.	0/0	$0
WEAVERVILLE	26-JUN-08	0.88 in.	0/0	$0
WEAVERVILLE	20-JUL-09	0.75 in.	0/0	$0
WEAVERVILLE	09-SEP-09	0.75 in.	0/0	$0
WEAVERVILLE	09-APR-11	1.00 in.	0/0	$0

	Date	Magnitude	Deaths / Injuries	Property Damage*
WEAVERVILLE	09-APR-11	0.88 in.	0/0	$0
WEAVERVILLE	30-APR-12	1.00 in.	0/0	$0
WEAVERVILLE	17-MAY-12	1.00 in.	0/0	$0
WEAVERVILLE	21-MAY-12	0.75 in.	0/0	$0
Woodfin				
None Reported	--	--	--	--
Unincorporated Area				
BUNCOMBE COUNTY	27-MAY-62	1.75 in.	0/0	$0
BUNCOMBE COUNTY	26-APR-82	1.75 in.	0/0	$0
BUNCOMBE COUNTY	26-APR-82	1.75 in.	0/0	$0
BUNCOMBE COUNTY	28-MAY-82	1.50 in.	0/0	$0
BUNCOMBE COUNTY	29-MAY-82	1.50 in.	0/0	$0
BUNCOMBE COUNTY	14-APR-84	1.75 in.	0/0	$0
BUNCOMBE COUNTY	07-JUN-85	1.00 in.	0/0	$0
BUNCOMBE COUNTY	10-JUL-85	0.75 in.	0/0	$0
BUNCOMBE COUNTY	29-MAY-87	1.75 in.	0/0	$0
BUNCOMBE COUNTY	24-JUN-88	0.75 in.	0/0	$0
BUNCOMBE COUNTY	16-JUL-88	0.75 in.	0/0	$0
BUNCOMBE COUNTY	28-APR-89	0.75 in.	0/0	$0
BUNCOMBE COUNTY	02-JUN-89	1.00 in.	0/0	$0
BUNCOMBE COUNTY	26-JUN-89	0.75 in.	0/0	$0
BUNCOMBE COUNTY	08-JUN-90	1.50 in.	0/0	$0
BUNCOMBE COUNTY	21-AUG-90	0.75 in.	0/0	$0
BUNCOMBE COUNTY	29-APR-91	0.75 in.	0/0	$0
Barnardsville	25-AUG-93	1.00 in.	0/0	$0
Averys Creek	09-JUN-95	1.75 in.	0/0	$0
WEST HAVEN	24-MAY-96	0.75 in.	0/0	$0
LEICESTER	24-JUN-96	0.88 in.	0/0	$0
AVERY CREEK	24-JUN-96	0.75 in.	0/0	$0
CANDLER	02-JUN-97	1.00 in.	0/0	$0
SKYLAND	08-APR-98	0.75 in.	0/0	$0
ENKA	16-APR-98	2.00 in.	0/0	$0
BARNARDSVILLE	07-MAY-98	1.75 in.	0/0	$0
BARNARDSVILLE	07-MAY-98	1.75 in.	0/0	$0
BARNARDSVILLE	07-MAY-98	1.75 in.	0/0	$0
SWANNANOA	22-JUN-98	0.75 in.	0/0	$0
SWANNANOA	21-JUL-98	0.75 in.	0/0	$0
FAIRVIEW	02-JUN-99	1.00 in.	0/0	$0
FAIRVIEW	13-MAY-00	1.00 in.	0/0	$0
CANDLER	10-AUG-00	0.75 in.	0/0	$0
LEICESTER	25-JUN-01	1.00 in.	0/0	$0
SANDYMUSH	04-JUN-02	1.00 in.	0/0	$0
LEICESTER	04-JUN-02	1.75 in.	0/0	$0
LEICESTER	20-JUN-02	0.75 in.	0/0	$0
SWANNANOA	01-JUL-02	0.88 in.	0/0	$0
ENKA	02-JUL-02	0.75 in.	0/0	$0
FAIRVIEW	15-MAY-03	1.75 in.	0/0	$0

	Date	Magnitude	Deaths / Injuries	Property Damage*
SWANNANOA	12-JUL-03	0.75 in.	0/0	$0
ENKA	04-AUG-03	1.75 in.	0/0	$0
AVERY CREEK	27-JUL-05	0.75 in.	0/0	$0
LEICESTER	04-AUG-05	0.75 in.	0/0	$0
ALEXANDER	03-APR-06	1.00 in.	0/0	$0
ASHEVILLE AIRPARK AR	19-APR-06	0.75 in.	0/0	$0
CANDLER	10-AUG-06	1.00 in.	0/0	$0
FAIRVIEW	08-JUN-07	1.75 in.	0/0	$0
BARNARDSVILLE	15-JUN-07	0.75 in.	0/0	$0
CANDLER	24-JUN-07	1.50 in.	0/0	$0
CANDLER	24-JUN-07	0.88 in.	0/0	$0
FAIRVIEW	24-JUN-07	0.88 in.	0/0	$0
BARNARDSVILLE	27-JUN-07	0.75 in.	0/0	$0
SKYLAND	19-JUL-07	0.75 in.	0/0	$0
CANDLER	10-JUN-08	1.00 in.	0/0	$0
CANDLER	10-JUN-08	0.75 in.	0/0	$0
ROYAL PINES	30-SEP-08	0.75 in.	0/0	$0
MIDWAY	24-APR-09	0.75 in.	0/0	$0
SHUMON	09-MAY-09	0.75 in.	0/0	$0
JUPITER	28-MAY-09	0.75 in.	0/0	$0
GROVEMONT	02-JUN-09	0.75 in.	0/0	$0
FAIRVIEW	02-JUN-09	1.25 in.	0/0	$0
FAIRVIEW	08-JUN-09	1.00 in.	0/0	$0
MIDWAY	10-JUN-09	1.00 in.	0/0	$0
ASHEVILLE AIRPARK AR	18-JUN-09	0.88 in.	0/0	$0
PAINT FORK	20-JUL-09	0.88 in.	0/0	$0
STOCKSVILLE	05-AUG-09	0.75 in.	0/0	$0
ARDEN	05-AUG-09	0.75 in.	0/0	$0
MURPHY JCT	09-SEP-09	0.75 in.	0/0	$0
DUNSMORE	26-JUL-10	1.00 in.	0/0	$0
BARNARDSVILLE	09-APR-11	0.75 in.	0/0	$0
WALKERTOWN	09-APR-11	0.88 in.	0/0	$0
BARNARDSVILLE	09-APR-11	0.88 in.	0/0	$0
RIDGECREST	09-APR-11	0.88 in.	0/0	$0
STONY FORK	02-JUN-11	1.00 in.	0/0	$0
BOSWELL	08-JUN-11	1.00 in.	0/0	$0
CANDLER	08-JUN-11	0.75 in.	0/0	$0
SAND HILL	08-JUN-11	1.00 in.	0/0	$0
BEVERLY HILLS	09-JUN-11	1.00 in.	0/0	$0
FLAT CREEK	10-JUN-11	0.75 in.	0/0	$0
BILTMORE	15-JUN-11	1.75 in.	0/0	$0
AVERY CREEK	21-JUN-11	1.25 in.	0/0	$0
BOSWELL	21-JUN-11	1.00 in.	0/0	$0
WILSON	05-APR-12	1.00 in.	0/0	$0
SWANNANOA	26-APR-12	0.88 in.	0/0	$0
CANDLER	26-APR-12	1.00 in.	0/0	$0
CANDLER	26-APR-12	0.88 in.	0/0	$0

	Date	Magnitude	Deaths / Injuries	Property Damage*
SKYLAND	26-APR-12	0.88 in.	0/0	$0
BILTMORE	26-APR-12	1.75 in.	0/0	$0
LEICESTER	30-APR-12	1.00 in.	0/0	$0
STOCKSVILLE	30-APR-12	0.75 in.	0/0	$0
WEST ASHEVILLE	17-MAY-12	0.75 in.	0/0	$0
MIDWAY	19-MAY-12	1.00 in.	0/0	$0
SHUMON	03-JUL-12	1.00 in.	0/0	$0
SHUMON	03-JUL-12	1.00 in.	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that the probability of future hail occurrences is highly likely (100 percent annual probability). Since hail is an atmospheric hazard (coinciding with thunderstorms), it is assumed that Buncombe County has equal exposure to this hazard. It can be expected that future hail events will continue to cause minor damage to property and vehicles throughout the county.

A.2.4 Hurricane and Tropical Storm

Location and Spatial Extent

Hurricanes and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect Buncombe County. The entire county is equally susceptible to hurricane and tropical storms.

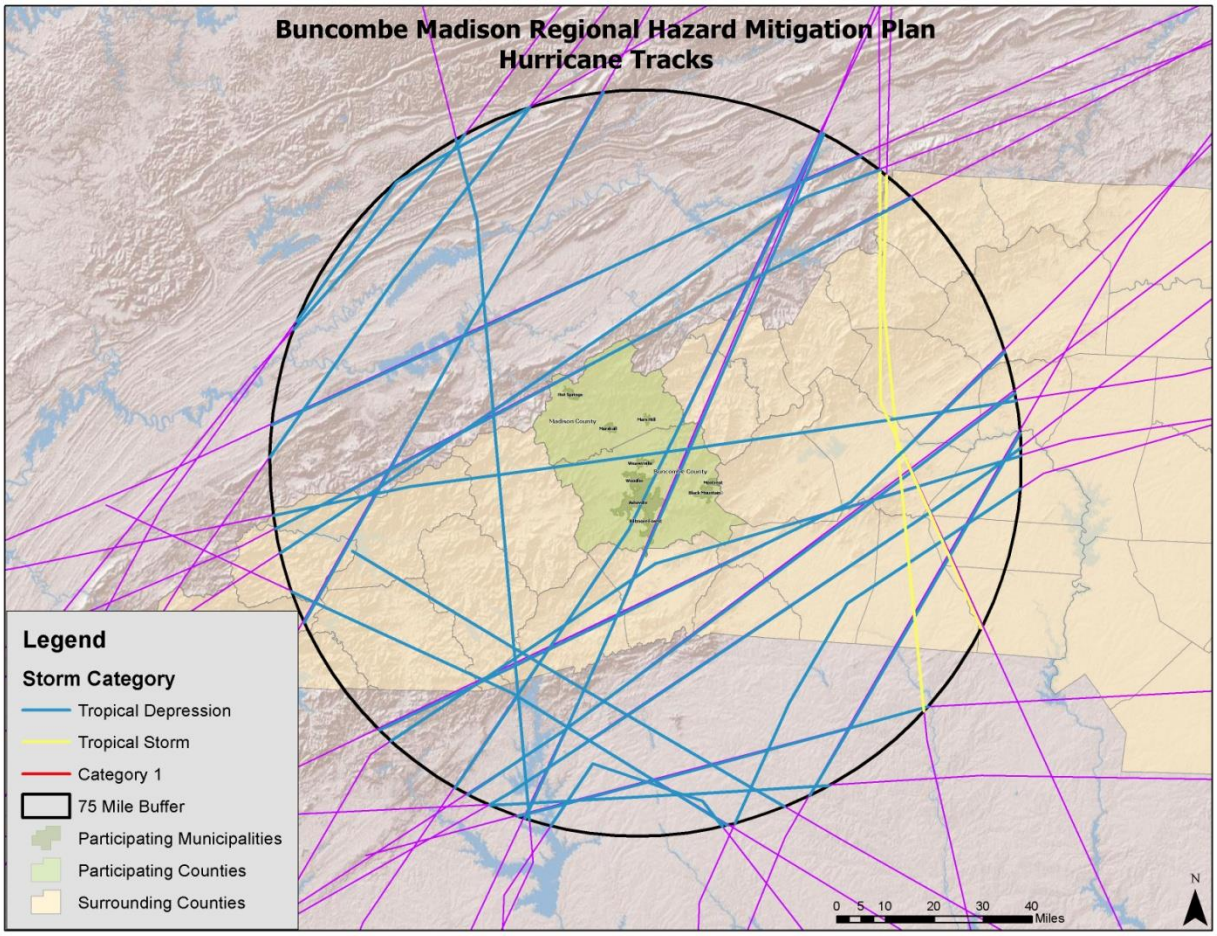
Historical Occurrences

According to the National Hurricane Center's historical storm track records, 24 tropical storm tracks have passed within 75 miles of Buncombe Madison Region since 1896.[2] This includes 2 tropical storms and 22 tropical depressions.

Of the recorded storm events, four tropical depressions have traversed directly through Buncombe County as shown in **Figure A.1**. **Table A.9** provides the date of occurrence, name (if applicable), maximum wind speed (as recorded within 75 miles of the Buncombe Madison Region) and Category of the storm based on the Saffir-Simpson Scale for each event.

[2] These storm track statistics do not include extra-tropical storms. Though these related hazard events are less severe in intensity, they may cause significant local impact in terms of rainfall and high winds.

FIGURE A.1: HISTORICAL HURRICANE STORM TRACKS WITHIN 75 MILES OF THE BUNCOMBE MADISON REGION



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

TABLE A.9: HISTORICAL STORM TRACKS WITHIN 75 MILES OF THE BUNCOMBE MADISON REGION (1850–2008)

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
7/17/1896	NOT NAMED	26.4	Tropical Depression
9/28/1901	NOT NAMED	30.8	Tropical Depression
10/7/1902	NOT NAMED	30.8	Tropical Depression
10/5/1905	NOT NAMED	22	Tropical Depression
9/3/1906	NOT NAMED	26.4	Tropical Depression
9/21/1907	NOT NAMED	30.8	Tropical Depression
8/26/1911	NOT NAMED	22	Tropical Depression
8/30/1913	NOT NAMED	22	Tropical Depression
8/4/1916	NOT NAMED	30.8	Tropical Depression
8/7/1928	NOT NAMED	26.4	Tropical Depression
10/7/1932	NOT NAMED	13.2	Tropical Depression
5/27/1934	NOT NAMED	22	Tropical Depression

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
8/23/1949	NOT NAMED	--	Tropical Depression
9/20/1959	GRACIE	39.6	Tropical Storm
7/18/1968	CELESTE	22	Tropical Depression
9/14/1975	ELOISE	17.6	Tropical Depression
9/3/1977	BABE	22	Tropical Depression
8/20/1985	ONE-C	22	Tropical Depression
9/22/1989	HUGO	48.4	Tropical Storm
8/14/1994	BERYL	13.2	Tropical Depression
7/6/2003	DOLORES	17.6	Tropical Depression
9/5/2004	FRANCES	22	Tropical Depression
9/6/2004	IVAN	17.6	Tropical Depression
7/3/2005	CINDY	17.6	Tropical Depression

Source: National Hurricane Center

The National Climatic Data Center did not report any events associated with a hurricane or tropical storm in Buncombe County between 1950 and 2013.

Federal records indicate that three disaster declarations were made in 1996 (Hurricane Fran), 2004 (Tropical Storm Frances), and 2004 (Hurricane Ivan) for the county.[3]

Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in Buncombe County. Most events do not carry winds that are above that of the winter storms and straight line winds received by the county. Some anecdotal information is available for the major storms that have impacted that area as found below:

Tropical Storm Frances – September 7-8, 2004
Tropical Storm Frances was a slow-moving, relatively large storm that dumped heavy rains over the eastern United States. The remnants of Frances produced a swath of 5 to 15 inches of rain across the North Carolina Mountains with reports of 12 to 15 inches of rain along the higher terrain and isolated reports in excess of 18 inches. Wind gusts reached between 40 and 60 mph along the Appalachian Mountains and numerous trees were downed. Frances caused significant crop damages totaling $55 million statewide. North Carolina residents received almost $20.6 million in federal disaster assistance following the storm.

Hurricane Ivan – September 16-17, 2004
Just a week and a half following Tropical Storm Frances, the remnants of Hurricane Ivan hit western North Carolina when many streams and rivers were already well above flood stage. The widespread flooding forced many roads to be closed and landslides were common across the mountain region. Wind gusts reached between 40 and 60 mph across the higher elevations of the Appalachian Mountains resulting in numerous downed trees. More than $13.8 million of federal aid was dispersed across North Carolina following Ivan.

[3] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Identification*.

Probability of Future Occurrences

Given the inland location of the county, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to Buncombe County due to induced events like flooding and landsliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). Given the regional nature of the hazard, all areas in the county are equally exposed to this hazard. However, when the county is impacted, the damage could be catastrophic, threatening lives and property throughout the planning area.

A.2.5 Lightning

Location and Spatial Extent

Lightning occurs randomly, therefore it is impossible to predict where and with what frequency it will strike. It is assumed that all of Buncombe County is uniformly exposed to lightning.

Historical Occurrences

According to the National Climatic Data Center, there have been 15 recorded lightning events in Buncombe County since 1993.[4] These events resulted in 1 death, 7 injuries, and almost $468,000 (2013 dollars) in damages, as listed in summary **Table A.10**. Detailed information on those events can be found in **Table A.11.** Many of the reported events are those that caused damage, and it should be expected that damages are likely much higher for this hazard than what is reported.

TABLE A.10: SUMMARY OF LIGHTNING OCCURRENCES IN BUNCOMBE COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Asheville	4	0/6	$21,386
Biltmore Forest	0	0/0	$0
Black Mountain	1	0/0	$69,212
Montreat	0	0/0	$0
Weaverville	1	0/1	$0
Woodfin	0	0/0	$0
Unincorporated Area	9	1/0	$377,105
BUNCOMBE COUNTY TOTAL	**15**	**1/7**	**$467,703**

Source: National Climatic Data Center

TABLE A.11: HISTORIC LIGHTNING OCCURRENCES IN BUNCOMBE COUNTY

	Date	Deaths / Injuries	Property Damage*	Details
Asheville				
ASHEVILLE	29-AUG-96	0/1	$0	Lightning injured one person.
ASHEVILLE	14-AUG-99	0/1	$0	Lightning struck a person near a dumpster

[4] These lightning events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional lightning events have occurred in Buncombe County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

	Date	Deaths / Injuries	Property Damage*	Details
				and burned their arm.
ASHEVILLE	20-JUN-01	0/0	$21,386	Lightning struck an unoccupied house, causing a fire that resulted in serious damage.
ASHEVILLE	14-JUL-06	0/4	$0	Four people, 3 adults and 1 child, received minor injuries from a lightning strike at the Biltmore Estate.
Biltmore Forest				
None Reported	--	--	--	--
Black Mountain				
BLACK MTN	03-JUN-02	0/0	$69,212	Lightning struck the Public Safety bldg, City Hall, the Fire Station, and 4 residences. One residence suffered a major fire and considerable damage.
Montreat				
None Reported	--	--	--	--
Weaverville				
WEAVERVILLE	12-JUL-03	0/1	$0	A man was seriously injured when he was struck by lightning while standing next to a tree at Reems Creek.
Woodfin				
None Reported	--	--	--	--
Unincorporated Area				
Enka	15-APR-93	0/0	$87,452	Lightning exploded a large poplar tree sending large chunks of wood into a nearby house and atop a car.
WEST ASHEVILLE	24-JAN-96	0/0	$0	Lightning struck a home in Buncombe county causing a small fire and some damage.
LEICESTER	06-MAY-96	0/0	$32,182	Lightning struck and partially burned a mobile home and also struck several other residences. Similar strikes also occurred in Asheville.
HOMINY	21-JUN-97	0/0	$110,111	A couple of severe thunderstorms developed in the mountains in the afternoon causing large hail south of Franklin and blowing down trees between Marshall and Hot Springs. A number of trees and power lines were downed at several locations in the foothills and piedmont. The most damage occurred in Hickory where numerous trees and power lines were downed. Caldwell county was hit hard. A cabinet shop and contents burned after being struck by lightning. Thunderstorm winds caused some damage, then high winds following the storm caused trees to fall in the Cajah's Mountain area. Lightning caused a fire in Buncombe county which destroyed a home.

	Date	Deaths / Injuries	Property Damage*	Details
ALEXANDER	21-JUL-97	0/0	$78,651	Lightning sparked a house fire.
ENKA	18-AUG-00	0/0	$36,713	Lightning struck a nearby tree, ran into a house, and ignited a fire which burned the house and its contents. Thunderstorms erupted in an unstable atmosphere during the late afternoon and early evening. Many of the storms or short line segments evolved into bow echoes, leaving a considerable amount of wind damage in their wake. Winds were estimated between 75 and 100 mph in several locations. However, most of the wind damage was limited to downed trees and power lines, though extensive in many areas causing considerable power outages and blocking many roads. Two people were injured by trees which fell on them and one person drowned when his boat was blown away from where he was swimming.
SKYLAND	03-JUL-01	0/0	$21,386	Lightning started a fire at a power transformer, destroying the building which was located at a power plant and a car belonging to one of the power plant employees.
FAIRVIEW	08-JUN-09	1/0	$0	A 65-year-old man was struck and killed by lightning on highway 74E just south of Fairview.
AVERY CREEK	28-FEB-11	0/0	$10,609	Lightning struck a home on Owenby Lane, igniting fire.

Property Damage is reported in 2013 dollars; All damages have not likely been reported.*
Source: National Climatic Data Center

Probability of Future Occurrences

Although there were not a high number of historical lightning events reported throughout Buncombe County via NCDC data, it is considered a regular occurrence, especially accompanied by thunderstorms. In fact, lightning events will assuredly happen on an annual basis, though not all events will cause damage. According to Vaisala's U.S. National Lightning Detection Network (NLDN®), Buncombe County is located in an area of the country that experienced an average of 2 to 4 lightning flashes per square kilometer per year between 1997 and 2010. Therefore, the probability of future events is highly likely (100 percent annual probability). It can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the county.

A.2.6 Thunderstorm Wind/High Wind

Location and Spatial Extent

A wind event is an atmospheric hazard, and thus has no geographic boundaries. It is typically a widespread event that can occur in all regions of the United States. However, thunderstorms are most common in the central and southern states because atmospheric conditions in those regions are favorable for generating these powerful storms. Also, Buncombe County typically experiences several

straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that Buncombe County has uniform exposure to an event and the spatial extent of an impact could be large.

Historical Occurrences

Severe storms have resulted in two disaster declarations in Buncombe County.[5] According to NCDC, there have been 180 reported thunderstorm and high wind events since 1959 in Buncombe County.[6] These events caused almost $3.9 million (2013 dollars) in damages. There were reports of 12 injuries and 2 fatalities. **Table A.12** summarizes this information. **Table A.13** presents detailed thunderstorm and high wind event reports including date, magnitude, and associated damages for each event.[7]

TABLE A.12: SUMMARY OF THUNDERSTORM / HIGH WIND OCCURRENCES IN BUNCOMBE COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Asheville	26	0/1	$196,286
Biltmore Forest	0	0/0	$0
Black Mountain	4	0/0	$1,384
Montreat	1	0/0	$0
Weaverville	11	0/1	$5,376
Woodfin	4	0/1	$0
Unincorporated Area	134	2/7	$3,679,273
BUNCOMBE COUNTY TOTAL	**180**	**2/12**	**$3,882,319**

Source: National Climatic Data Center

TABLE A.13: HISTORICAL THUNDERSTORM / HIGH WIND OCCURRENCES IN BUNCOMBE COUNTY

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
Asheville					
Asheville	20-AUG-93	THUNDERSTORM WINDS	0 kts.	0/0	$0
ASHEVILLE	15-JUN-96	TSTM WIND	50 kts.	0/0	$0
ASHEVILLE	26-JUL-96	TSTM WIND	50 kts.	0/1	$0
ASHEVILLE	28-JUL-97	TSTM WIND	50 kts.	0/0	$0
ASHEVILLE	20-MAR-98	TSTM WIND	50 kts.	0/0	$0
ASHEVILLE	23-JAN-99	TSTM WIND	68 kts.	0/0	$22,689
ASHEVILLE	25-JUN-00	TSTM WIND	50 kts.	0/0	$0
ASHEVILLE	22-JUN-01	TSTM WIND	55 kts.	0/0	$0
ASHEVILLE	03-JUL-01	TSTM WIND	50 kts.	0/0	$0
ASHEVILLE	08-JUL-01	TSTM WIND	65 kts.	0/0	$0
ASHEVILLE	08-JUL-01	TSTM WIND	70 kts.	0/0	$0
ASHEVILLE	17-MAR-02	TSTM WIND	50 kts.	0/0	$1,384

[5] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.

[6] These thunderstorm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional thunderstorm events have occurred in Buncombe County. As additional local data becomes available, this hazard profile will be amended.

[7] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
ASHEVILLE	02-MAY-02	TSTM WIND	51 kts.	0/0	$0
ASHEVILLE	05-JUN-02	TSTM WIND	50 kts.	0/0	$6,921
ASHEVILLE	02-JUL-02	TSTM WIND	50 kts.	0/0	$0
ASHEVILLE	02-MAY-03	TSTM WIND	50 kts.	0/0	$134,392
ASHEVILLE	11-AUG-04	TSTM WIND	52 kts.	0/0	$0
ASHEVILLE	27-JUL-05	TSTM WIND	50 kts.	0/0	$0
ASHEVILLE	11-JUN-06	TSTM WIND	55 kts.	0/0	$0
ASHEVILLE	11-JUN-06	TSTM WIND	50 kts.	0/0	$0
ASHEVILLE	10-AUG-06	TSTM WIND	60 kts.	0/0	$0
ASHEVILLE	15-JUN-07	THUNDERSTORM WIND	50 kts.	0/0	$0
ASHEVILLE	28-JUN-07	THUNDERSTORM WIND	50 kts.	0/0	$0
ASHEVILLE	27-JUL-07	THUNDERSTORM WIND	50 kts.	0/0	$0
ASHEVILLE	04-MAR-08	THUNDERSTORM WIND	50 kts.	0/0	$0
ASHEVILLE	26-APR-12	THUNDERSTORM WIND	50 kts.	0/0	$30,900
Biltmore Forest					
None Reported	--	--	--	--	--
Black Mountain					
BLACK MTN	25-JUN-00	TSTM WIND	55 kts.	0/0	$0
BLACK MTN	13-JUN-02	TSTM WIND	50 kts.	0/0	$1,384
BLACK MTN	02-MAY-03	TSTM WIND	50 kts.	0/0	$0
BLACK MTN	26-JUN-07	THUNDERSTORM WIND	50 kts.	0/0	$0
Montreat					
MONTREAT	04-JUL-97	TSTM WIND	50 kts.	0/0	$0
Weaverville					
WEAVERVILLE	13-JUN-97	TSTM WIND	50 kts.	0/0	$0
WEAVERVILLE	24-JUL-99	TSTM WIND	50 kts.	0/0	$0
WEAVERVILLE	25-JUN-00	TSTM WIND	50 kts.	0/0	$0
WEAVERVILLE	14-JUL-00	TSTM WIND	50 kts.	0/0	$0
WEAVERVILLE	08-JUL-01	TSTM WIND	50 kts.	0/0	$0
WEAVERVILLE	04-JUL-02	TSTM WIND	50 kts.	0/1	$0
WEAVERVILLE	15-JUN-03	TSTM WIND	50 kts.	0/0	$1,344
WEAVERVILLE	04-AUG-03	TSTM WIND	50 kts.	0/0	$4,032
WEAVERVILLE	04-JUL-11	THUNDERSTORM WIND	50 kts.	0/0	$0
WEAVERVILLE	04-JUL-11	THUNDERSTORM WIND	50 kts.	0/0	$0
WEAVERVILLE	06-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
Woodfin					
WOODFIN	04-JUL-97	TSTM WIND	50 kts.	0/3	$0
WOODFIN	21-AUG-07	THUNDERSTORM WIND	50 kts.	0/0	$0
WOODFIN	22-JUN-12	THUNDERSTORM WIND	55 kts.	0/0	$0
WOODFIN	06-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
Unincorporated Area					
BUNCOMBE COUNTY	22-MAY-59	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	24-JUL-64	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	28-JUN-66	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	04-JUL-70	TSTM WIND	61 kts.	0/0	$0

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
BUNCOMBE COUNTY	10-JUN-82	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	08-MAR-84	TSTM WIND	63 kts.	1/1	$0
BUNCOMBE COUNTY	21-AUG-85	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	01-JUN-87	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	23-JUN-88	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	10-JUL-88	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	10-JUL-88	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	04-JUN-89	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	25-JUL-89	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	08-JUN-90	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	09-APR-91	TSTM WIND	0 kts.	0/1	$0
BUNCOMBE COUNTY	24-JUL-91	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	06-AUG-91	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	11-AUG-92	TSTM WIND	0 kts.	0/0	$0
BUNCOMBE COUNTY	11-AUG-92	TSTM WIND	0 kts.	0/0	$0
Eastern	05-DEC-93	HIGH WINDS	0 kts.	0/0	$874,516
BUNCOMBE COUNTY	05-OCT-95	HIGH WINDS	0 kts.	1/5	$1,657,168
BUNCOMBE COUNTY	18-JAN-96	HIGH WIND	0 kts.	0/0	$5,028
LEICESTER	24-JAN-96	TSTM WIND	0 kts.	0/0	$40,228
LEICESTER	24-JUN-96	TSTM WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	05-MAR-97	HIGH WIND	55 kts.	0/0	$0
BUNCOMBE COUNTY	13-MAY-97	HIGH WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	07-JAN-98	HIGH WIND	50 kts.	0/0	$7,744
BUNCOMBE COUNTY	03-FEB-98	HIGH WIND	0 kts.	0/0	$25,823
ENKA	16-APR-98	TSTM WIND	50 kts.	0/0	$0
SWANNANOA	22-JUN-98	TSTM WIND	55 kts.	0/0	$0
SWANNANOA	21-JUL-98	TSTM WIND	52 kts.	0/0	$0
SKYLAND	23-JAN-99	TSTM WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	03-MAR-99	HIGH WIND	60 kts.	0/0	$151,259
SWANNANOA	06-MAY-99	TSTM WIND	50 kts.	0/0	$0
LEICESTER	07-MAY-99	TSTM WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	15-SEP-99	HIGH WIND	45 kts.	0/0	$0
BUNCOMBE COUNTY	02-NOV-99	HIGH WIND	55 kts.	0/0	$0
BUNCOMBE COUNTY	13-JAN-00	HIGH WIND	52 kts.	0/0	$0
BUNCOMBE COUNTY	19-MAR-00	HIGH WIND	55 kts.	0/0	$0
BUNCOMBE COUNTY	28-MAR-00	HIGH WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	08-APR-00	HIGH WIND	50 kts.	0/0	$0
FAIRVIEW	13-MAY-00	TSTM WIND	52 kts.	0/0	$0
CANDLER	25-MAY-00	TSTM WIND	70 kts.	0/0	$73,427
CANDLER	03-JUN-00	TSTM WIND	50 kts.	0/0	$0
CANDLER	10-AUG-00	TSTM WIND	60 kts.	0/0	$0
BUNCOMBE COUNTY	16-DEC-00	HIGH WIND	55 kts.	0/0	$0
BUNCOMBE COUNTY	06-MAR-01	HIGH WIND	55 kts.	0/0	$0
BUNCOMBE COUNTY	20-MAR-01	HIGH WIND	55 kts.	0/0	$67,893
JUPITER	01-APR-01	TSTM WIND	55 kts.	0/0	$28,515
FAIRVIEW	19-MAY-01	TSTM WIND	50 kts.	0/0	$0

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
SKYLAND	19-MAY-01	TSTM WIND	50 kts.	0/0	$0
CANDLER	19-MAY-01	TSTM WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	04-JUL-01	HIGH WIND	40 kts.	0/0	$0
LEICESTER	08-JUL-01	TSTM WIND	60 kts.	0/0	$0
SKYLAND	08-JUL-01	TSTM WIND	55 kts.	0/0	$0
BUNCOMBE COUNTY	13-OCT-01	HIGH WIND	50 kts.	0/0	$0
LEICESTER	25-OCT-01	TSTM WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	24-NOV-01	HIGH WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	29-NOV-01	HIGH WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	04-FEB-02	HIGH WIND	50 kts.	0/0	$0
JUPITER	02-MAY-02	TSTM WIND	55 kts.	0/0	$0
SKYLAND	02-MAY-02	TSTM WIND	55 kts.	0/0	$0
COUNTYWIDE	13-MAY-02	TSTM WIND	50 kts.	0/0	$4,153
LEICESTER	04-JUN-02	TSTM WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	27-SEP-02	HIGH WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	06-NOV-02	HIGH WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	30-NOV-02	HIGH WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	13-DEC-02	HIGH WIND	65 kts.	0/0	$0
BUNCOMBE COUNTY	25-DEC-02	HIGH WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	23-JAN-03	HIGH WIND	60 kts.	0/0	$3,072
BUNCOMBE COUNTY	23-FEB-03	HIGH WIND	50 kts.	0/0	$0
LEICESTER	02-MAY-03	TSTM WIND	50 kts.	0/0	$4,032
ARDEN	08-JUN-03	TSTM WIND	50 kts.	0/0	$0
FAIRVIEW	12-JUL-03	TSTM WIND	60 kts.	0/0	$1,344
LEICESTER	13-JUL-03	TSTM WIND	50 kts.	0/0	$0
BARNARDSVILLE	22-JUL-03	TSTM WIND	50 kts.	0/0	$0
ARDEN	01-AUG-03	TSTM WIND	50 kts.	0/0	$6,720
ENKA	04-AUG-03	TSTM WIND	60 kts.	0/0	$26,878
BUNCOMBE COUNTY	14-OCT-03	HIGH WIND	50 kts.	0/0	$1,512
BUNCOMBE COUNTY	13-NOV-03	HIGH WIND	50 kts.	0/0	$2,993
BUNCOMBE COUNTY	18-NOV-03	HIGH WIND	50 kts.	0/0	$2,496
BUNCOMBE COUNTY	07-MAR-04	HIGH WIND	50 kts.	0/0	$9,242
CANDLER	22-MAY-04	TSTM WIND	50 kts.	0/0	$26,095
LEICESTER	31-MAY-04	TSTM WIND	50 kts.	0/0	$0
LEICESTER	12-JUN-04	TSTM WIND	60 kts.	0/0	$6,524
LEICESTER	05-JUL-04	TSTM WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	05-JUL-04	HIGH WIND	55 kts.	0/0	$1,305
BUNCOMBE COUNTY	16-SEP-04	HIGH WIND	55 kts.	0/0	$168,533
BUNCOMBE COUNTY	17-SEP-04	HIGH WIND	50 kts.	0/0	$6,116
BUNCOMBE COUNTY	22-JAN-05	HIGH WIND	60 kts.	0/0	$0
BUNCOMBE COUNTY	08-MAR-05	HIGH WIND	60 kts.	0/0	$0
BUNCOMBE COUNTY	02-APR-05	HIGH WIND	60 kts.	0/0	$73,895
COUNTYWIDE	20-MAY-05	TSTM WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	14-JAN-06	HIGH WIND	60 kts.	0/0	$1,230
BUNCOMBE COUNTY	25-JAN-06	HIGH WIND	55 kts.	0/0	$3,514
ENKA	20-MAY-06	TSTM WIND	50 kts.	0/0	$0

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
CANDLER	30-MAY-06	TSTM WIND	50 kts.	0/0	$0
CANDLER	04-JUL-06	TSTM WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	15-NOV-06	HIGH WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	15-APR-07	HIGH WIND	70 kts.	0/0	$0
BUNCOMBE COUNTY	16-APR-07	HIGH WIND	65 kts.	0/0	$398,017
SKYLAND	19-JUL-07	THUNDERSTORM WIND	50 kts.	0/0	$0
LEICESTER	30-JAN-08	THUNDERSTORM WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	10-FEB-08	HIGH WIND	55 kts.	0/0	$0
BUNCOMBE COUNTY	11-MAY-08	HIGH WIND	60 kts.	0/0	$0
BUNCOMBE COUNTY	31-DEC-08	HIGH WIND	50 kts.	0/0	$0
OAKLEY	03-MAY-09	THUNDERSTORM WIND	75 kts.	0/0	$0
FAIRVIEW	08-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0
LEICESTER	11-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0
FORKS OF IVY	16-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0
LEICESTER	17-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0
ASHEVILLE AIRPARK AR	18-JUN-09	THUNDERSTORM WIND	55 kts.	0/0	$0
ROYAL PINES	28-JUL-09	THUNDERSTORM WIND	50 kts.	0/0	$0
ROYAL PINES	28-JUL-09	THUNDERSTORM WIND	50 kts.	0/0	$0
FAIRVIEW	05-AUG-09	THUNDERSTORM WIND	50 kts.	0/0	$0
ROCKVIEW	05-AUG-09	THUNDERSTORM WIND	50 kts.	0/0	$0
BEVERLY HILLS	21-JUN-10	THUNDERSTORM WIND	55 kts.	0/0	$0
JUGTOWN	20-JUL-10	THUNDERSTORM WIND	50 kts.	0/0	$0
ROYAL PINES	25-JUL-10	THUNDERSTORM WIND	50 kts.	0/0	$0
BINGHAM HGTS	05-AUG-10	THUNDERSTORM WIND	55 kts.	0/0	$0
MIDWAY	05-AUG-10	THUNDERSTORM WIND	50 kts.	0/0	$0
MURPHY JCT	04-APR-11	THUNDERSTORM WIND	50 kts.	0/0	$0
BOSWELL	08-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
BEVERLY HILLS	09-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
FLAT CREEK	10-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
SKYLAND	12-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
CANTO	18-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
BILTMORE	02-SEP-11	THUNDERSTORM WIND	50 kts.	0/0	$0
JUPITER	01-APR-12	THUNDERSTORM WIND	55 kts.	0/0	$0
SHUMON	03-JUL-12	THUNDERSTORM WIND	55 kts.	0/0	$0
LEICESTER	05-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
VOLGA	06-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
BARNARDSVILLE	10-AUG-12	THUNDERSTORM WIND	50 kts.	0/0	$0
BUNCOMBE COUNTY	29-OCT-12	HIGH WIND	50 kts.	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

Given the high number of previous events, it is certain that wind events, including straight-line wind and thunderstorm wind, will occur in the future. This results in a probability level of highly likely (100 percent annual probability) for future wind events for the entire county.

A.2.7 Tornado

Location and Spatial Extent

Tornadoes occur throughout the state of North Carolina, and thus in Buncombe County. Tornadoes typically impact a relatively small area, but damage may be extensive. Event locations are completely random and it is not possible to predict specific areas that are more susceptible to tornado strikes over time. Therefore, it is assumed that Buncombe County is uniformly exposed to this hazard.

Historical Occurrences

Tornadoes are a fairly rare occurrence in mountainous areas. However, they have and do occur in the Buncombe County. Tornadoes have not resulted in any disaster declarations in Buncombe County.[8] According to the National Climatic Data Center, there have been a total of six recorded tornado events in Buncombe County since 1976 (**Table A.14**), resulting in almost $3.7 million (2013 dollars) in property damages.[9] The magnitude of these tornadoes ranges from F0 to F1 in intensity (**Table A.15**), although an F2 through F5 event is possible. It is important to note that only tornadoes that have been reported are factored into this risk assessment. It is likely that a high number of occurrences have gone unreported over the past 63 years.

TABLE A.14: SUMMARY OF TORNADO OCCURRENCES IN BUNCOMBE COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Asheville	2	0/0	$378,147
Biltmore Forest	0	0/0	$0
Black Mountain	0	0/0	$0
Montreat	0	0/0	$0
Weaverville	0	0/0	$0
Woodfin	0	0/0	$0
Unincorporated Area	4	0/0	$3,306,730
BUNCOMBE COUNTY TOTAL	**6**	**0/0**	**$3,684,877**

Source: National Climatic Data Center

TABLE A.15: HISTORICAL TORNADO IMPACTS IN BUNCOMBE COUNTY

	Date	Magnitude	Deaths/ Injuries	Property Damage*	Details
Asheville					
Asheville	19-MAY-93	F0	0/0	$0	Witnesses observed a funnel touch down briefly near Biltmore Village.

[8]A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.

[9] These tornado events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional tornadoes have occurred in Buncombe County. As additional local data becomes available, this hazard profile will be amended.

	Date	Magnitude	Deaths/ Injuries	Property Damage*	Details
ASHEVILLE	06-MAY-99	F1	0/0	$378,147	One severe thunderstorm spawned a weak tornado in the city of Asheville around sunrise. Along the 2 mile damage path, 500 trees were downed, many on homes and vehicles. A garage was destroyed, roofs were blown partially off a couple buildings, a school roof was damaged, and some condos were condemned from tree damage.
Biltmore Forest					
None Reported	--	--	--	--	--
Black Mountain					
None Reported	--	--	--	--	--
Montreat					
None Reported	--	--	--	--	--
Weaverville					
None Reported	--	--	--	--	--
Woodfin					
None Reported	--	--	--	--	--
Unincorporated Area					
BUNCOMBE COUNTY	18-FEB-76	F1	0/0	$111,126	
BUNCOMBE COUNTY	18-FEB-76	F1	0/0	$1,111,264	
BUNCOMBE COUNTY	06-JUN-77	F1	0/0	$1,042,170	
BUNCOMBE COUNTY	06-JUN-77	F1	0/0	$1,042,170	

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

According to historical information, tornado events are not an annual occurrence for the county. Furthermore, the mountainous terrain of the county makes tornadoes a rare occurrence. While the majority of the reported tornado events are small in terms of size, intensity, and duration, they do pose a significant threat should Buncombe County experience a direct tornado strike. The probability of future tornado occurrences affecting Buncombe County is possible (1 to 10 percent annual probability).

A.2.8 Winter Storm and Freeze

Location and Spatial Extent

Nearly the entire continental United States is susceptible to winter storm and freeze events. Some ice and winter storms may be large enough to affect several states, while others might affect limited, localized areas. The degree of exposure typically depends on the normal expected severity of local winter weather. Buncombe County is accustomed to severe winter weather conditions and frequently receives severe winter weather during the winter months. Given the atmospheric nature of the hazard, the entire county has uniform exposure to a winter storm.

Historical Occurrences

Winter weather has resulted in two disaster declarations in Buncombe County. This includes the Blizzard of 1996 and severe winter storms and flooding in 2010.[10] According to the National Climatic Data Center, there have been a total of 157 recorded winter storm events in Buncombe County since 1993 (**Table A.16**).[11] These events resulted in over $6.4 million (2013 dollars) in damages.[12] Detailed information on the recorded winter storm events can be found in **Table A.17**.

TABLE A.16: SUMMARY OF WINTER STORM EVENTS IN BUNCOMBE COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Buncombe County	157	0/0	$6,470,842

Source: National Climatic Data Center

TABLE A.17: HISTORICAL WINTER STORM IMPACTS IN BUNCOMBE COUNTY

	Date	Type of Storm	Deaths / Injuries	Property Damage*
Asheville				
None Reported	--	--	--	--
Biltmore Forest				
None Reported	--	--	--	--
Black Mountain				
None Reported	--	--	--	--
Weaverville				
None Reported	--	--	--	--
Woodfin				
None Reported	--	--	--	--
Unincorporated Area				
Statewide	12-MAR-93	WINTER STORM	2/10†	$874,516
Northern and Central	03-JAN-94	HEAVY SNOW	0/0	$0
Northern Interior and	10-FEB-94	ICE STORM	0/0	$0
Mountains	14-NOV-95	SNOW	0/0	$0
Mountains and Foothills	09-DEC-95	FREEZING RAIN	0/0	$3,314
Northern Mountains	25-DEC-95	SNOW	0/0	$0
BUNCOMBE COUNTY	25-DEC-95	SNOW	0/0	$0
BUNCOMBE COUNTY	06-JAN-96	WINTER STORM	0/0	$0
BUNCOMBE COUNTY	11-JAN-96	WINTER STORM	0/0	$0
BUNCOMBE COUNTY	26-JAN-96	ICE STORM	0/0	$0
BUNCOMBE COUNTY	01-FEB-96	FREEZING RAIN	0/0	$0
BUNCOMBE COUNTY	02-FEB-96	ICE STORM	0/0	$5,363,700
BUNCOMBE COUNTY	07-FEB-96	SNOW	0/0	$0
BUNCOMBE COUNTY	11-FEB-96	Other	0/0	$0

[10] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[11] These ice and winter storm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional winter storm conditions have affected Buncombe County.
[12] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

	Date	Type of Storm	Deaths / Injuries	Property Damage*
BUNCOMBE COUNTY	12-FEB-96	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	16-FEB-96	SNOW	0/0	$0
BUNCOMBE COUNTY	16-FEB-96	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	05-DEC-96	Snow and Ice	0/0	$0
BUNCOMBE COUNTY	08-JAN-97	Snow and sleet	0/0	$0
BUNCOMBE COUNTY	09-JAN-97	ICE STORM	0/0	$149,811
BUNCOMBE COUNTY	10-JAN-97	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	10-FEB-97	Snow	0/0	$0
BUNCOMBE COUNTY	13-FEB-97	WINTER STORM	0/0	$0
BUNCOMBE COUNTY	05-DEC-97	SNOW	0/0	$0
BUNCOMBE COUNTY	08-DEC-97	WINTRY MIX	0/0	$0
BUNCOMBE COUNTY	27-DEC-97	SNOW	0/0	$0
BUNCOMBE COUNTY	29-DEC-97	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	30-DEC-97	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	18-JAN-98	SNOW	0/0	$0
BUNCOMBE COUNTY	18-JAN-98	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	27-JAN-98	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	03-FEB-98	SNOW	0/0	$0
BUNCOMBE COUNTY	03-MAR-98	SNOW	0/0	$0
BUNCOMBE COUNTY	11-MAR-98	SNOW	0/0	$0
BUNCOMBE COUNTY	23-DEC-98	FREEZING RAIN/SLEET	0/0	$0
BUNCOMBE COUNTY	02-JAN-99	ICE STORM	0/0	$0
BUNCOMBE COUNTY	31-JAN-99	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	13-FEB-99	SNOW	0/0	$0
BUNCOMBE COUNTY	23-FEB-99	SNOW	0/0	$0
BUNCOMBE COUNTY	24-FEB-99	SNOW	0/0	$0
BUNCOMBE COUNTY	03-MAR-99	SNOW	0/0	$0
BUNCOMBE COUNTY	09-MAR-99	WINTER STORM	0/0	$0
BUNCOMBE COUNTY	26-MAR-99	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	29-APR-99	SNOW	0/0	$0
BUNCOMBE COUNTY	24-DEC-99	SNOW	0/0	$0
BUNCOMBE COUNTY	16-JAN-00	FREEZING RAIN/SLEET	0/0	$0
BUNCOMBE COUNTY	20-JAN-00	SNOW	0/0	$0
BUNCOMBE COUNTY	22-JAN-00	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	26-JAN-00	SNOW	0/0	$0
BUNCOMBE COUNTY	29-JAN-00	ICE STORM	0/0	$0
BUNCOMBE COUNTY	04-FEB-00	SNOW	0/0	$0
BUNCOMBE COUNTY	08-APR-00	SNOW	0/0	$0
BUNCOMBE COUNTY	19-NOV-00	SNOW	0/0	$0
BUNCOMBE COUNTY	03-DEC-00	SNOW	0/0	$0
BUNCOMBE COUNTY	13-DEC-00	FREEZING RAIN	0/0	$0
BUNCOMBE COUNTY	17-DEC-00	SNOW	0/0	$0
BUNCOMBE COUNTY	19-DEC-00	SNOW	0/0	$0
BUNCOMBE COUNTY	01-JAN-01	SNOW	0/0	$0
BUNCOMBE COUNTY	08-JAN-01	SNOW	0/0	$0
BUNCOMBE COUNTY	08-JAN-01	SNOW	0/0	$0

	Date	Type of Storm	Deaths / Injuries	Property Damage*
BUNCOMBE COUNTY	20-JAN-01	SNOW	0/0	$0
BUNCOMBE COUNTY	22-FEB-01	SNOW/SLEET	0/0	$0
BUNCOMBE COUNTY	06-MAR-01	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	15-MAR-01	SNOW	0/0	$0
BUNCOMBE COUNTY	20-MAR-01	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	01-APR-01	SNOW	0/0	$0
BUNCOMBE COUNTY	17-APR-01	SNOW SHOWERS	0/0	$0
BUNCOMBE COUNTY	06-FEB-02	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	04-DEC-02	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	22-DEC-02	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	25-DEC-02	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	06-JAN-03	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	16-JAN-03	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	19-JAN-03	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	23-JAN-03	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	26-JAN-03	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	06-FEB-03	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	09-FEB-03	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	14-FEB-03	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	16-FEB-03	WINTER STORM	0/0	$0
BUNCOMBE COUNTY	27-FEB-03	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	30-MAR-03	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	30-MAR-03	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	30-MAR-03	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	10-APR-03	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	28-NOV-03	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	03-DEC-03	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	04-DEC-03	WINTER STORM	0/0	$0
BUNCOMBE COUNTY	05-DEC-03	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	18-DEC-03	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	18-DEC-03	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	09-JAN-04	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	25-JAN-04	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	02-FEB-04	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	02-FEB-04	SLEET STORM	0/0	$0
BUNCOMBE COUNTY	05-FEB-04	WINTER WEATHER/MIX	0/0	$326
BUNCOMBE COUNTY	07-FEB-04	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	12-FEB-04	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	15-FEB-04	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	26-FEB-04	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	30-MAR-04	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	11-DEC-04	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	14-DEC-04	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	19-DEC-04	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	16-JAN-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	22-JAN-05	WINTER WEATHER/MIX	0/0	$0

	Date	Type of Storm	Deaths / Injuries	Property Damage*
BUNCOMBE COUNTY	22-JAN-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	02-FEB-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	10-FEB-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	27-FEB-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	28-FEB-05	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	28-FEB-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	01-MAR-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	08-MAR-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	11-MAR-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	17-MAR-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	02-APR-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	23-APR-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	25-OCT-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	21-NOV-05	WINTER WEATHER/MIX	0/0	$0
BUNCOMBE COUNTY	03-DEC-05	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	08-DEC-05	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	15-DEC-05	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	15-DEC-05	ICE STORM	0/0	$79,173
BUNCOMBE COUNTY	16-DEC-05	FREEZING FOG	0/0	$0
BUNCOMBE COUNTY	14-JAN-06	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	30-JAN-06	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	08-FEB-06	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	11-FEB-06	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	11-FEB-06	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	18-FEB-06	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	20-MAR-06	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	22-MAR-06	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	07-DEC-06	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	09-JAN-07	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	18-JAN-07	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	21-JAN-07	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	28-JAN-07	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	01-FEB-07	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	17-FEB-07	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	06-APR-07	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	08-APR-07	FROST/FREEZE	0/0	$0
BUNCOMBE COUNTY	01-JAN-08	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	16-JAN-08	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	19-JAN-08	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	31-JAN-08	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	01-FEB-08	ICE STORM	0/0	$0
BUNCOMBE COUNTY	26-FEB-08	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	27-OCT-08	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	21-NOV-08	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	01-DEC-08	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	02-FEB-09	WINTER WEATHER	0/0	$0

	Date	Type of Storm	Deaths / Injuries	Property Damage*
BUNCOMBE COUNTY	07-APR-09	WINTER WEATHER	0/0	$0
BUNCOMBE COUNTY	18-DEC-09	WINTER STORM	0/0	$0
BUNCOMBE COUNTY	04-FEB-10	WINTER STORM	0/0	$0
BUNCOMBE COUNTY	25-DEC-10	HEAVY SNOW	0/0	$0
BUNCOMBE COUNTY	29-OCT-12	WINTER WEATHER	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
†Deaths/injuries were not reported at the county level; potentially outside of the county.
Source: National Climatic Data Center

There have been several severe winter weather events in Buncombe County. The text below describes one of the major events and associated impacts on the county. Similar impacts can be expected with severe winter weather.

1996 Winter Storm
This storm left two feet of snow and several thousand citizens without power for up to nine days. Although shelters were opened, some roads were impassible for up to four days. This event caused considerable disruption to business, industry, schools, and government services.

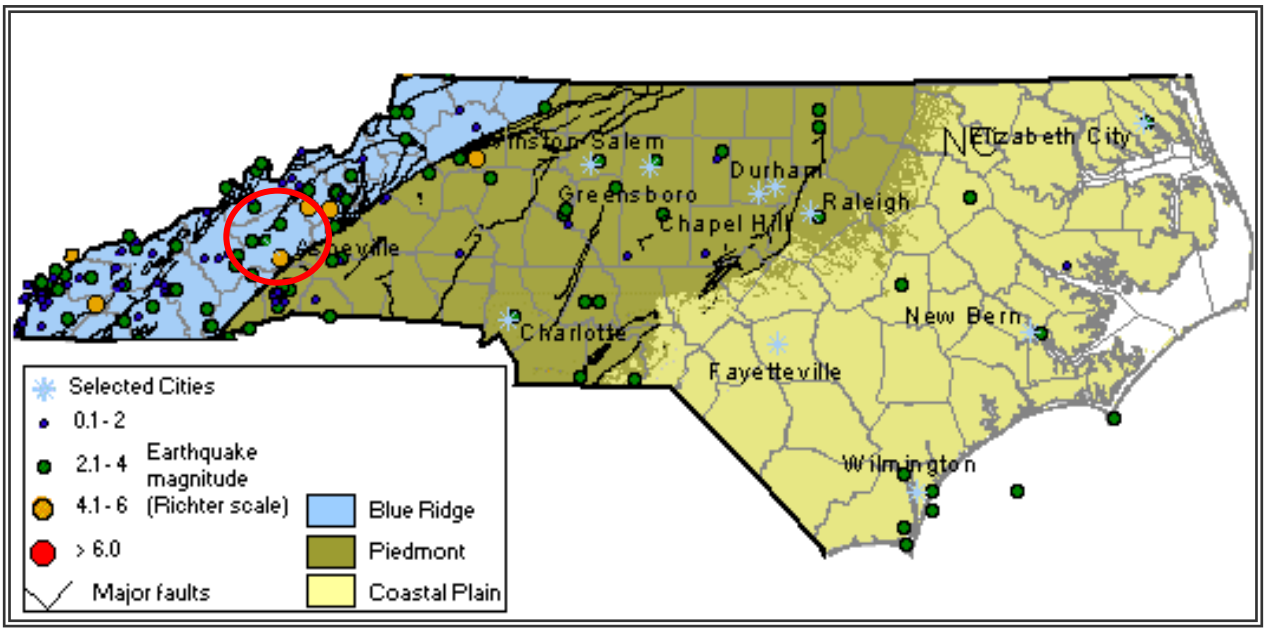
Winter storms throughout the planning area have several negative externalities including hypothermia, cost of snow and debris cleanup, business and government service interruption, traffic accidents, and power outages. Furthermore, citizens may resort to using inappropriate heating devices that could to fire or an accumulation of toxic fumes.

Probability of Future Occurrences
Winter storm events will remain a regular occurrence in Buncombe County due to location and elevation. According to historical information, Buncombe County generally experiences almost eight winter storm events each year. Therefore, the annual probability is highly likely (100 percent).

A.2.9 Earthquake

Location and Spatial Extent
Approximately two-thirds of North Carolina is subject to earthquakes, with the western and southeast region most vulnerable to a very damaging earthquake. The state is affected by both the Charleston Fault in South Carolina and New Madrid Fault in Tennessee. Both of these faults have generated earthquakes measuring greater than 8 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines throughout North Carolina. **Figure A.2** is a map showing geological and seismic information for North Carolina.

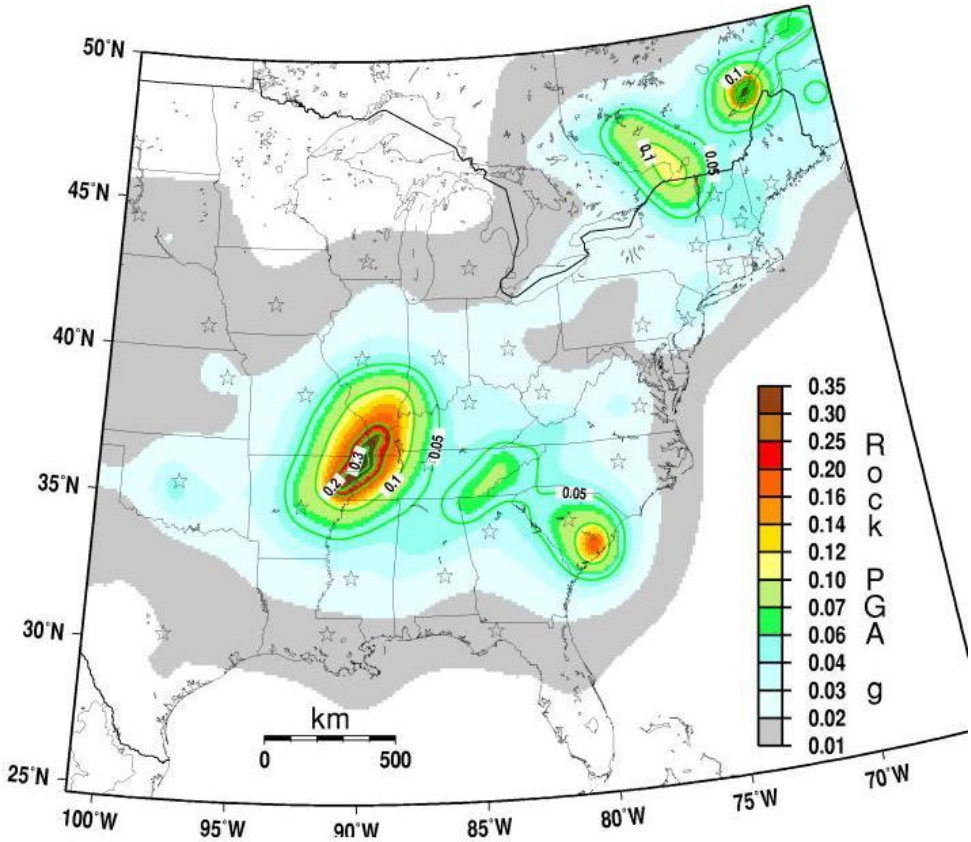
FIGURE A.2: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure A.3 shows the intensity level associated with Buncombe County, based on the national USGS map of peak acceleration with 10 percent probability of exceedance in 50 years. It is the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The map was compiled by the U.S. Geological Survey (USGS) Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards. According to this map, Buncombe County lies within an approximate zone of level "5" to "7" ground acceleration. This indicates that the county exists within an area of low to moderate seismic risk.

FIGURE A.3: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: United States Geological Survey, 2008

Historical Occurrences

At least 70 earthquakes are known to have affected Buncombe County since 1911. The strongest of these measured a VI on the Modified Mercalli Intensity (MMI) scale. **Table A.18** provides a summary of earthquake events reported by the National Geophysical Data Center between 1638 and 1985. **Table A.19** presents a detailed occurrence of each event including the date, distance for the epicenter, magnitude, and Modified Mercalli Intensity (if known).[13]

TABLE A.18: SUMMARY OF SEISMIC ACTIVITY IN BUNCOMBE COUNTY

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Asheville	26	VI	--
Biltmore Forest	0	--	--
Black Mountain	3	IV	3.3
Montreat	5	V	--
Weaverville	2	VI	--
Woodfin	0	--	--

[13] Due to reporting mechanisms, not all earthquakes events were recorded during this time. Furthermore, some are missing data, such as the epicenter location, due to a lack of widely used technology. In these instances, a value of "unknown" is reported.

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Unincorporated Area	34	VI	--
BUNCOMBE COUNTY TOTAL	**70**	**VI**	**--**

Source: National Geophysical Data Center

TABLE A.19: SIGNIFICANT SEISMIC EVENTS IN BUNCOMBE COUNTY (1638 -1985)

Location	Date	Epicentral Distance	Magnitude	MMI
Asheville				
Asheville	4/20/1911			V
Asheville	10/29/1915	26.0 km		V
Asheville	2/21/1916	12.0 km		V
Asheville	10/20/1924	66.0 km		IV
Asheville	11/3/1928	44.0 km		VI
Asheville	3/31/1938			IV
Asheville	12/25/1940			II
Asheville	12/25/1940			III
Asheville	5/10/1941			III
Asheville	7/26/1945	155.0 km	5.6	IV
Asheville	1/2/1954	151.0 km		IV
Asheville	9/7/1956	131.0 km		V
Asheville	9/7/1956	131.0 km		V
Asheville	5/13/1957	52.0 km		IV
Asheville	7/2/1957	12.0 km		VI
Asheville	5/16/1958			IV
Asheville	11/9/1968	593.0 km	5.3	IV
Asheville	7/13/1969	117.0 km	3.5	IV
Asheville	11/20/1969	243.0 km	4.3	IV
Asheville	12/13/1969	68.0 km		III
Asheville	11/30/1973	129.0 km	4.7	III
Asheville	3/24/1978	1552.0 km	6.1	III
Asheville	8/13/1979	170.0 km	3.7	II
Asheville	7/27/1980	310.0 km	5.1	IV
Asheville	5/5/1981		3.5	IV
Asheville	3/25/1983	29.0 km	3.3	IV
Biltmore Forest				
None Reported	--	--	--	--
Black Mountain				
Black Mountain	2/21/1916	21.0 km		V
Black Mountain	7/2/1957	21.0 km		IV
Black Mountain	3/25/1983	34.0 km	3.3	IV
Montreat				
Montreat	1/2/1954	164.0 km		IV
Montreat	7/2/1957	23.0 km		V
Montreat	11/30/1973	150.0 km	4.7	IV
Montreat	1/19/1976	193.0 km	4.0	IV

Location	Date	Epicentral Distance	Magnitude	MMI
Montreat	3/25/1983	37.0 km	3.3	IV
Weaverville				
Weaverville	5/13/1957	50.0 km		IV
Weaverville	7/2/1957	22.0 km		VI
Woodfin				
None Reported	--	--	--	--
Unincorporated Area				
Skyland	2/21/1916	3.0 km		VI
Swannanoa	2/21/1916	14.0 km		IV
West Asheville	11/20/1928	37.0v		IV
Leicester	1/2/1954	137.0 km		IV
Barnardsville	5/13/1957	40.0 km		IV
Ridgecrest	5/13/1957	29.0 km		IV
Swannanoa	5/13/1957	39.0 km		V
Arden	7/2/1957	4.0 km		IV
Barnardsville	7/2/1957	31.0 km		V
Candler	7/2/1957	17.0 km		IV
Enka	7/2/1957	14.0 km		V
Leicester	7/2/1957	25.0 km		V
Ridgecrest	7/2/1957	24.0 km		IV
Skyland	7/2/1957	3.0 km		IV
Stocksville	7/2/1957	27.0 km		V
Swannanoa	7/2/1957	14.0 km		VI
Arden	11/30/1973	135.0 km	4.7	III
Barnardsville	11/30/1973	136.0 km	4.7	V
Enka	11/30/1973	121.0 km	4.7	IV
Ridgecrest	11/30/1973	153.0 km	4.7	IV
Skyland	11/30/1973	134.0 km	4.7	IV
Arden	1/19/1976	196.0 km	4.0	II
Arden	8/26/1979	71.0 km	3.7	IV
Barnardsville	8/26/1979	105.0 km	3.7	IV
Candler	4/9/1981	56.0 km	3.2	IV
Arden	5/5/1981	16.0 km	3.5	IV
Skyland	5/5/1981	18.0 km	3.5	V
Arden	3/25/1983	15.0 km	3.3	IV
Barnardsville	3/25/1983	48.0 km	3.3	IV
Enka	3/25/1983	26.0 km	3.3	III
Fairview	3/25/1983	20.0 km	3.3	IV
Ridgecrest	3/25/1983	34.0 km	3.3	III
Skyland	3/25/1983	16.0 km	3.3	IV
Swannanoa	3/25/1983	29.0 km	3.3	III

Source: National Geophysical Data Center

Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting Buncombe County is unlikely. However, it is likely that future earthquakes resulting in light to moderate perceived shaking and

damages ranging from none to very light will affect the county. The annual probability level for the county is estimated between 10 and 100 percent (likely).

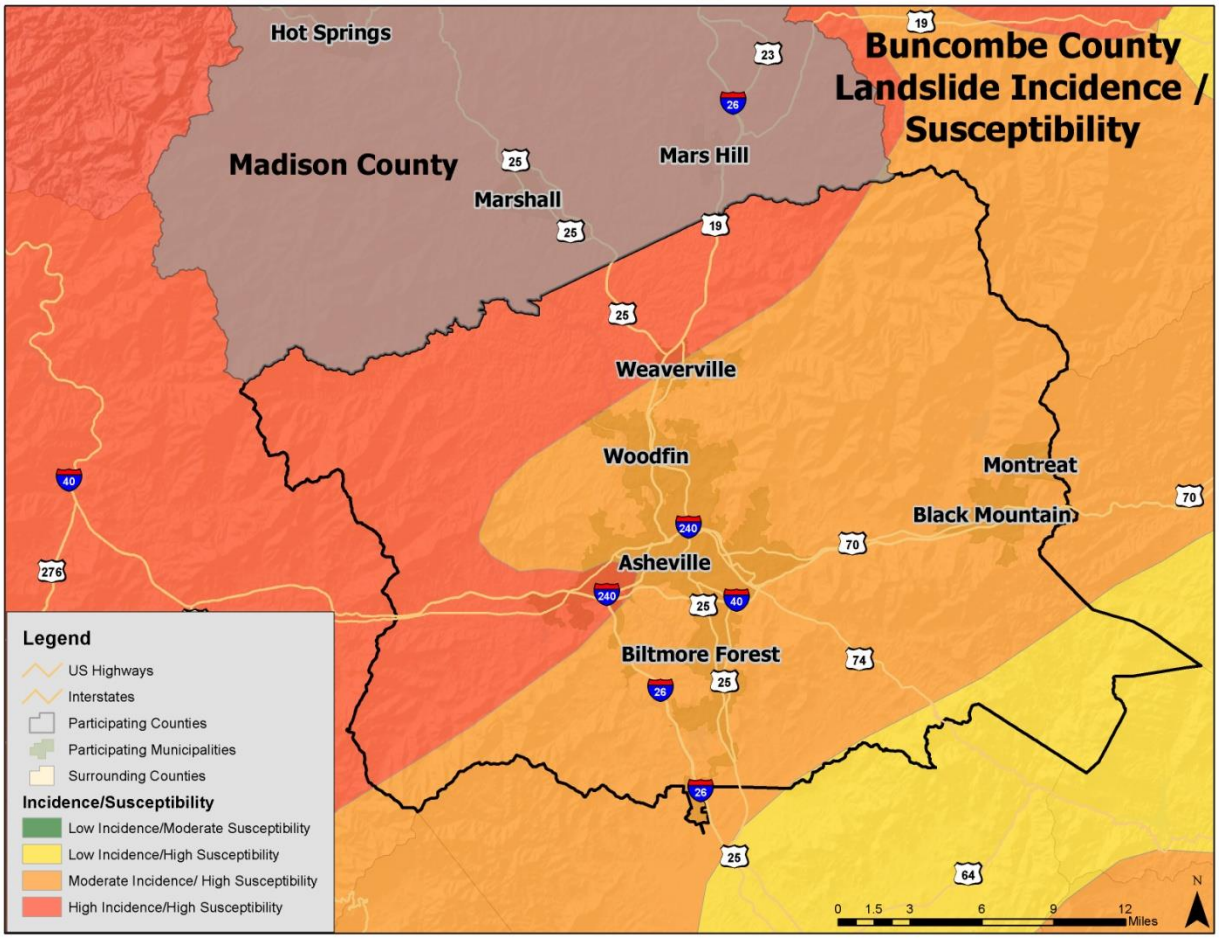
A.2.10 Landslide

Location and Spatial Extent

Landslides occur along steep slopes when the pull of gravity can no longer be resisted (often due to heavy rain). Human development can also exacerbate risk by building on previously undevelopable steep slopes and constructing roads by cutting through mountains. Landslides are possible throughout Buncombe County.

According to **Figure A.4** below, the majority of the county has moderate landslide activity. Most of the remaining portion of the county has a high incidence occurrence rate, although there is a small area of low incidence in the southeast corner of the county. There is also high susceptibility throughout the entire county.

FIGURE A.4: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF BUNCOMBE COUNTY



Source: United States Geological Survey

Historical Occurrences

Steep topography throughout Buncombe County makes the planning area susceptible to landslides. Most landslides are caused by heavy rainfall in the area. Building on steep slopes that was not previously possible also contributes to risk. **Table A.20** presents a summary of the landslide occurrence events as provided by the North Carolina Geological Survey[14]. The georeferenced locations of the landslide events presented in the aforementioned tables are presented in **Figure A.5**. Some incidence mapping has also been completed throughout the western portion of North Carolina though it is not complete. Therefore, it should be noted that many more incidents than what is reported are likely to have occurred in Buncombe County.

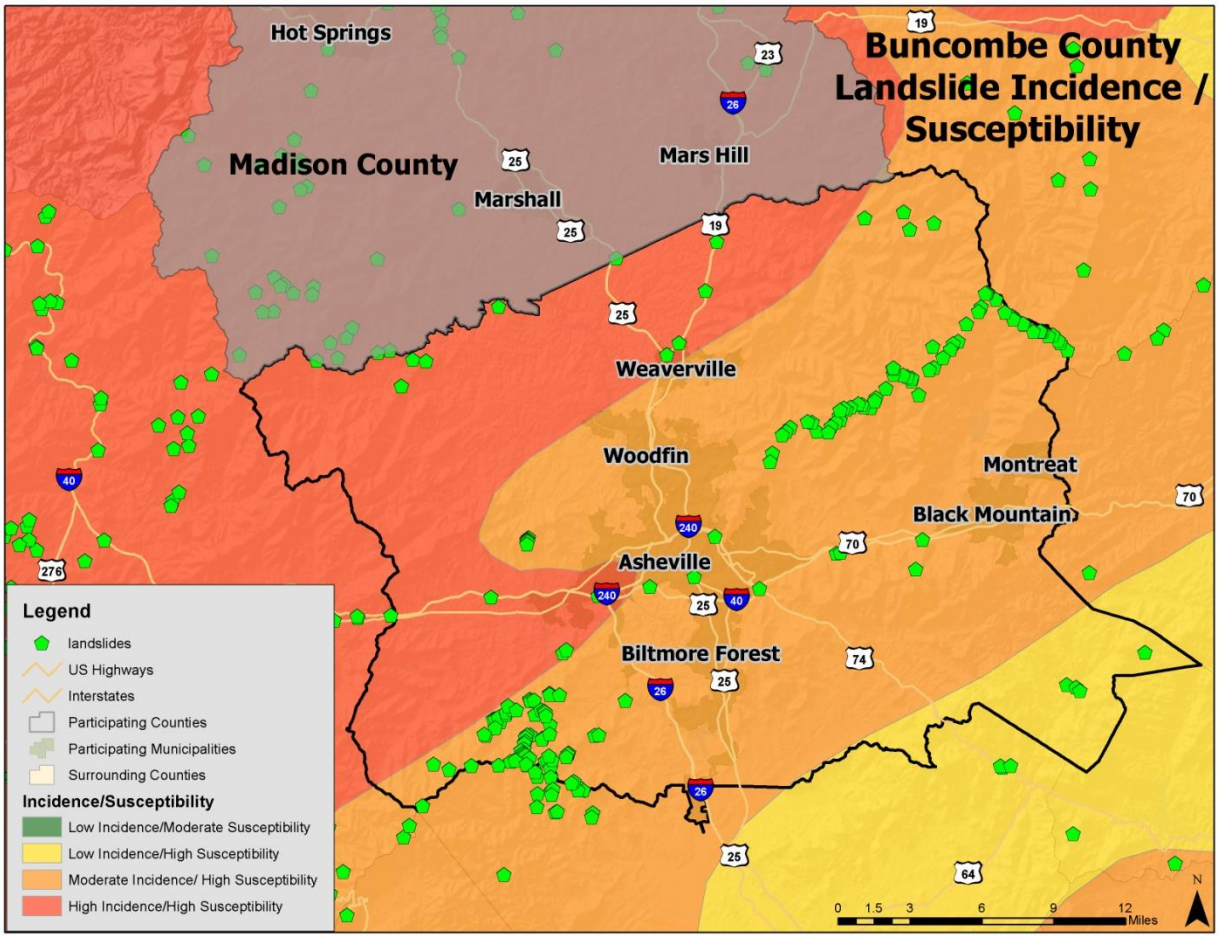
TABLE A.20: SUMMARY OF LANDSLIDE ACTIVITY IN BUNCOMBE COUNTY

Location	Number of Occurrences
Asheville	3
Biltmore Forest	0
Black Mountain	0
Montreat	0
Weaverville	1
Woodfin	0
Unincorporated Area	148
BUNCOMBE COUNTY TOTAL	**152**

Source: North Carolina Geological Survey

[14] It should be noted that the North Carolina Geological Survey (NCGS) emphasized the dataset provided was incomplete. Therefore, there may be additional historical landslide occurrences. Furthermore, dates were not included for every event. The earliest date reported was 1940. No damage information was provided by NCGS.

FIGURE A.5: LOCATION OF PREVIOUS LANDSLIDE OCCURRENCES IN BUNCOMBE COUNTY



Source: North Carolina Geological Survey

The National Climatic Data center also reported three landslide events that took place in the Buncombe Madison Region.

Buncombe County — September 8, 2004
Flooding began during the late afternoon across the county and gradually worsened during the evening and overnight hours, with near-record flooding observed along the Swannaoa and French Broad Rivers. Most valley communities across the county were affected by severe flooding along the rivers, or along smaller streams. Flooding along the Swannanoa devastated Asheville's Biltmore area, as well as the Black Mountain and Swannanoa communities. Numerous businesses and residences were damaged or destroyed by flood waters. Widespread damage to roads and bridges also occurred, either due to flooding or landslides. Resulting landslides caused $13,047,732 (2013 dollars) of property damage in Buncombe County.

Buncombe County — September 17, 2004
After many hours of moderate to heavy rainfall, gradual rises on creeks and streams resulted in the second devastating flood across the county in just 9 days. Flooding first began around Candler, but eventually affected every valley community in the county. Flooding was actually more widespread than during the Frances flood, but was not quite as severe. Virtually every stream in the county flooded,

including the French Broad River. Two males, ages 32 and 28, died in Leicester when they attempted to cross a flooded area in a pickup truck. Hundreds of roads were flooded and the bridge over highway 197 in Barnardsville was washed out. The French Broad flooded the studios and other businesses in the River District in downtown Asheville. At Enka, a motel was flooded, which necessitated the rescue of 40 people. Numerous homes were destroyed or severely damaged by flood water or landslides. There was a total of $13,047,732 (2013 dollars) of property damage.

Buncombe County — July 7, 2005
Part of a hillside gave way, damaging the Broad River VFDs building. There was a total of $63,339 (2013 dollars) of property damage.

The information below identifies additional historical information reported in the previous hazard mitigation plan.

Buncombe County
In September 2004, intense rainfall from the remnants of Hurricanes Frances and Ivan triggered at least 400 landslides throughout western North Carolina. Following these events, the NC Department of Environment and Natural Resources (NCDENR) conducted a field study to document the number, location, and extent of previous landslides in Buncombe, Haywood, Henderson, Jackson, Macon, and Watauga Counties. This study revealed 1,253 landslide features throughout Buncombe County (314 landslides and 938 landslide deposit areas). According to a North Carolina Landslide Fact Sheet produced after this study, "…landslide deposits are where significant volumes of unconsolidated soil and rock fragments have accumulated over time from several processes such as debris flows, debris slides, and rock falls. Most mapped deposits are likely prehistoric, but have yet to be verified by modern age-dating techniques."

According to NCDENR data, most recent landslide events include: a storm event in November of 1977 that triggered over 60 debris flows in the Bent Creek area; a debris flow in the Starnes Cove community triggered by the remnants of Hurricane Ivan in September of 2004 that destroyed one home, damaged two vehicles, destroyed the garage of another home, and damaged the road; and a rockslide that caused significant damage to the Broad River Fire Department in July of 2005 during the remnants of Tropical Storm Cindy. The debris deposit volume from the 2004 Starnes Cove event was estimated to be 7,500 to 10,000 cubic yards of earthen material. The volume estimate did not include debris from the damaged and destroyed structures. Volume estimates were not available for the 1977 and 2005 events.

Probability of Future Occurrences

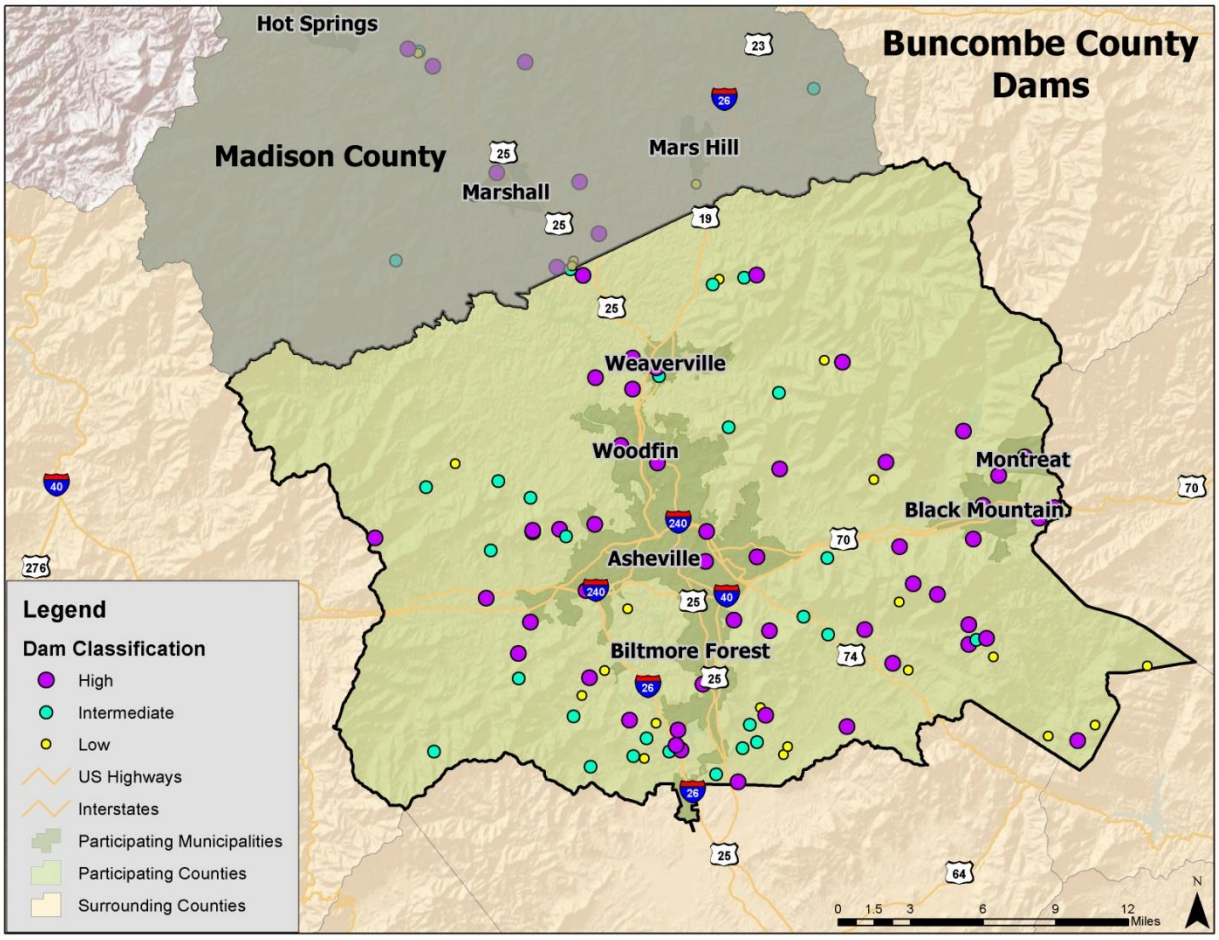
Based on historical information and the USGS susceptibility index, the probability of future landslide events is highly likely (100 percent probability). Local conditions may become more favorable for landslides due to heavy rain, for example. This would increase the likelihood of occurrence. It should also be noted that some areas in Buncombe County have greater risk than others given factors such as steepness on slope and modification of slopes.

A.2.11 Dam and Levee Failure

Location and Spatial Extent

According to the North Carolina Division of Land Management there are 96 dams in Buncombe County.[15] **Figure A.6** shows the dam location and the corresponding hazard ranking for each. Of these dams, 50 are classified as high hazard potential. These high hazard dams are listed in **Table A.21**.

FIGURE A.6: BUNCOMBE COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources, 2012

TABLE A.21: BUNCOMBE COUNTY HIGH HAZARD DAMS

Dam Name	Hazard Potential	Surface Area (acres)	Max Impoundment (Ac-ft)	Owner Type
Buncombe County				
Bee Tree Lake Dam	High	41	2800	Local Gov
Black Mountain Reservoir Dam	High	3.1	56	Local Gov

[15] The February 8, 2012 list of high hazard dams obtained from the North Carolina Division of Energy, Mineral, and Land Resources (http://portal.ncdenr.org/web/lr/dams) was reviewed and amended by local officials to the best of their knowledge.

Dam Name	Hazard Potential	Surface Area (acres)	Max Impoundment (Ac-ft)	Owner Type
Lake Craig Dam	High	0	50	Local Gov
North Fork Reservoir Dam	High	334	21700	Local Gov
Msd Treatment Plant Dam	High	11	385	Local Gov
Lake Tomahawk Dam	High	9.6	85	Local Gov
Woodfin Reservoir Dam	High	5.6	157	Local Gov
Lake Ashnoca Dam	High	35	0	Private
Beacon Reservoir Dam	High	0	0	Private
Bearwallow Lake Dam	High	0	0	Private
Beaver Lake Dam	High	60	996	Private
Busbee Reservoir Dam	High	8	48	Private
Capps Pond Dam	High	8.8	11	Private
Crowfields Dam	High	2	22	Private
Echo Lake Dam	High	10.5	185	Private
Elida Home Lake Dam	High	0	0	Private
Biltmore Lake Dam	High	65	1523	Private
Flat Top Mountain Lake Dam	High	10	200	Private
Holcombe Dam	High	2	0	Private
Freedom Lake	High	2	28	Private
Jewell Acres Dam	High	2	12	Private
Lake Charles Dam	High	3	25	Private
Lake Kenilworth Dam	High	12	215	Private
Caldwell Pond Dam	High	1.5	18	Private
Camp Merrimac Dam	High	1	10	Private
Moore's Dam	High	2	24	Private
Morgan Pond Dam	High	1.8	25	Private
Nolen Pond Dam	High	0	0	Private
Walters Lake Dam	High	0.7	0	Private
The Cliffs at High Carolina Dam	High	6	80	Private
Camp Ridgecrest Lake Dam	High	3.5	80	Private
Robinson Dam	High	2	0	Private
Russell Dam	High	0	0	Private
Starnes Cove Lower Dam	High	1	12	Private
Lake Susan Dam	High	2.7	20	Private
Woodland Hills Dam	High	2.5	35	Private
Bent Creek Ranch Dam	High	0	0	Private
Starnes Cove Upper Dam	High	0.6	7	Private
Roddy Dam	High	1	10	Private
Vanderbeek Dam	High	1	0	Private
Laurel Lake Dam	High	2	23.5	Private
Kyfields Condominiums Dam	High	1.3	13	Private
MacNair Dam	High	1.2	7	Private
North Buncombe Quarry SB No. 7	High	0	0	Private
Porter Dam	High	2.8	19	Private
Ashley Woods Dam	High	0	0	Private
Ross Creek Dam	High	3.5	15	State

Dam Name	Hazard Potential	Surface Area (acres)	Max Impoundment (Ac-ft)	Owner Type
Asheville Lake Julian Dam	High	240	0	Utility
Asheville 1982 Ash Pond Dam	High	46	70	Utility
Asheville 1964 Ash Pond Dam	High	45	1620	Utility

Source: North Carolina Division of Land Resources, 2012

It should also be noted that the North Carolina dam classification regulations were recently updated. As a result of the change, more dams are generally classified as high hazard.

(Taken from previous Buncombe County hazard mitigation plan.) The highest level of risk [of a dam failure] is along the Swannanoa River below the Bee Tree and North Fork Dams. This area extends along US 70 Highway from Swannanoa to Biltmore. In a breech involving the ¾ Probable Maximum Precipitation the maximum flood depth within the inundation area would be 58.5 feet. These dams have the greatest impoundment and, therefore, larger inundation areas. It is possible that a dam failure having limited impact over a small area could occur.

Historical Occurrences

The only dam failure to cause significant damage occurred when Bear Wallow Dam along Newfound Creek in Buncombe County failed on February 22, 1976. The private earthen dam broke, destroying one home and killing a family of four. There is no record of additional significant dam failures in the region; however, several breach scenarios in the area could be catastrophic.

Probability of Future Occurrences

Given the current dam inventory and historic data, a dam breach is unlikely (less than 1 percent annual probability) in the future. However, as has been demonstrated in the past, regular monitoring is necessary to prevent these events.

A.2.12 Erosion

Location and Spatial Extent

Erosion in Buncombe County is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine grained particles such as sand, Buncombe County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs in the county, particularly along the banks of rivers and streams, but it is not an extreme threat. No areas of concern were reported by the planning team.

Historical Occurrences

Several sources were vetted to identify areas of erosion in Buncombe County. This includes searching local newspapers, interviewing local officials, and reviewing the previous hazard mitigation plan. Little information could be found and erosion was not addressed in the previous Buncombe County hazard mitigation plan.

Probability of Future Occurrences

Erosion remains a natural, dynamic, and continuous process for Buncombe County, and it will continue to occur. The annual probability level assigned for erosion is possible (between 1 and 10 percent).

A.2.13 Flood

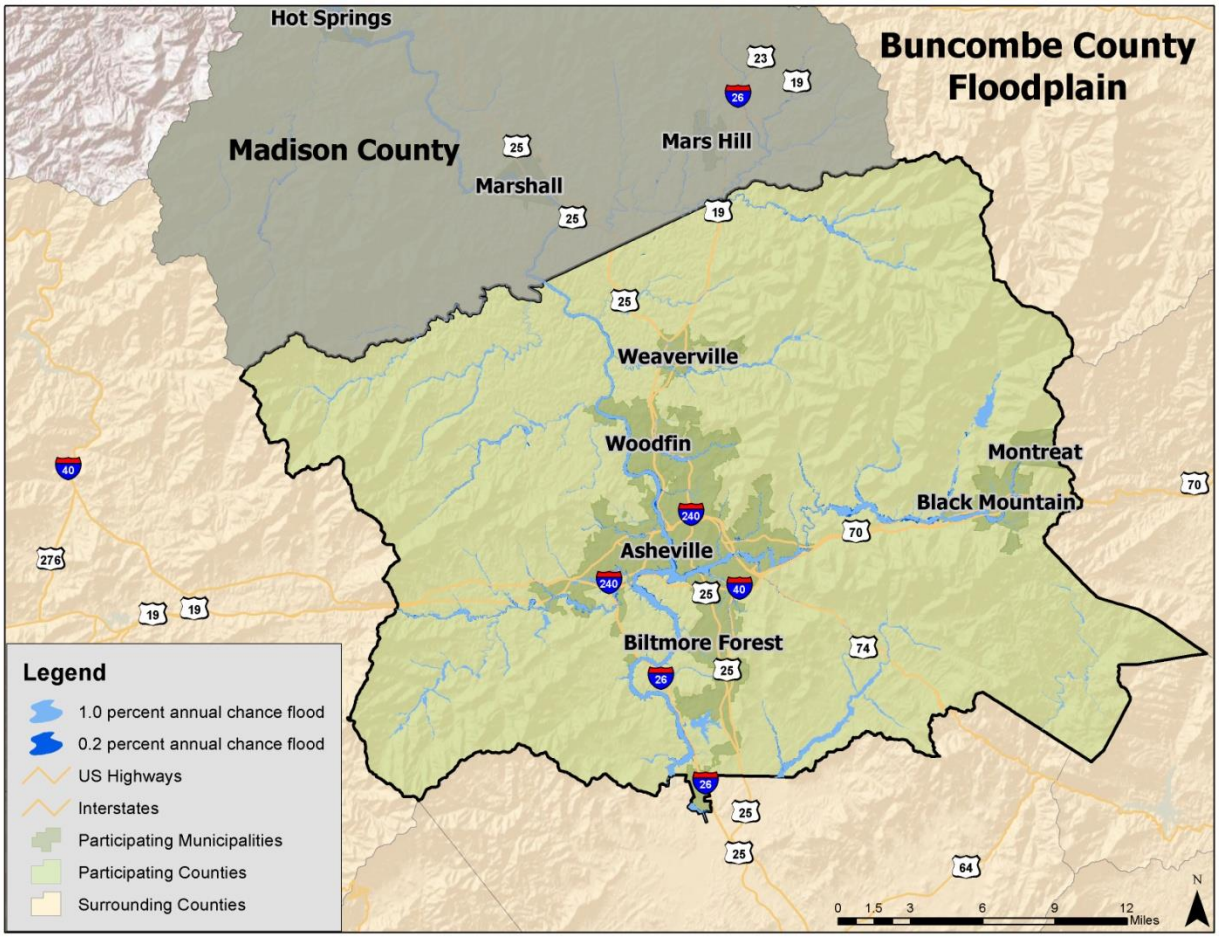
Location and Spatial Extent

There are areas in Buncombe County that are susceptible to flood events. Special flood hazard areas in the county were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM).[16] This includes Zone A (1-percent annual chance floodplain), Zone AE (1-percent annual chance floodplain with elevation), and Zone X500 (0.2-percent annual chance floodplain). According to GIS analysis, of the 660 square miles that make up Buncombe County, there are 22.2 square miles of land in zones A and AE (1-percent annual chance floodplain/100-year floodplain) and 2.2 square miles of land in zone X500 (0.2-percent annual chance floodplain/500-year floodplain).

These flood zone values account for 3.7 percent of the total land area in Buncombe County. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas. **Figure A.7**, **Figure A.8**, **Figure A.9**, **Figure A.10**, **Figure A.11**, **Figure A.12**, and **Figure A.13** illustrate the location and extent of currently mapped special flood hazard areas for Buncombe County and its municipalities based on best available FEMA Digital Flood Insurance Rate Map (DFIRM) data.

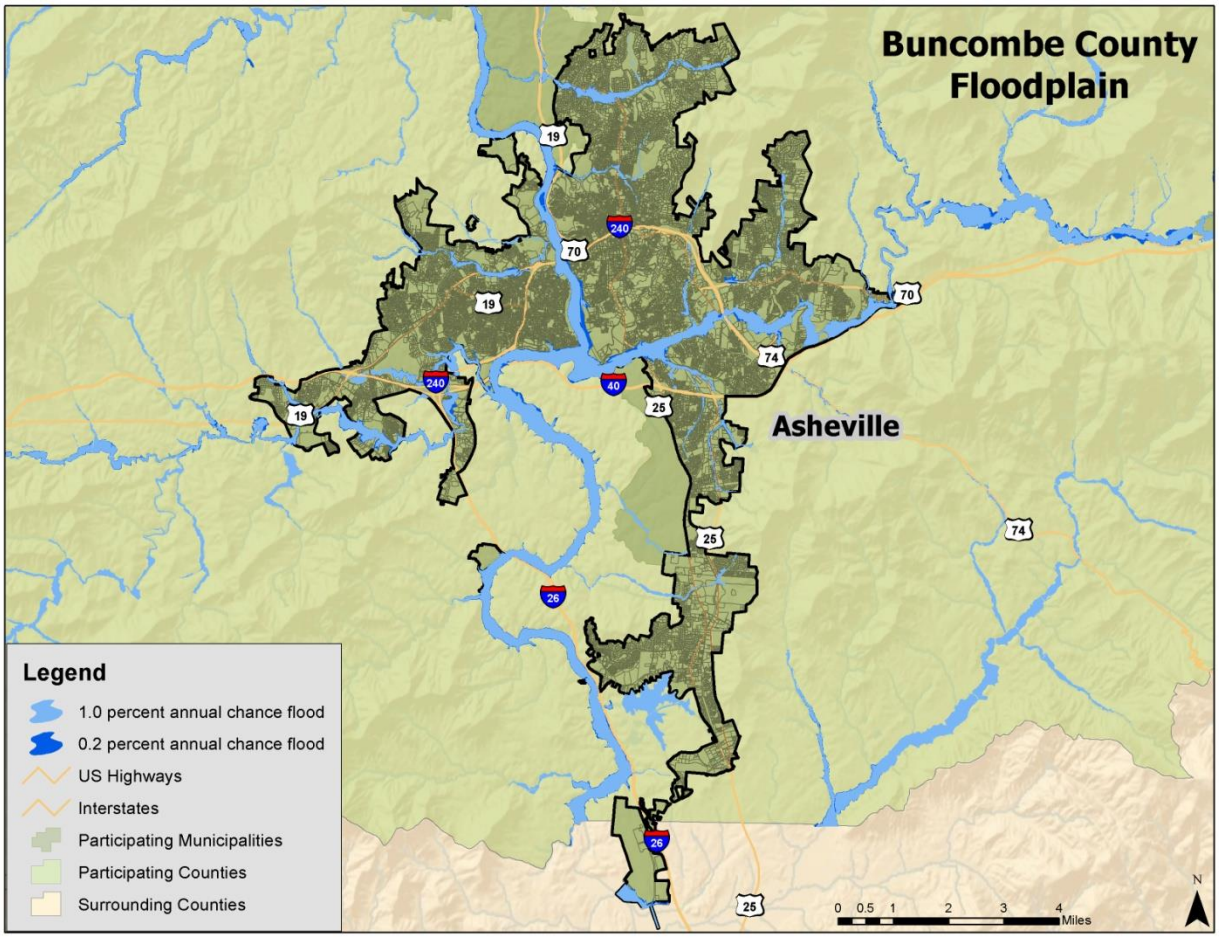
[16] The county-level DFIRM data used for Buncombe County were updated in 2011.

FIGURE A.7: SPECIAL FLOOD HAZARD AREAS IN BUNCOMBE COUNTY



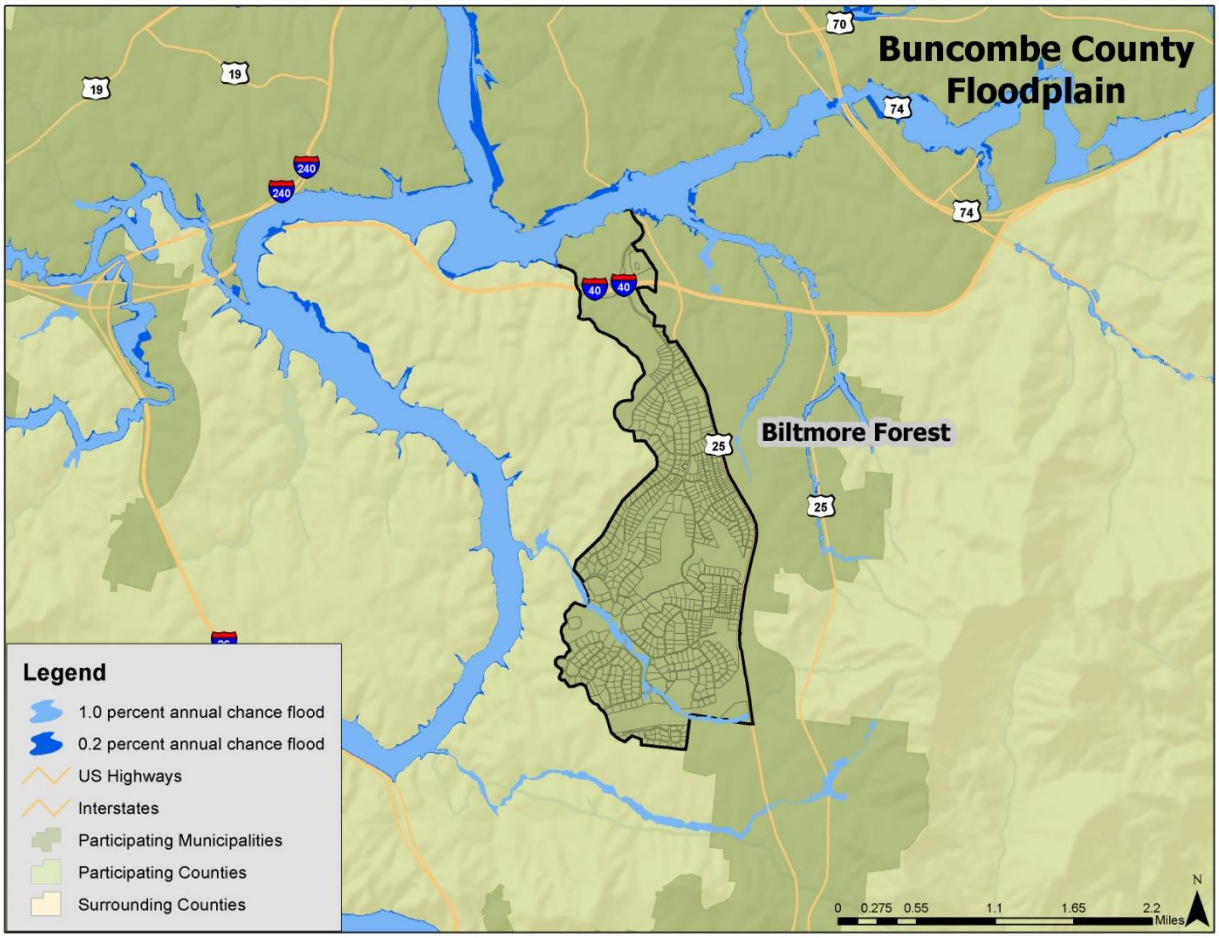
Source: Federal Emergency Management Agency

FIGURE A.8: SPECIAL FLOOD HAZARD AREAS IN ASHEVILLE



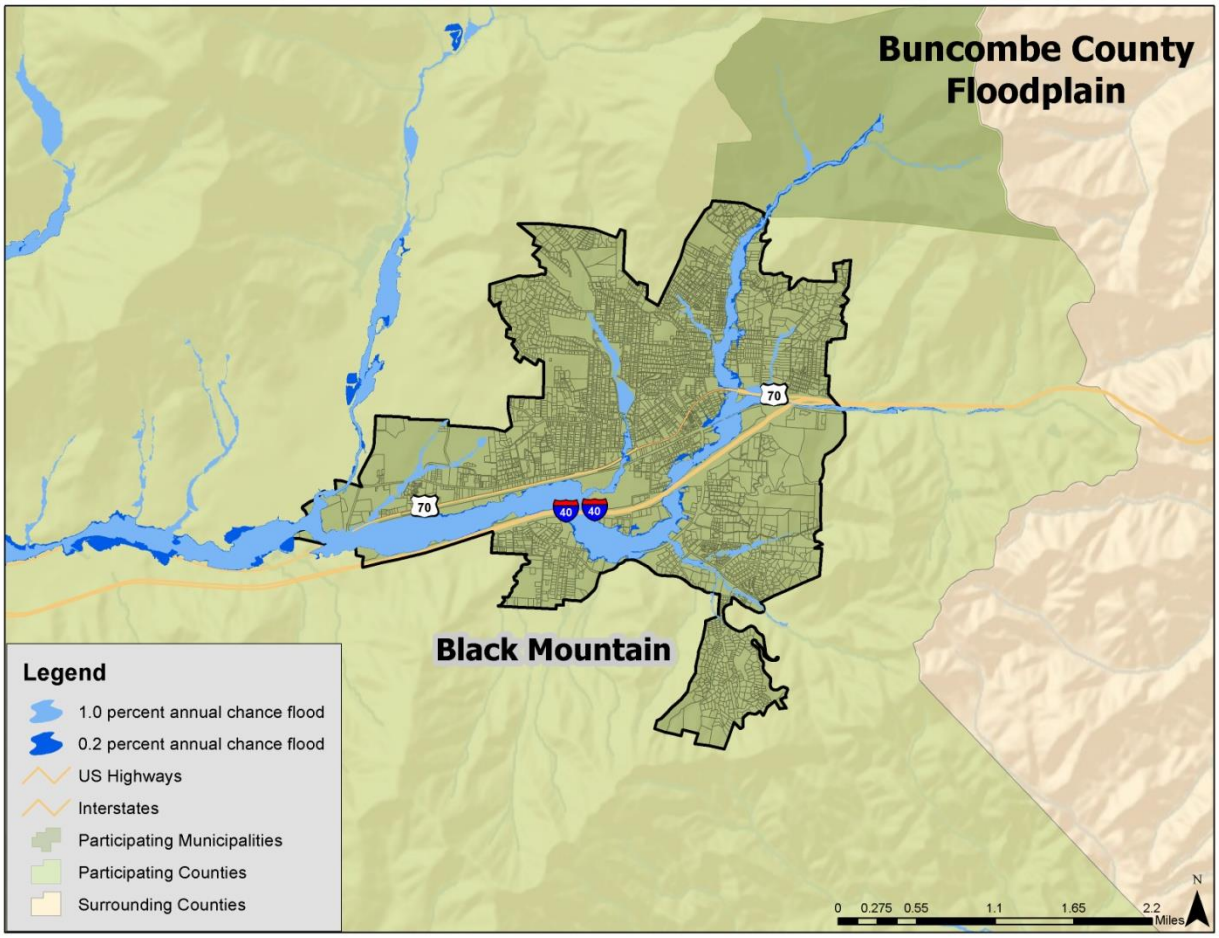
Source: Federal Emergency Management Agency

FIGURE A.9: SPECIAL FLOOD HAZARD AREAS IN BILTMORE FOREST



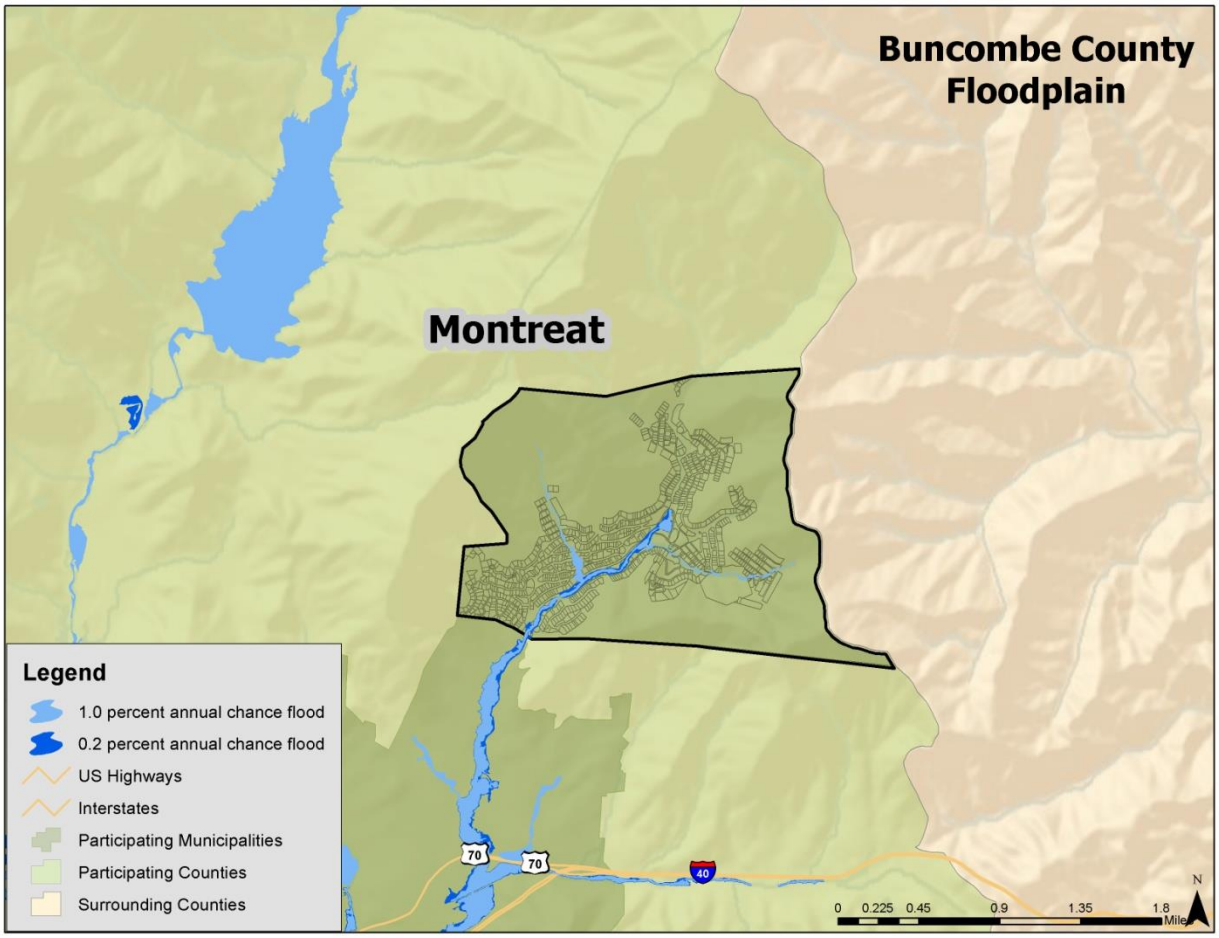
Source: Federal Emergency Management Agency

FIGURE A.10: SPECIAL FLOOD HAZARD AREAS IN BLACK MOUNTAIN



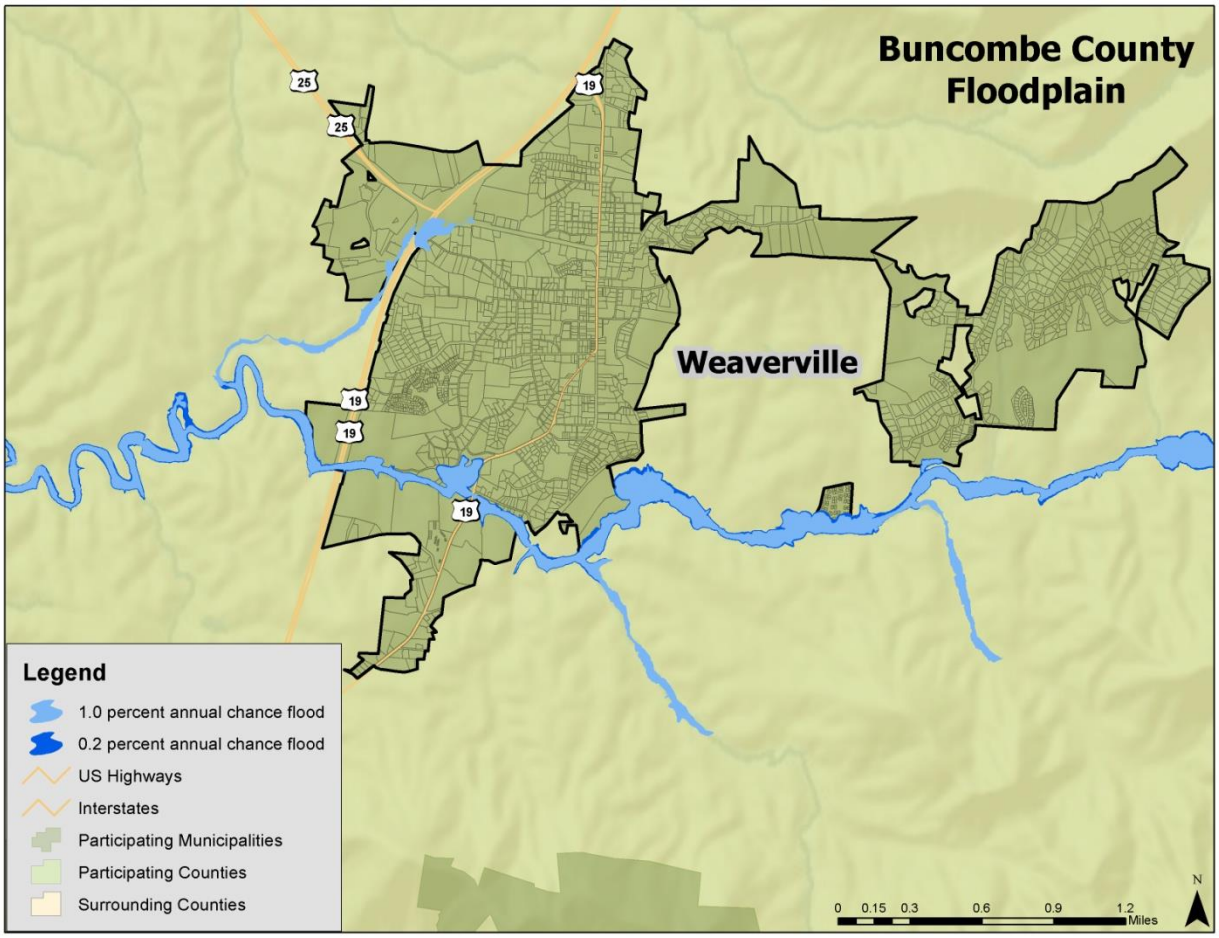
Source: Federal Emergency Management Agency

FIGURE A.11: SPECIAL FLOOD HAZARD AREAS IN MONTREAT



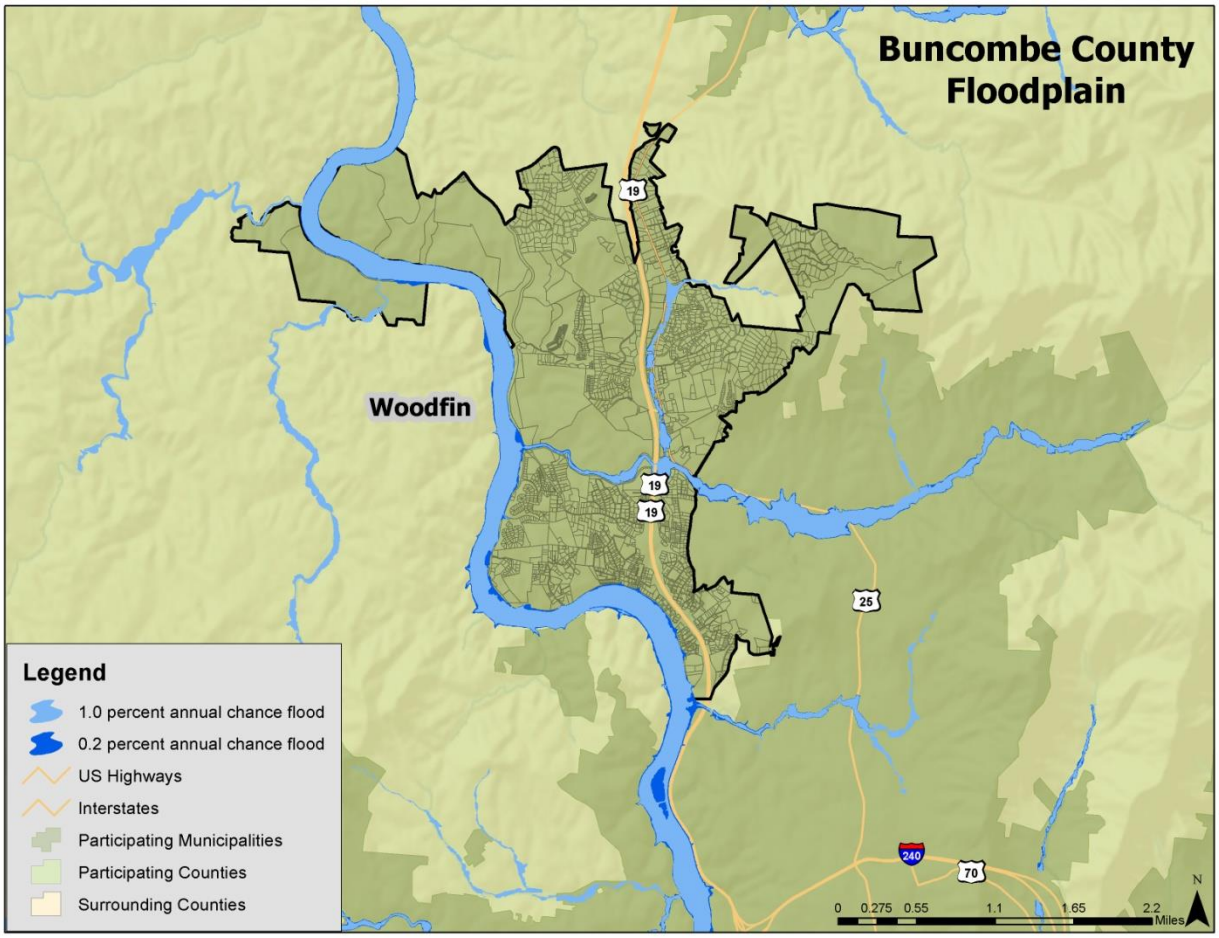
Source: Federal Emergency Management Agency

FIGURE A.12: SPECIAL FLOOD HAZARD AREAS IN WEAVERVILLE



Source: Federal Emergency Management Agency

FIGURE A.13: SPECIAL FLOOD HAZARD AREAS IN WOODFIN



Source: Federal Emergency Management Agency

Historical Occurrences

Flooding has resulted in three disaster declarations in Buncombe County.[17] Information from the National Climatic Data Center was used to ascertain additional historical flood events. The National Climatic Data Center reported a total of 25 events in Buncombe County since 1993.[18] A summary of these events is presented in **Table A.22**. These events accounted for almost $107.6 million (2013 dollars) in property damage in the county.[19] In addition, two fatalities were reported. Specific information on flood events, including date, type of flooding, and deaths and injuries, can be found in **Table A.23**.

[17] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[18] These events are only inclusive of those reported by NCDC. It is likely that additional occurrences have occurred and have gone unreported.
[19] The total damage amount was averaged over the number of affected counties when multiple counties were involved in the flood event.

TABLE A.22: SUMMARY OF FLOOD OCCURRENCES IN BUNCOMBE COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Asheville	3	0/0	$13,842
Biltmore Forest	0	0/0	$0
Black Mountain	0	0/0	$0
Montreat	0	0/0	$0
Weaverville	3	0/0	$20,600
Woodfin	0	0/0	$0
Unincorporated Area	19	2/0	$107,545,617
BUNCOMBE COUNTY TOTAL	**25**	**2/0**	**$107,580,059**

Source: National Climatic Data Center

TABLE A.23: HISTORICAL FLOOD EVENTS IN BUNCOMBE COUNTY

	Date	Type	Deaths / Injuries	Property Damage*
Asheville				
ASHEVILLE	26-JUN-97	FLASH FLOOD	0/0	$0
ASHEVILLE	05-JUN-02	URBAN/SML STREAM FLD	0/0	$13,842
ASHEVILLE	04-AUG-03	FLASH FLOOD	0/0	$0
Biltmore Forest				
None Reported	--	--	--	--
Black Mountain				
None Reported	--	--	--	--
Montreat				
None Reported	--	--	--	--
Weaverville				
WEAVERVILLE	08-AUG-01	FLASH FLOOD	0/0	$0
WEAVERVILLE	22-FEB-03	FLASH FLOOD	0/0	$0
WEAVERVILLE	21-MAY-12	FLASH FLOOD	0/0	$20,600
Woodfin				
None Reported	--	--	--	--
Unincorporated Area				
BUNCOMBE COUNTY	23-MAR-93	FLASH FLOODS	0/0	$0
BUNCOMBE COUNTY	11-FEB-94	FLASH FLOODS	0/0	$0
BUNCOMBE COUNTY	18-JAN-96	FLOOD	0/0	$0
BUNCOMBE COUNTY	26-JAN-96	FLOOD	0/0	$3,218
NEW HOMINY	03-SEP-96	FLASH FLOOD	0/0	$0
WEST PART OF COUNTY	04-SEP-96	FLASH FLOOD	0/0	$0
EASTERN PART	04-SEP-96	FLASH FLOOD	0/0	$0
COUNTYWIDE	07-JAN-98	FLOOD	0/0	$1,548,892
LEICESTER	20-MAR-00	FLASH FLOOD	0/0	$0
SKYLAND	22-JUN-01	FLASH FLOOD	0/0	$1,425,761
CENTRAL PORTION	06-MAY-03	FLASH FLOOD	0/0	$134,392
LEICESTER	13-JUL-03	FLASH FLOOD	0/0	$0

	Date	Type	Deaths / Injuries	Property Damage*
BUNCOMBE COUNTY	06-FEB-04	FLOOD	0/0	$0
BUNCOMBE COUNTY	07-SEP-04	FLOOD	0/0	$52,190,927
BUNCOMBE COUNTY	16-SEP-04	FLOOD	2/0	$52,190,927
ARDEN	11-JUL-05	FLASH FLOOD	0/0	$0
SKYLAND	13-JUL-05	FLASH FLOOD	0/0	$0
LEICESTER	19-JUL-05	FLASH FLOOD	0/0	$0
NEW BRIDGE	11-JUL-12	FLASH FLOOD	0/0	$51,500

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Historical Summary of Insured Flood Losses

According to FEMA flood insurance policy records as of July 2013, there have been 373 flood losses reported in Buncombe County through the National Flood Insurance Program (NFIP) since 1978, totaling over $17.1 million in claims payments. A summary of these figures for the county is provided in **Table A.24**. It should be emphasized that these numbers include only those losses to structures that were insured through the NFIP policies, and for losses in which claims were sought and received. It is likely that many additional instances of flood loss in Buncombe County were either uninsured, denied claims payment, or not reported.

TABLE A.24: SUMMARY OF INSURED FLOOD LOSSES IN BUNCOMBE COUNTY

Location	Flood Losses	Claims Payments
Asheville	227	$13,850,453
Biltmore Forest	0	$0
Black Mountain	12	$35,989
Montreat	0	$0
Weaverville	0	$0
Woodfin	1	$1,008
Unincorporated Area	133	$3,299,684
BUNCOMBE COUNTY TOTAL	**373**	**$17,187,134**

Source: Federal Emergency Management Agency, National Flood Insurance Program

Repetitive Loss Properties

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Currently there are over 140,000 repetitive loss properties nationwide.

As of November 2013, there are 27 non-mitigated repetitive loss property located in Buncombe County, which accounted for 64 losses and more than $4.4 million in claims payments under the NFIP. The average claim amount for this property is $69,260. Twenty-four of the twenty-seven properties are commercial and the remaining three are multi-family residential. Without mitigation these properties will likely continue to experience flood losses. **Table A.25** presents detailed information on repetitive loss properties and NFIP claims and policies for Buncombe County.

TABLE A.25: REPETITIVE LOSS PROPERTIES IN BUNCOMBE COUNTY

Location	Number of Properties	Types of Properties	Number of Losses	Building Payments	Content Payments	Total Payments	Average Payment
Asheville	27	24 commercial, 3 multi-family	64	$2,580,932.68	$1,851,722.77	$4,432,655.45	$69,260.24
Biltmore Forest	0	--	0	$0	$0	$0	$0
Black Mountain	0	--	0	$0	$0	$0	$0
Montreat	0	--	0	$0	$0	$0	$0
Weaverville	0	--	0	$0	$0	$0	$0
Woodfin	0	--	0	$0	$0	$0	$0
Unincorporated Area	0	--	0	$0	$0	$0	$0
BUNCOMBE COUNTY TOTAL	**1**		**3**	**$8,360.80**	**$249.67**	**$8,610.47**	**$2,870.16**

Source: National Flood Insurance Program

Probability of Future Occurrences

Flood events will remain a threat in areas prone to flooding in Buncombe County, and the probability of future occurrences will remain likely (between 10 and 100 percent annual probability). The participating jurisdictions and unincorporated areas of the county have risk to flooding, though not all areas will experience flood. The probability of future flood events based on magnitude and according to best available data is illustrated in the figures above**,** which indicates those areas susceptible to the 1-percent annual chance flood (100-year floodplain) and the 0.2-percent annual chance flood (500-year floodplain).

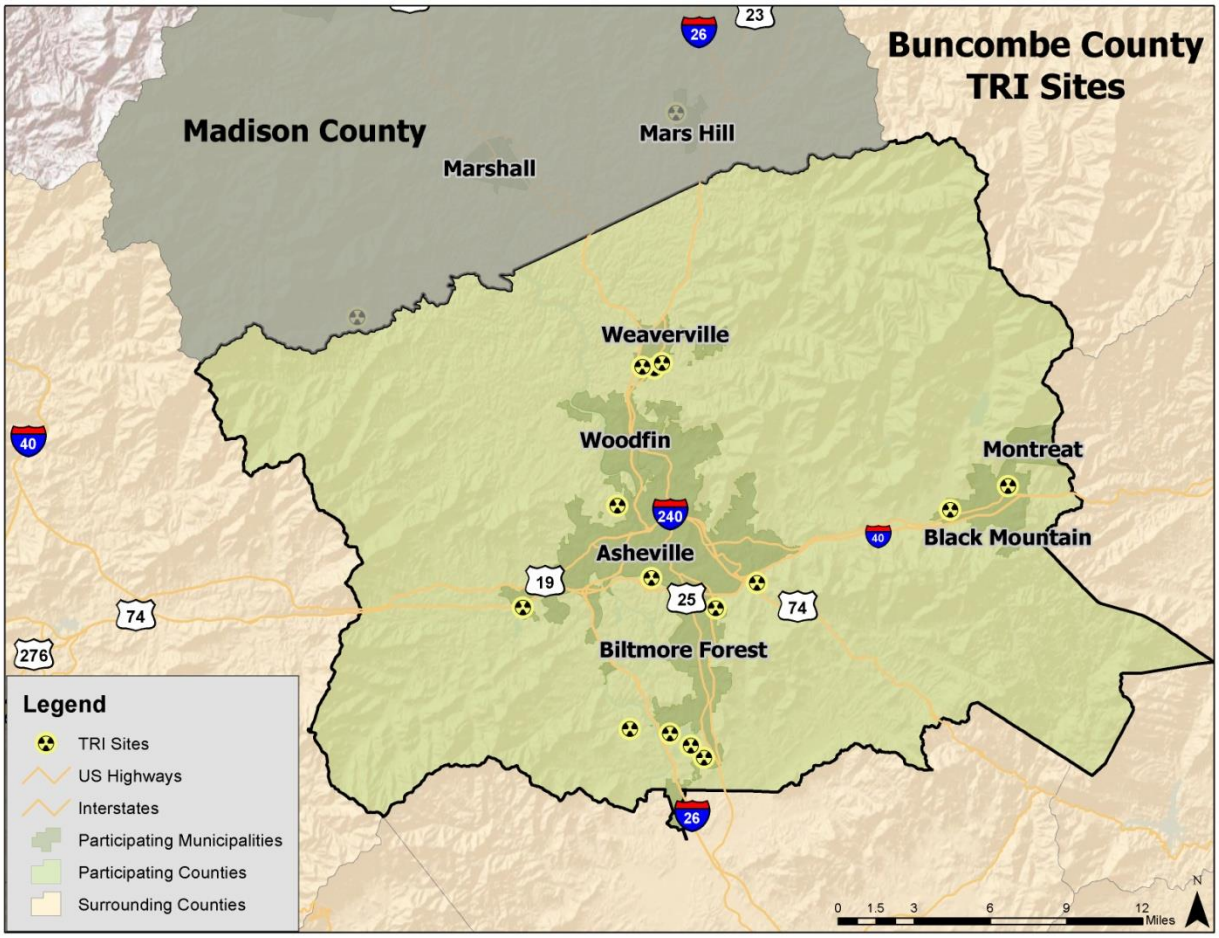
It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the county and participating jurisdictions. For example, Asheville has a higher risk of flood than other municipalities. Flood is not the greatest hazard of concern but will continue to occur and cause damage. Therefore, mitigation actions may be warranted, particularly for repetitive loss properties.

A.2.14 Hazardous Materials Incidents

Location and Spatial Extent

Buncombe County has 17 TRI sites. These sites are shown in **Figure A.14.**

FIGURE A.14: TOXIC RELEASE INVENTORY (TRI) SITES IN BUNCOMBE COUNTY



Source: Environmental Protection Agency

In addition to "fixed" hazardous materials locations, hazardous materials may also impact the county via roadways and rail. Many roads in the county are narrow and winding, making hazardous material transport in the area especially treacherous. All roads that permit hazardous material transport are considered potentially at risk to an incident.

Historical Occurrences

There have been a total of 20 recorded HAZMAT incidents in Buncombe County since 1973 (**Table A.26**). **Table A.27** presents detailed information on historic HAZMAT incidents in Buncombe County as reported by the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA).

TABLE A.26: SUMMARY OF HAZMAT INCIDENTS IN BUNCOMBE COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Asheville	18	0/0	$0
Biltmore Forest	0	0/0	$0
Black Mountain	0	0/0	$0

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Montreat	0	0/0	$0
Weaverville	0	0/0	$0
Woodfin	0	0/0	$0
Unincorporated Area	2	0/0	$0
BUNCOMBE COUNTY TOTAL	**20**	**0/0**	**$0**

Source: United States Department of Transportation Pipelines and Hazardous Materials Safety Administration

TABLE A.27: HAZMAT INCIDENTS IN BUNCOMBE COUNTY

Report Number	Date	City	Mode	Serious Incident?	Fatalities / Injuries	Damages ($)	Quantity Released
Asheville							
I-1973040033	2/21/1973	ASHEVILLE	Highway	No	0/0	$0	0
I-1975100648	10/6/1975	ASHEVILLE	Highway	No	0/0	$0	0
I-1977070560	7/7/1977	ASHEVILLE	Highway	No	0/0	$0	1 LGA
I-1977120527	11/17/1977	ASHEVILLE	Highway	No	0/0	$0	55 LGA
I-1978110085	10/25/1978	ASHEVILLE	Highway	No	0/0	$0	0
I-1982050541	5/13/1982	ASHEVILLE	Highway	No	0/0	$0	2 LGA
I-1982050540	5/18/1982	ASHEVILLE	Highway	No	0/0	$0	20 SLB
I-1983010378	1/14/1983	ASHEVILLE	Highway	No	0/0	$0	3 LGA
I-1984070044	6/12/1984	ASHEVILLE	Highway	No	0/0	$0	0
I-1990090077	8/7/1990	ASHEVILLE	Highway	No	0/0	$0	0.5 LGA
I-1991080234	7/8/1991	ASHEVILLE	Highway	No	0/0	$0	0.0625 LGA
I-1993010086	11/23/1992	CANDLER	Highway	No	0/0	$0	112.5 LGA
I-1993030245	2/4/1993	ASHEVILLE	Highway	No	0/0	$0	100 LGA
I-1994100545	9/6/1994	ASHEVILLE	Highway	No	0/0	$0	0.002113 LGA
I-2005100468	9/13/2005	ASHEVILLE	Highway	No	0/0	$0	0.015625 LGA
I-2006080135	6/30/2006	ASHEVILLE	Highway	No	0/0	$0	0.25 LGA
E-2009050261	4/24/2009	ASHEVILLE	Highway	No	0/0	$0	2.5 LGA
I-2009110158	10/30/2009	ASHEVILLE	Highway	No	0/0	$0	0.007813 LGA
Biltmore Forest							
None Reported	--	--	--	--	--	--	--
Black Mountain							
None Reported	--	--	--	--	--	--	--
Montreat							
None Reported	--	--	--	--	--	--	--
Weaverville							
None Reported	--	--	--	--	--	--	--
Woodfin							
None Reported	--	--	--	--	--	--	--
Unincorporated Area							
I-1985060174	5/28/1985	ASHEVILLE	FREIGHT FORWARDER	No	0/0	$0	1 LGA
I-2003060118	5/20/2003	ARDEN	Highway	No	0/0	$0	1 LGA

Source: United States Department of Transportation Pipelines and Hazardous Materials Safety Administration

Probability of Future Occurrences

Given the location of 17 toxic release inventory sites in Buncombe County and several roadway and rail incidents, it is possible that a hazardous material incident may occur in the county (between 1 and 10 percent annual probability). County and municipal officials are mindful of this possibility and take precautions to prevent such an event from occurring. Furthermore, there are detailed plans in place to respond to an occurrence. The county may also be impacted by neighboring counties which also face risk due to TRI sites.

A.2.15 Wildfire

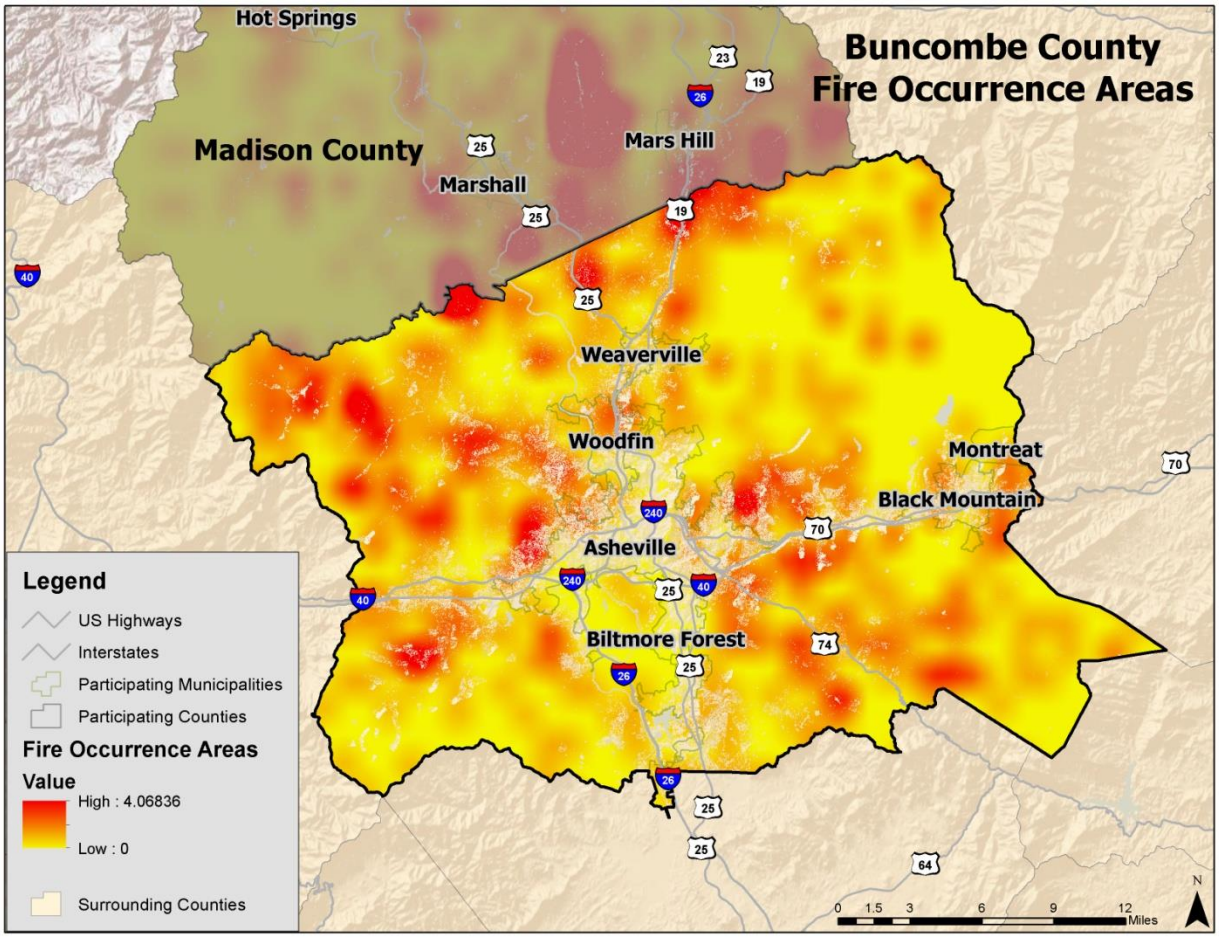
Location and Spatial Extent

The entire county is at risk to a wildfire occurrence. However, several factors such as drought conditions or high levels of fuel on the forest floor, may make a wildfire more likely. Furthermore, areas in the urban-wildland interface are particularly susceptible to fire hazard as populations abut formerly undeveloped areas. The Fire Occurrence Areas in the figure below give an indication of historic location.

Historical Occurrences

Figure A.15 shows the Fire Occurrence Areas (FOA) in Buncombe County based on data from the Southern Wildfire Risk Assessment. This data is based on historical fire ignitions and is reported as the number of fires that occur per 1,000 acres each year.

FIGURE A.15: HISTORIC WILDFIRE EVENTS IN BUNCOMBE COUNTY



Source: Southern Wildfire Risk Assessment

Based on data from the North Carolina Division of Forest Resources from 2003 to 2012, Buncombe County experiences an average of 54 wildfires annually which burn an average of 171 acres per year. The data indicates that most of these fires are small, averaging three acres per fire. **Table A.28** lists the number of reported wildfire occurrences in the county between the years 2003 and 2012.

TABLE A.28: HISTORICAL WILDFIRE OCCURRENCES IN BUNCOMBE COUNTY

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Buncombe County										
Number of Fires	23	53	47	82	75	23	29	54	77	75
Number of Acres	35.3	212.0	77.3	241.5	402.0	334.8	167.8	75.6	57.2	102.7

Source: North Carolina Division of Forest Resources

Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Buncombe County. The likelihood of wildfires increases during drought cycles and abnormally dry conditions. Fires are likely to stay small in size but could

increase due local climate and ground conditions. Dry, windy conditions with an accumulation of forest floor fuel (potentially due to ice storms or lack of fire) could create conditions for a large fire that spreads quickly. It should also be noted that some areas do vary somewhat in risk. For example, highly developed areas are less susceptible unless they are located near the urban-wildland boundary. The risk will also vary due to assets. Areas in the urban-wildland interface will have much more property at risk, resulting in increased vulnerability and need to mitigate, compared to rural, mainly forested areas. The areas surrounding the participating municipalities appear to have the highest risk in the county. The probability assigned to Buncombe County for future wildfire events is likely (10 to 100 percent annual probability).

A.2.16 Conclusions on Hazard Risk

The hazard profiles presented above were developed using best available data and result in what may be considered principally a qualitative assessment as recommended by FEMA in its "How-to" guidance document titled *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA Publication 386-2). It relies heavily on historical and anecdotal data, stakeholder input, and professional and experienced judgment regarding observed and/or anticipated hazard impacts. It also carefully considers the findings in other relevant plans, studies, and technical reports.

Hazard Extent

Table A.29 describes the extent of each natural hazard identified for Buncombe County. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE A.29: EXTENT OF BUNCOMBE COUNTY HAZARDS

Atmospheric Hazards	
Drought	Drought extent is defined by the North Carolina Drought Monitor Classifications which include Abnormally Dry, Moderate Drought, Severe Drought, Extreme Drought, and Exceptional Drought (page 5:6). According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Buncombe County has received this ranking three times over the fourteen-year reporting period.
Extreme Heat	The extent of extreme heat can be defined by the maximum temperature reached. The highest temperature recorded in Buncombe County is 103 degrees Fahrenheit in reported on July 20, 1926.
Hailstorm	Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Buncombe County was 2.0 inches (reported on April 16, 1998). It should be noted that future events may exceed this.
Hurricane and Tropical Storm	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5 (Table 5.9). The greatest classification of hurricane to traverse directly through Buncombe County was an Unnamed Storm in 1901 which reached a maximum wind speed of 31 knots in the county. It should be noted that stronger storms could impact the region without a direct hit.
Lightning	According to the Vaisala flash density map (Figure 5.5), Buncombe County is located in an area that experiences 2 to 4 lightning flashes per square kilometer per year. It should be noted that future lightning occurrences may exceed these figures.

Thunderstorm Wind / High Wind	Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Climatic Data Center, the strongest recorded wind event in Buncombe County was reported on May 5, 2009 at 75 knots (approximately 86 mph). It should be noted that future events may exceed these historical occurrences.
Tornado	Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA (Figure 5.6) as well as the Fujita/Enhanced Fujita Scale (Tables 5.14 and 5.15). The greatest magnitude reported was an F1 (reported on May 6, 1999).
Winter Storm and Freeze	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall was reported in Buncombe County was 20 inches reported on March 3, 1942. Due to extreme variations in elevation throughout the county, extent totals will vary for each participating jurisdiction and reliable data on snowfall totals is not available.
Geologic Hazards	
Earthquake	Earthquake extent can be measured by the Richter Scale (Table 5.18) and the Modified Mercalli Intensity (MMI) scale (Table 5.19) and the distance of the epicenter from Buncombe County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact the county was VI (slightly strong) with a correlating Richter Scale measurement of approximately 5.4 (last reported on July 2, 1957). The epicenter of this earthquake was located 3 km away.
Landslide	As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is moderate across the majority of Buncombe County (there is high incidence in the northwest part of the county and low incidence in the southeast corner of the county). There is also high susceptibility throughout the entire county.
Hydrologic Hazards	
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria (Table 5.23). Of the 96 dams in Buncombe County, 50 are classified as high-hazard.
Erosion	The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records located in Buncombe County.
Flood	Flood extent can be measured by the amount of land and property in the floodplain as well as flood height and velocity. The amount of land in the floodplain accounts for 3.7 percent of the total land area in Buncombe County. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the county. While a gage does not exist for each participating jurisdiction, there is one at or near several areas. The greatest peak discharge recorded for the county was reported on July 16, 1916. Water reached a discharge of 110,000 cubic feet per second and the stream gage height was recorded at 23.10 feet.
Other Hazards	
Hazardous Materials Incident	According to USDOT PHMSA, the largest hazardous materials incident reported in the county is 112.5 LGA released on the highway on November 23, 1992. It should be noted that larger events are possible.

Wildfire	Wildfire data was provided by the North Carolina Division of Forest Resources and is reported annually by county from 2003-2012. The greatest number of fires to occur in Buncombe County in any year was 82 in 2006. The greatest number of acres to burn in the county in a single year occurred in 2007 when 402 acres were burned. Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout the county.

Priority Risk Index Results

In order to draw some meaningful planning conclusions on hazard risk for Buncombe County, the results of the hazard profiling process were used to generate countywide hazard classifications according to a "Priority Risk Index" (PRI). More information on the PRI and how it was calculated can be found in Section 5.18.2.

Table A.30 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Regional Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE A.30: SUMMARY OF PRI RESULTS FOR BUNCOMBE COUNTY

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Atmospheric Hazards						
Drought	Likely	Minor	Large	More than 24 hours	More than 1 week	**2.5**
Extreme Heat	Unlikely	Minor	Large	More than 24 hours	Less than 1 week	**1.8**
Hailstorm	Highly Likely	Minor	Moderate	Less than 6 hours	Less than 6 hours	**2.6**
Hurricane and Tropical Storm	Possible	Limited	Large	More than 24 hours	Less than 24 hours	**2.3**
Lightning	Highly Likely	Minor	Negligible	Less than 6 hours	Less than 6 hours	**2.2**
Thunderstorm / High Wind	Highly Likely	Critical	Moderate	6 to 12 hours	Less than 6 hours	**3.1**
Tornado	Possible	Critical	Small	Less than 6 hours	Less than 6 hours	**2.4**
Winter Storm and Freeze	Highly Likely	Critical	Large	More than 24 hours	Less than 1 week	**3.3**
Geologic Hazards						
Earthquake	Likely	Minor	Moderate	Less than 6 hours	Less than 6 hours	**2.3**
Landslide	Highly Likely	Critical	Small	Less than 6 hours	Less than 6 hours	**3.0**
Hydrologic Hazards						
Dam and Levee Failure	Unlikely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.3**
Erosion	Possible	Minor	Small	More than 24 hours	More than 1 week	**1.8**
Flood	Likely	Critical	Small	6 to 12 hours	Less than 1 week	**2.8**
Other Hazards						
Hazardous Materials Incident	Possible	Limited	Small	Less than 6 hours	Less than 24 hours	**2.2**
Wildfire	Likely	Minor	Small	Less than 6 hours	Less than 1 week	**2.4**

A.2.17 Final Determinations on Hazard Risk

The conclusions drawn from the hazard profiling process for Buncombe County, including the PRI results and input from the Regional Hazard Mitigation Planning Team, resulted in the classification of risk for each identified hazard according to three categories: High Risk, Moderate Risk, and Low Risk (**Table A.31**). For purposes of these classifications, risk is expressed in relative terms according to the estimated impact that a hazard will have on human life and property throughout all of Buncombe County. A more quantitative analysis to estimate potential dollar losses for each hazard has been performed separately, and is described in Section 6: *Vulnerability Assessment* and below in Section A.3. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

TABLE A.31: CONCLUSIONS ON HAZARD RISK FOR BUNCOMBE COUNTY

HIGH RISK	Winter Storm and Freeze Thunderstorm Wind / High Wind Landslide Flood Hailstorm
MODERATE RISK	Drought Tornado Wildfire Hurricane and Tropical Storm Earthquake Dam and Levee Failure
LOW RISK	Lightning Hazardous Material Incident Extreme Heat Erosion

A.3 BUNCOMBE COUNTY VULNERABILITY ASSESSMENT

This subsection identifies and quantifies the vulnerability of Buncombe County to the significant hazards previously identified. This includes identifying and characterizing an inventory of assets in the county and assessing the potential impact and expected amount of damages caused to these assets by each identified hazard event. More information on the methodology and data sources used to conduct this assessment can be found in Section 6: *Vulnerability Assessment*.

A.3.1 Asset Inventory

Table A.32 lists the number of parcels, total value of parcels, total number of parcels with improvements, and the total assessed value of improvements for Buncombe County and its participating jurisdictions (study area of vulnerability assessment).[20]

TABLE A.32: IMPROVED PROPERTY IN BUNCOMBE COUNTY

Location	Number of Parcels	Total Assessed Value of Parcels	Estimated Number of Buildings	Total Assessed Value of Improvements
Asheville	35,244	$11,206,812,503	21,619	$8,150,333,103
Biltmore Forest	722	$614,875,900	623	$412,272,900
Black Mountain	4,358	$852,294,400	2,645	$586,663,500
Montreat	910	$266,778,600	442	$178,898,100
Weaverville	1,805	$407,464,200	1,045	$294,357,000
Woodfin	2,484	$412,651,300	1,287	$278,079,600
Unincorporated Area	76,192	$16,176,025,400	45,065	$10,310,634,500
BUNCOMBE COUNTY TOTAL	**121,715**	**$29,936,902,303**	**72,726**	**$20,211,238,703**

Table A.33 lists the fire stations, police stations, emergency operations centers (EOCs), medical care facilities, schools and other critical facilities located in Buncombe County. All data was collected from local government GIS departments. In addition, **Figure A.16** shows the locations of essential facilities in Buncombe County. **Table A.45**, near the end of this section, shows a complete list of the critical facilities by name, as well as the hazards that affect each facility. As noted previously, this list is not all-inclusive and only includes information provided by the county.

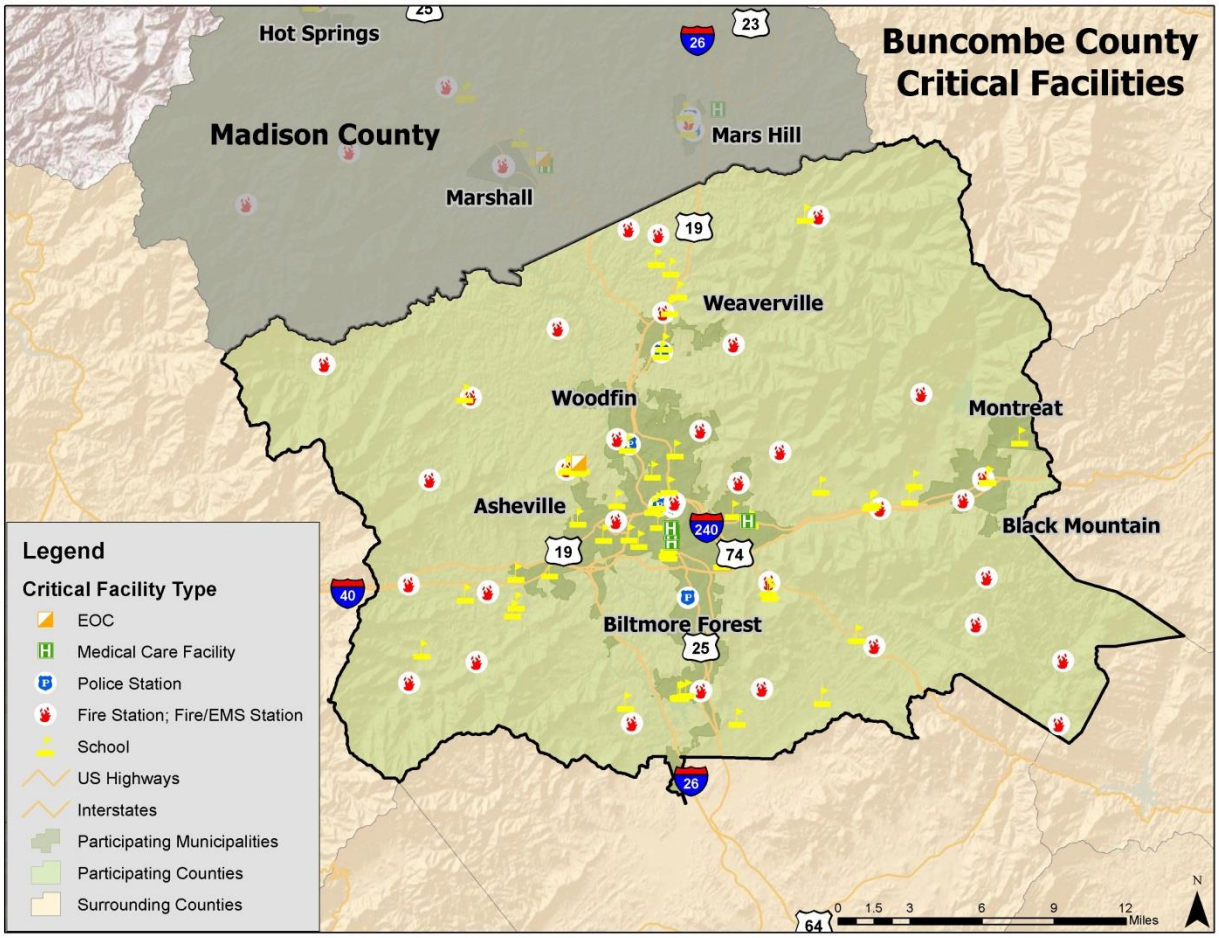
TABLE A.33: CRITICAL FACILITY INVENTORY IN BUNCOMBE COUNTY

Location	Fire Stations	Police Stations	Medical Care Facilities	EOC	Schools
Asheville	6	2	4	0	23
Biltmore Forest	0	1	0	0	0
Black Mountain	3	1	0	0	2
Montreat	0	0	0	0	1
Weaverville	2	1	0	0	2
Woodfin	1	1	0	0	1
Unincorporated Area	26	0	0	1	26
BUNCOMBE COUNTY TOTAL	**38**	**6**	**4**	**1**	**55**

Source: Hazus-MH

[20] Total assessed values for improvements is based on tax assessor records as joined to digital parcel data. This data does not include dollar figures for tax-exempt improvements such as publicly-owned buildings and facilities. It should also be noted that, due to record keeping, some duplication is possible thus potentially resulting in an inflated value exposure for an area.

FIGURE A.16: CRITICAL FACILITY LOCATIONS IN BUNCOMBE COUNTY



Source: Hazus-MH 2.1

A.3.2 Social Vulnerability

In addition to identifying those assets potentially at risk to identified hazards, it is important to identify and assess those particular segments of the resident population in Buncombe County that are potentially at risk to these hazards.

Table A.34 lists the population by jurisdiction according to U.S. Census 2010 population estimates. Unfortunately, estimates were not available at the census block level, limited the results to county-wide estimates. The total population in Buncombe County according to Census data is 238,318 persons. Additional population estimates are presented above in Section A.1.

TABLE A.34: TOTAL POPULATION IN BUNCOMBE COUNTY

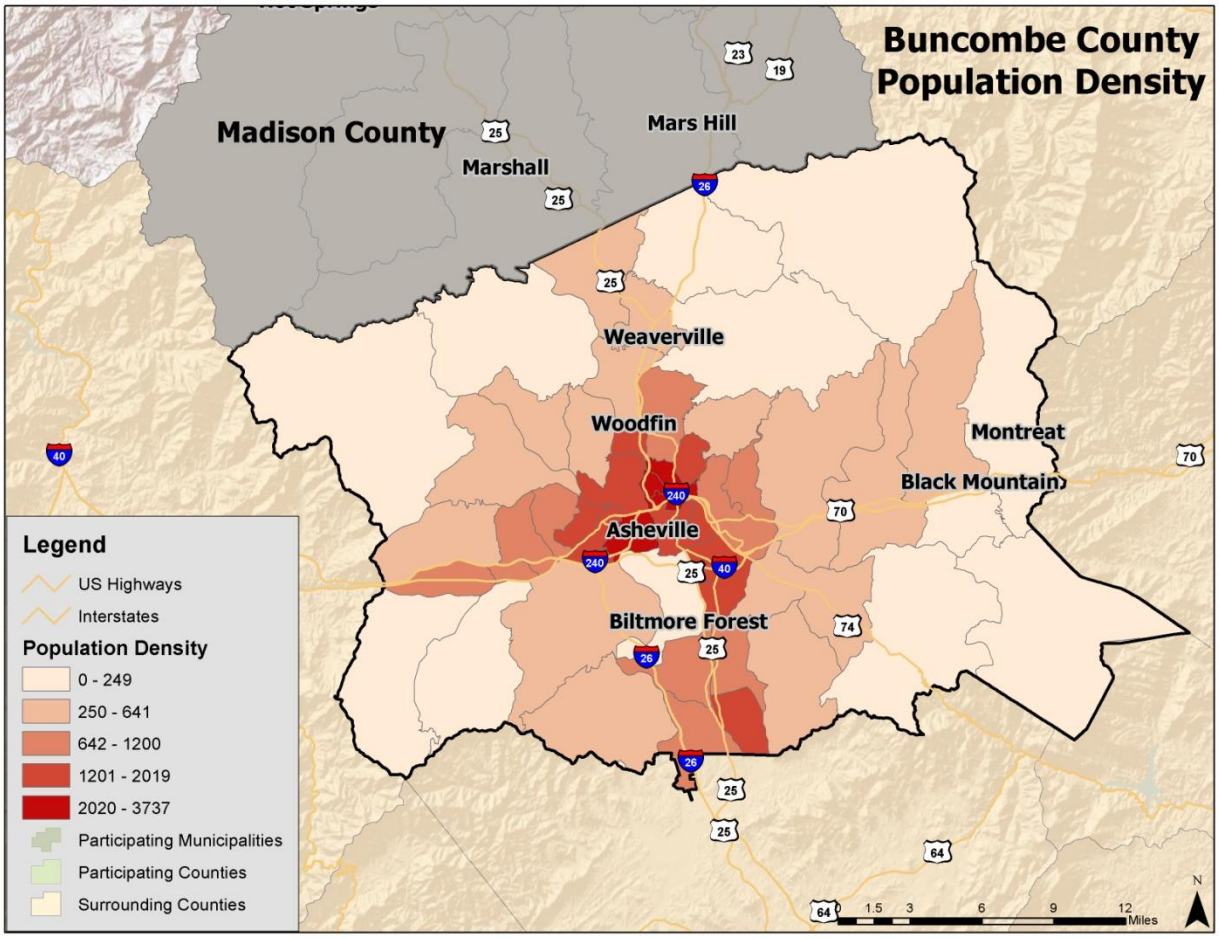
Jurisdiction	2010 Census Population
Buncombe County	**238,318**
City of Asheville	83,393
Town of Biltmore Forest	1,343

Jurisdiction	2010 Census Population
Town of Black Mountain	7,848
Town of Montreat	723
Town of Weaverville	3,210
Town of Woodfin	6,123

Source: United States Census 2010

In addition, **Figure A.17** illustrates the population density by census tract as it was reported by the U.S. Census Bureau in 2010.[21]

FIGURE A.17: POPULATION DENSITY IN BUNCOMBE COUNTY



Source: United States Census Bureau, 2010

A.3.3 Vulnerability Assessment Results

As noted in Section 6: *Vulnerability Assessment*, only hazards with a specific geographic boundary, modeling tool, or sufficient historical data allow for further analysis. Those results, specific to Buncombe County, are presented here. All other hazards are assumed to impact the entire planning

[21] Population by census block was not available at the time this plan was completed.

region (drought, extreme heat, hailstorm, lightning, thunderstorm wind, tornado, and winter storm and freeze) or, due to lack of data, analysis would not lead to credible results (erosion, dam and levee failure). The total county exposure, and thus risk, was presented in **Table A.32**.

The annualized loss estimate for all hazards is presented at the end of this section in **Table A.45.**

The hazards presented in this section include: hurricane and tropical storm winds, earthquake, landslide, flood, hazardous materials incident, and wildfire.

Hurricane and Tropical Storm

Historical evidence indicates that Buncombe County has a significant risk to the hurricane and tropical storm hazard. Several tracks have come near or traversed through the county, as shown and discussed in Section A.2.4.

Hurricanes and tropical storms can cause damage through numerous additional hazards such as flooding, erosion, tornadoes, and high winds and precipitation, thus it is difficult to estimate total potential losses from these cumulative effects. The current Hazus-MH hurricane model only analyzes hurricane winds and is not capable of modeling and estimating cumulative losses from all hazards associated with hurricanes; therefore only hurricane winds are analyzed in this section. It can be assumed that all existing and future buildings and populations are at risk to the hurricane and tropical storm hazard. Hazus-MH 2.1 was used to determine annualized losses for the county as shown below in **Table A.35.** Only losses to buildings are reported, in order to best match annualized losses reported for other hazards. Hazus-MH reports losses at the U.S. Census tract level, so determining participating jurisdiction losses was not possible.

TABLE A.35: ANNUALIZED LOSS ESTIMATIONS FOR HURRICANE WIND HAZARD

Location	Total Annualized Loss
Buncombe County	$237,000

Source: Hazus-MH 2.1

In addition, probable peak wind speeds were calculated in Hazus. These are shown below in **Table A.36.**

TABLE A.36: PROBABLE PEAK HURRICANE / TROPICAL STORM WIND SPEEDS (MPH)

Location	50-year event	100-year event	500-year event	1,000-year event
Asheville	52.0	61.1	80.4	87.1
Biltmore Forest	52.0	60.9	80.1	87.1
Black Mountain	51.5	61.0	80.1	87.0
Montreat	51.5	61.0	79.7	87.0
Weaverville	50.4	60.2	78.8	85.6
Woodfin	50.7	60.2	79.5	86.0
Asheville	52.0	61.1	80.4	87.1
Unincorporated Area	52.5	61.9	80.7	87.8
MAXIMUM WIND SPEED REPORTED	**52.0**	**61.9**	**80.7**	**87.8**

Source: Hazus-MH 2.1

Social Vulnerability
Given some susceptibility across the county, it is assumed that the total population is at risk to the hurricane and tropical storm hazard.

Critical Facilities
Given equal vulnerability across Buncombe County, all critical facilities are considered to be at risk. Some buildings may perform better than others in the face of such an event due to construction and age, among other factors. Determining individual building response is beyond the scope of this plan. However, this plan will consider mitigation actions for vulnerable structures, including critical facilities, to reduce the impacts of the hurricane wind hazard. A list of specific critical facilities and their associated risk can be found in **Table A.45** at the end of this section.

In conclusion, a hurricane event has the potential to impact many existing and future buildings, critical facilities, and populations in Buncombe County. Hurricane events can cause substantial damage in their wake including fatalities, extensive debris clean-up, and extended power outages.

Earthquake
For the earthquake hazard vulnerability assessment, a probabilistic scenario was created to estimate the annualized loss for Buncombe County. The results of the analysis reported at the U.S. Census tract level do not make it feasible to estimate losses at the jurisdiction level. Since the scenario is annualized, no building counts are provided. Losses reported included losses due to building damage and do not include losses to contents, inventory, or business interruption. **Table A.37** summarizes the findings.

TABLE A.37: ANNUALIZED LOSS ESTIMATIONS FOR EARTHQUAKE HAZARD

Location	Total Annualized Loss
Buncombe County	$129,000

Source: Hazus-MH 2.1

Social Vulnerability
It can be assumed that all existing and future populations are at risk to the earthquake hazard.

Critical Facilities
The Hazus probabilistic analysis indicated that no critical facilities would sustain measurable damage in an earthquake event. However, all critical facilities should be considered at-risk to minor damage, should an event occur. A list of individual critical facilities and their risk can be found in **Table A.45**.

In conclusion, an earthquake has the potential to impact all existing and future buildings, facilities, and populations in Buncombe County. Minor earthquakes may rattle dishes and cause minimal damage while stronger earthquakes will result in structural damage as indicated in the Hazus scenario above. Impacts of earthquakes include debris clean-up, service disruption and, in severe cases, fatalities due to building collapse. Specific vulnerabilities for assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available. Furthermore, mitigation actions to address earthquake vulnerability will be considered.

Landslide

In order to complete the vulnerability assessment for landslides in Buncombe County, GIS analysis was used. The potential dollar value of exposed land and property total can be determined using the USGS Landslide Susceptibility Index (detailed in Section A.2.10), county level tax parcel data, and GIS analysis. **Table A.38** presents the potential at-risk property where available. Nearly all areas of Buncombe County are identified as moderate or high incidence areas by the USGS landslide data. All areas of the county are also of high landslide susceptibility. The incidence levels (high and moderate) were used to identify different areas of concern for the analysis below.

TABLE A.38: TOTAL POTENTIAL AT-RISK PARCELS FOR THE LANDSLIDE HAZARD

Location	Number of Parcels At Risk		Number of Improvements At Risk		Total Value of Improvements At Risk ($)	
Incidence Level	Moderate	High	Moderate	High	Moderate	High
Asheville	31,519	3,858	$19,139	2,510	7,588,361,403	$586,924,900
Biltmore Forest	722	0	$623	0	412,272,900	$0
Black Mountain	4,358	0	$2,645	0	586,663,500	$0
Montreat	910	0	$442	0	178,898,100	$0
Weaverville	1,382	488	$684	377	218,253,400	$83,392,500
Woodfin	2,484	0	$1,287	0	278,079,600	$0
Unincorporated Area	48,717	25,938	$28,510	15,933	7,554,425,500	$2,811,895,600
BUNCOMBE COUNTY TOTAL	**90,092**	**30,284**	**$53,330**	**18,820**	**16,816,954,403**	**$3,482,213,000**

Source: United States Geological Survey

Social Vulnerability

Given high susceptibility across the entire county, it is assumed that the total population is at risk.

Critical Facilities

All critical facilities are located in a high susceptibility area. Twenty-six facilities in Buncombe County are located in a high incidence area (high susceptibility). All but two of the remaining critical facilities in Buncombe County are located in the moderate landslide incidence/high susceptibility area. A list of specific critical facilities and their associated risk can be found in **Table A.45** at the end of this section.

In conclusion, a landslide has the potential to impact all existing and future buildings, facilities, and populations in Buncombe County, though some areas are at a higher risk than others due to a variety of factors. For example, steep slopes and modified slopes bear a greater risk than flat areas. Specific vulnerabilities for county assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available.

Flood

Historical evidence indicates that Buncombe County is susceptible to flood events. A total of 25 flood events have been reported by the National Climatic Data Center resulting in $107.6 million dollars in damages. On an annualized level, these damages amounted to $5.4 million for Buncombe County.

In order to assess flood risk, a GIS-based analysis was used to estimate exposure to flood events using Digital Flood Insurance Rate Map (DFIRM) data in combination with local tax assessor records for the county. The determination of assessed value at-risk (exposure) was calculated using GIS analysis by

summing the total assessed building values for only those improved properties that were confirmed to be located within an identified floodplain. **Table A.39** presents the potential at-risk property. Both the number of parcels and the approximate value are presented.

TABLE A.39: ESTIMATED EXPOSURE OF PARCELS TO THE FLOOD HAZARD

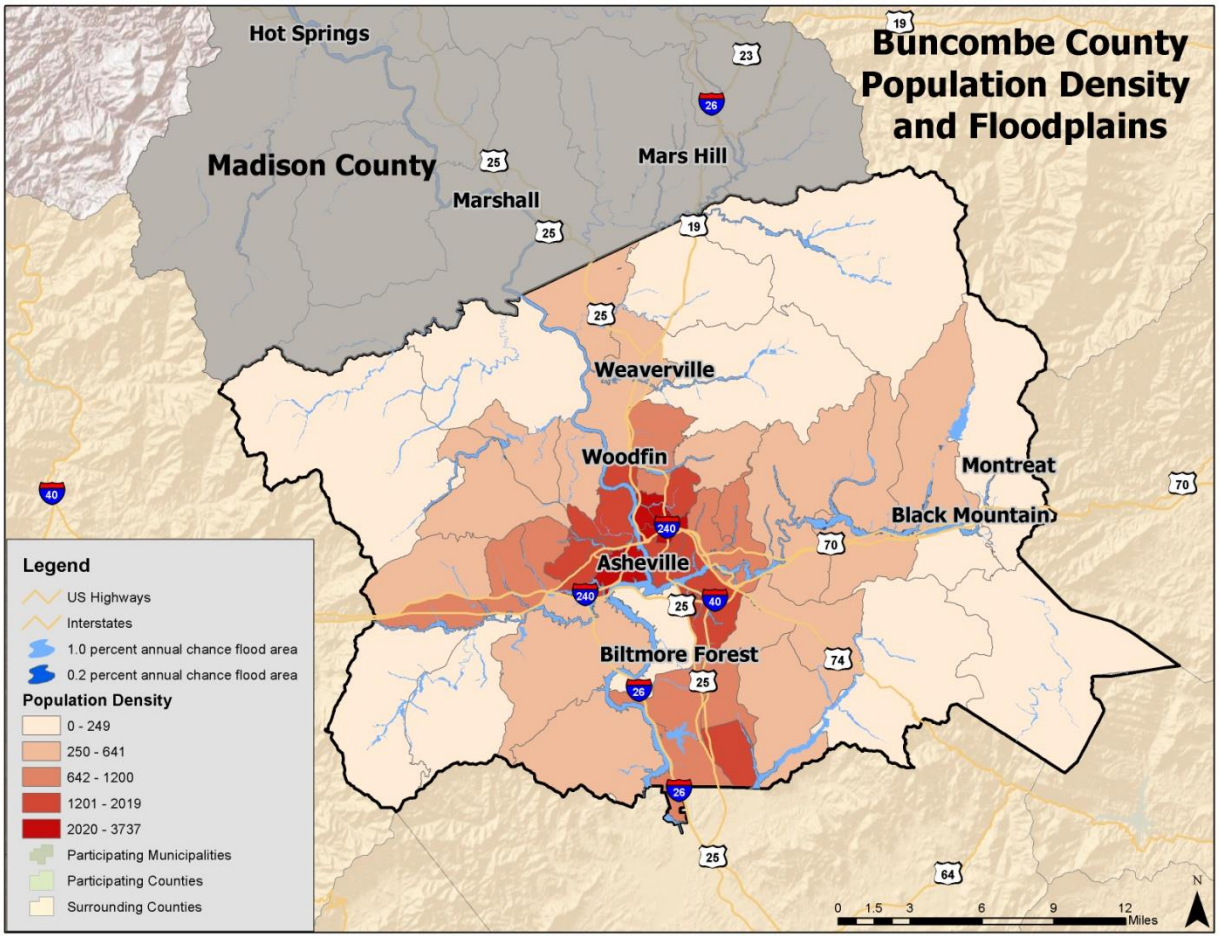
	1.0-percent ACF			0.2-percent ACF		
Location	**Approx. Number of Parcels**	**Approx. Number Improved Buildings**	**Approx. Improved Value of Buildings**	**Approx. Number of Parcels**	**Approx. Number Improved Buildings**	**Approx. Improved Value of Buildings**
Asheville	2,325	538	$252,184,700	0	0	$0
Biltmore Forest	11	0	$0	0	0	$0
Black Mountain	399	132	$33,338,900	0	0	$0
Montreat	50	12	$13,223,200	0	0	$0
Weaverville	43	9	$442,300	0	0	$0
Woodfin	123	49	$11,703,100	0	0	$0
Unincorporated Area	5,062	920	$317,763,600	5	0	$0
BUNCOMBE COUNTY TOTAL	**4,167**	**2,264**	**$436,220,849**	**254**	**192**	**$39,952,798**

Source: Federal Emergency Management Agency DFIRM

Social Vulnerability

Since 2010 population was only available at the tract level, it was difficult to determine a reliable figure on population at-risk to flood due to tract level population data. **Figure A.18** is presented to gain a better understanding of at risk population.

FIGURE A.18 : POPULATION DENSITY NEAR FLOODPLAINS



Source: Federal Emergency Management Agency DFIRM, United States Census 2010

Critical Facilities

The critical facility analysis revealed that there are no critical facilities located in the Buncombe County 1.0-percent annual chance floodplain and 0.2-percent annual chance floodplain based on FEMA DFIRM boundaries and GIS analysis. A list of specific critical facilities and their associated risk can be found in **Table A.45** at the end of this section.

In conclusion, a flood has the potential to impact many existing and future buildings and populations in Buncombe County, though some areas are at a higher risk than others. All types of structures in a floodplain are at-risk, though elevated structures will have a reduced risk. As noted, the floodplains used in this analysis include the 100-year and 500-year FEMA regulated floodplain boundaries. It is certainly possible that more severe events could occur beyond these boundaries or urban (flash) flooding could impact additional structures. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates. Furthermore, areas subject to repetitive flooding should be analyzed for potential mitigation actions.

Hazardous Materials Incident

Although historical evidence and existing Toxic Release Inventory sites indicate that Buncombe County is susceptible to hazardous materials events, there are few reports of damage. Therefore, it is difficult to

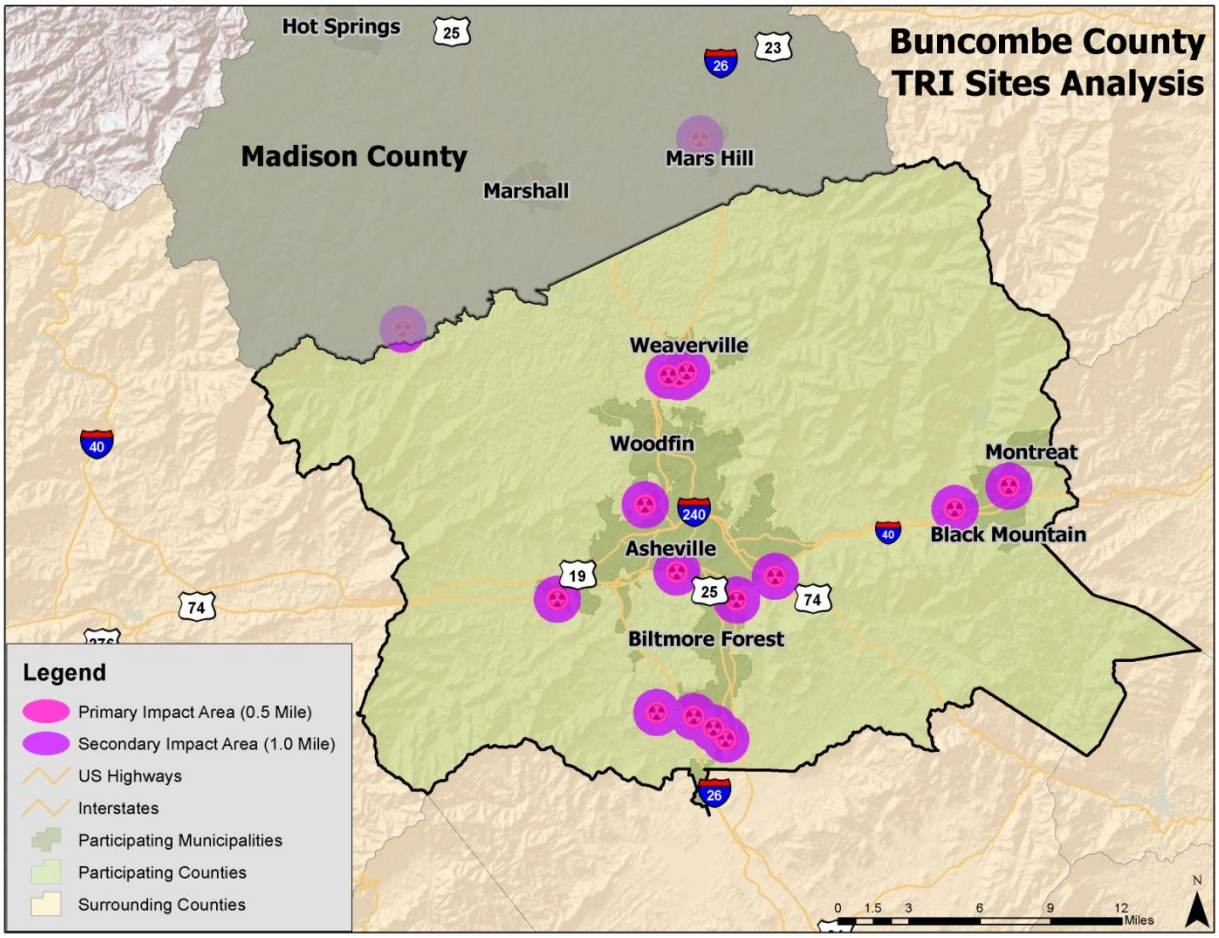
calculate a reliable annualized loss figure. It is assumed that while one major event could result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for Buncombe County.

Most hazardous materials incidents that occur are contained and suppressed before destroying any property or threatening lives. However, they can have a significant negative impact. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops. Certain chemicals may travel through the air or water, affecting a much larger area than the point of the incidence itself. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features, can substantially increase the damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

In order to conduct the vulnerability assessment for this hazard, GIS intersection analysis was used for fixed and mobile areas and parcels.[22] In both scenarios, two sizes of buffers—0.5 mile and 1.0 mile—were used. These areas are assumed to respect the different levels of effect: immediate (primary) and secondary. Primary and secondary impact sites were selected based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks against Buildings and engineering judgment. For the fixed site analysis, geo-referenced TRI listed toxic sites in Buncombe County, along with buffers, were used for analysis as shown in **Figure A.19.** For the mobile analysis, the major roads (Interstate highway, U.S. highway, and State highway) and railroads, where hazardous materials are primarily transported that could adversely impact people and buildings, were used for the GIS buffer analysis. **Figure A.20** shows the areas used for mobile toxic release buffer analysis. The results indicate the approximate number of parcels, improved value, as shown in **Table A.40** (fixed sites), **Table A.41** (mobile road sites) and **Table A.42** (mobile railroad sites).[23]

[22] This type of analysis will likely yield inflated results (generally higher than what is actually reported after an event).
[23] Note that parcels included in the 1.0-mile analysis are also included in the 0.5-mile analysis.

FIGURE A.19 : TRI SITES WITH BUFFERS IN BUNCOMBE COUNTY



Source: Environmental Protection Agency

TABLE A.40: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS (FIXED SITES)

	0.5-mile buffer			1.0-mile buffer		
Location	**Approx. Number of Parcels**	**Approx. Number Improved**	**Approx. Improved Value**	**Approx. Number of Parcels**	**Approx. Number Improved**	**Approx. Improved Value**
Asheville	979	551	$285,977,000	6,094	4,012	$1,018,263,500
Biltmore Forest	0	0	$0	23	15	$2,615,700
Black Mountain	1,066	739	$171,797,800	2,729	1,792	$309,394,900
Montreat	0	0	$0	1	0	$0
Weaverville	402	272	$43,419,900	994	599	$97,287,000
Woodfin	0	0	$0	3	1	$1,701,000
Unincorporated Area	1,801	1,214	$286,718,200	8,161	5,279	$1,110,721,800
BUNCOMBE COUNTY TOTAL	**4,248**	**2,776**	**$787,912,900**	**18,005**	**11,698**	**$2,539,983,900**

FIGURE A.20 : MOBILE HAZMAT BUFFERS IN BUNCOMBE COUNTY

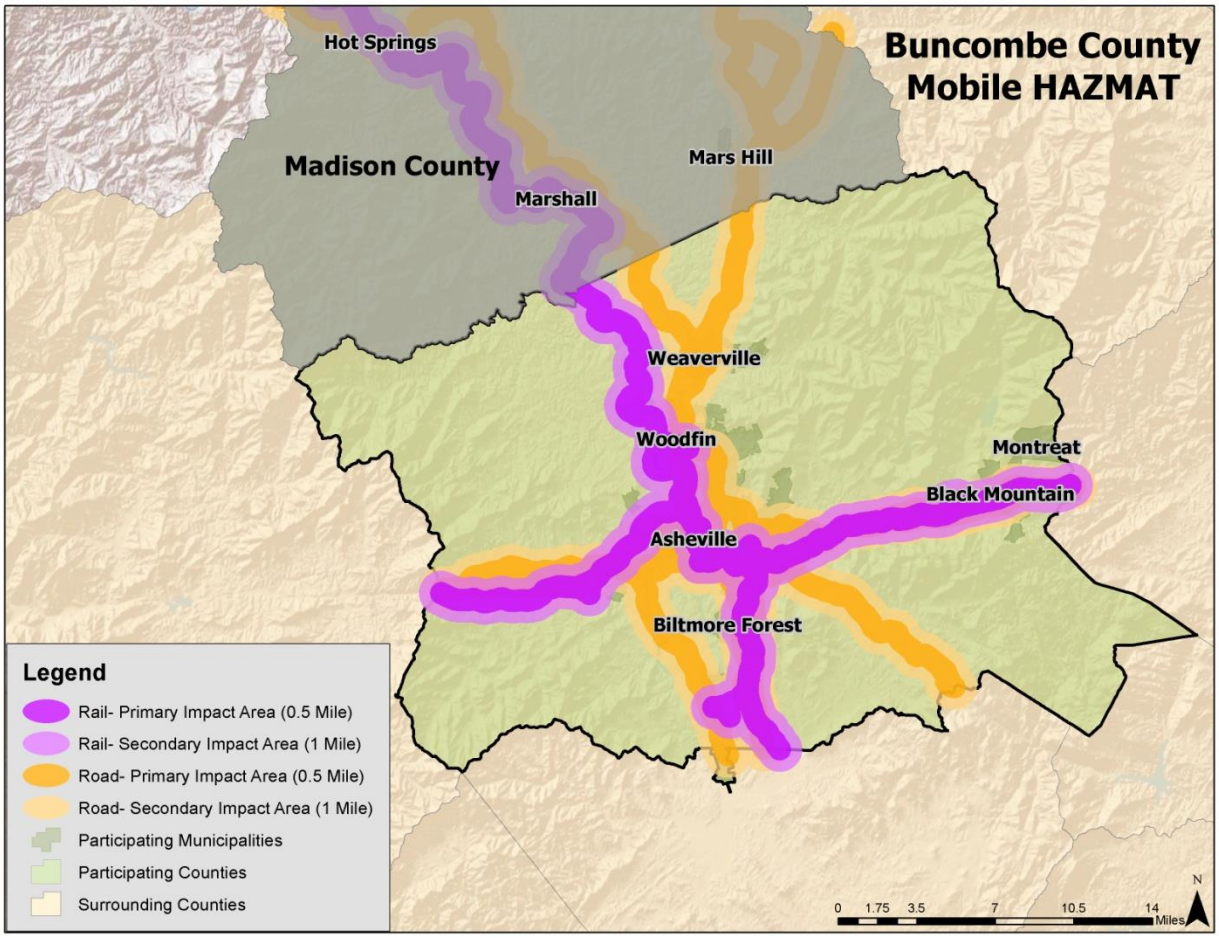


TABLE A.41: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - ROAD)

	0.5-mile buffer			1.0-mile buffer		
Location	**Approx. Number of Parcels**	**Approx. Number Improved**	**Approx. Improved Value**	**Approx. Number of Parcels**	**Approx. Number Improved**	**Approx. Improved Value**
Asheville	28,382	16,772	$5,182,669,403	33,576	20,196	$6,067,660,403
Biltmore Forest	496	439	$243,338,100	692	598	$350,283,600
Black Mountain	2,492	1,575	$306,134,200	3,833	2,445	$420,828,400
Montreat	0	0	$0	0	0	$0
Weaverville	1,311	892	$153,858,300	1,321	893	$154,164,500
Woodfin	1,697	995	$127,685,300	2,418	1,267	$162,655,300
Unincorporated Area	19,291	10,994	$2,635,346,900	32,174	19,145	$4,089,053,500
BUNCOMBE COUNTY TOTAL	**53,669**	**31,667**	**$8,649,032,203**	**74,014**	**44,544**	**$11,244,645,703**

TABLE A.42: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - RAILROAD)

	0.5-mile buffer			1.0-mile buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Asheville	14,437	8,742	$2,538,366,053	25,028	14,732	$4,331,549,053
Biltmore Forest	279	240	$128,667,400	655	563	$325,660,000
Black Mountain	1,964	1,199	$258,706,200	3,503	2,254	$393,220,300
Montreat	0	0	$0	0	0	$0
Weaverville	0	0	$0	0	0	$0
Woodfin	1,468	810	$94,988,200	2,118	1,084	$133,522,200
Unincorporated Area	10,176	5,787	$1,496,278,300	20,723	12,239	$2,632,531,800
BUNCOMBE COUNTY TOTAL	**28,324**	**16,778**	**$4,517,006,153**	**52,027**	**30,872**	**$7,816,483,353**

Social Vulnerability

Given high susceptibility across the entire county, it is assumed that the total population is at risk to hazardous materials incidents. It should be noted that areas of population concentration may be at an elevated risk due to a greater burden to evacuate population quickly.

Critical Facilities

Fixed Site Analysis:

The critical facility analysis for fixed TRI sites revealed that there are 23 Buncombe County facilities located in a HAZMAT risk zone. The primary impact zone includes 9 facilities, 3 fire/EMS stations, 1 police station, and 5 schools. The remaining facilities are in the secondary, 1.0-mile zone. This includes 12 schools, 1 medical care facility, and 1 police station. A list of specific critical facilities and their associated risk can be found in **Table A.45** at the end of this section.

Mobile Analysis:

The critical facility analysis for road and railroad transportation corridors in Buncombe County revealed that there are 68 critical facilities located in the primary and secondary mobile HAZMAT buffer areas for roads and 49 critical facilities located in the railroad HAZMAT buffer areas. The 1.0-mile road buffer area (worst case scenario modeled) includes the following critical facilities: 17 fire/EMS stations, 6 police stations, 4 medical care facilities, and 41 schools. The 1.0-mile railroad buffer areas include the following critical facilities: 11 fire/EMS stations, 5 police stations, 3 medical care facilities, and 30 schools. It should be noted that many of the facilities located in the buffer areas for road are also located in the buffer areas for railroad and/or the fixed site analysis. A list of specific critical facilities and their associated risk can be found in **Table A.45** at the end of this section.

In conclusion, a hazardous material incident has the potential to impact many existing and future buildings, critical facilities, and populations in Buncombe County. Those areas in a primary buffer are at the highest risk, though all areas carry some vulnerability due to variations in conditions that could alter the impact area such direction and speed of wind, volume of release, etc. Further, incidents from neighboring counties could also impact the county and participating jurisdictions.

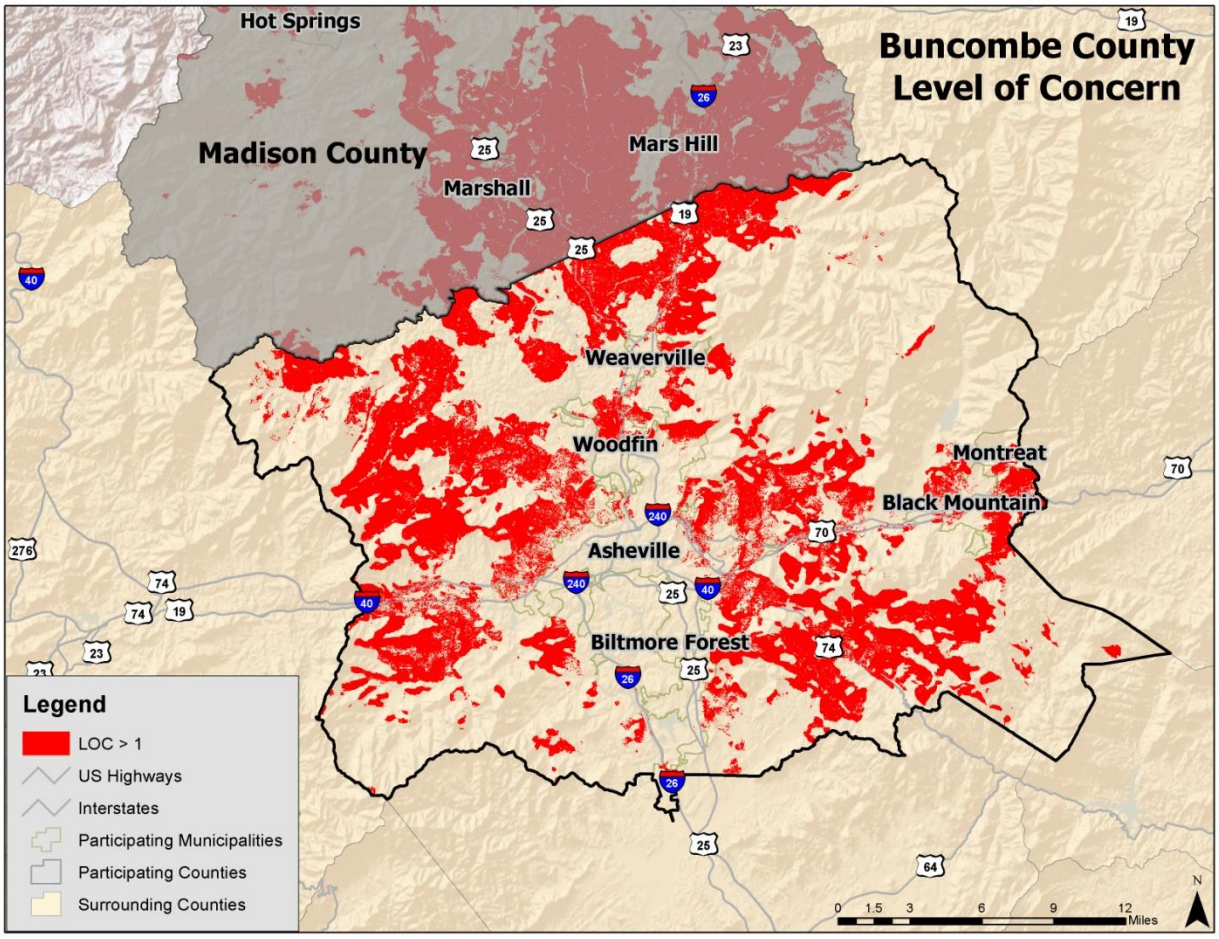
Wildfire

Although historical evidence indicates that Buncombe County is susceptible to wildfire events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. Annualized loss is considered negligible though it should be noted that a single event could result in significant damages throughout the county.

To estimate exposure to wildfire, the approximate number of parcels and their associated improved value was determined using GIS analysis. For the critical facility analysis, areas of concern were intersected with critical facility locations. **Figure A.21**, **Figure A.22**, **Figure A.23**, **Figure A.24**, **Figure A.25**, **Figure A.26**, and **Figure A.27** show the Level of Concern data. Initially provided as raster data, it was converted to a polygon to allow for analysis. The LOC data ranges from 1 to 100 with higher values being most severe (as noted previously, this is only a measure of relative risk). Twenty-five was the highest level recorded in the Buncombe Madison planning area. Therefore, areas with a value above 1 were chosen to be displayed as areas of risk. The county contains numerous areas where the value falls into the at-risk category, making it somewhat more at-risk than many other regions of North Carolina. Since all of this land area is on the lower fourth of the overall LOC scale, there is likely somewhat less risk in the county than in other areas of the country.

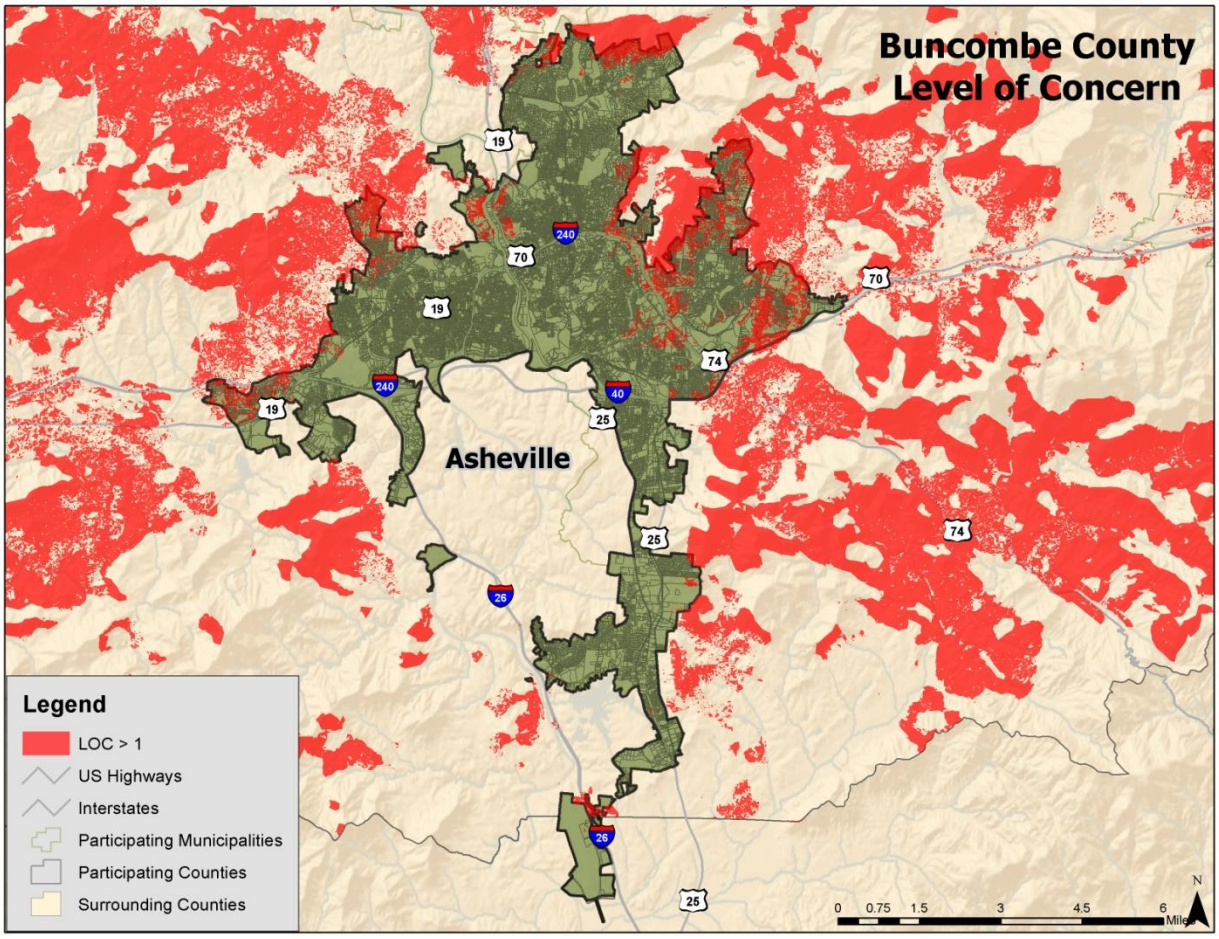
Table A.43 shows the results of the analysis.

FIGURE A.21: WILDFIRE RISK AREAS IN BUNCOMBE COUNTY



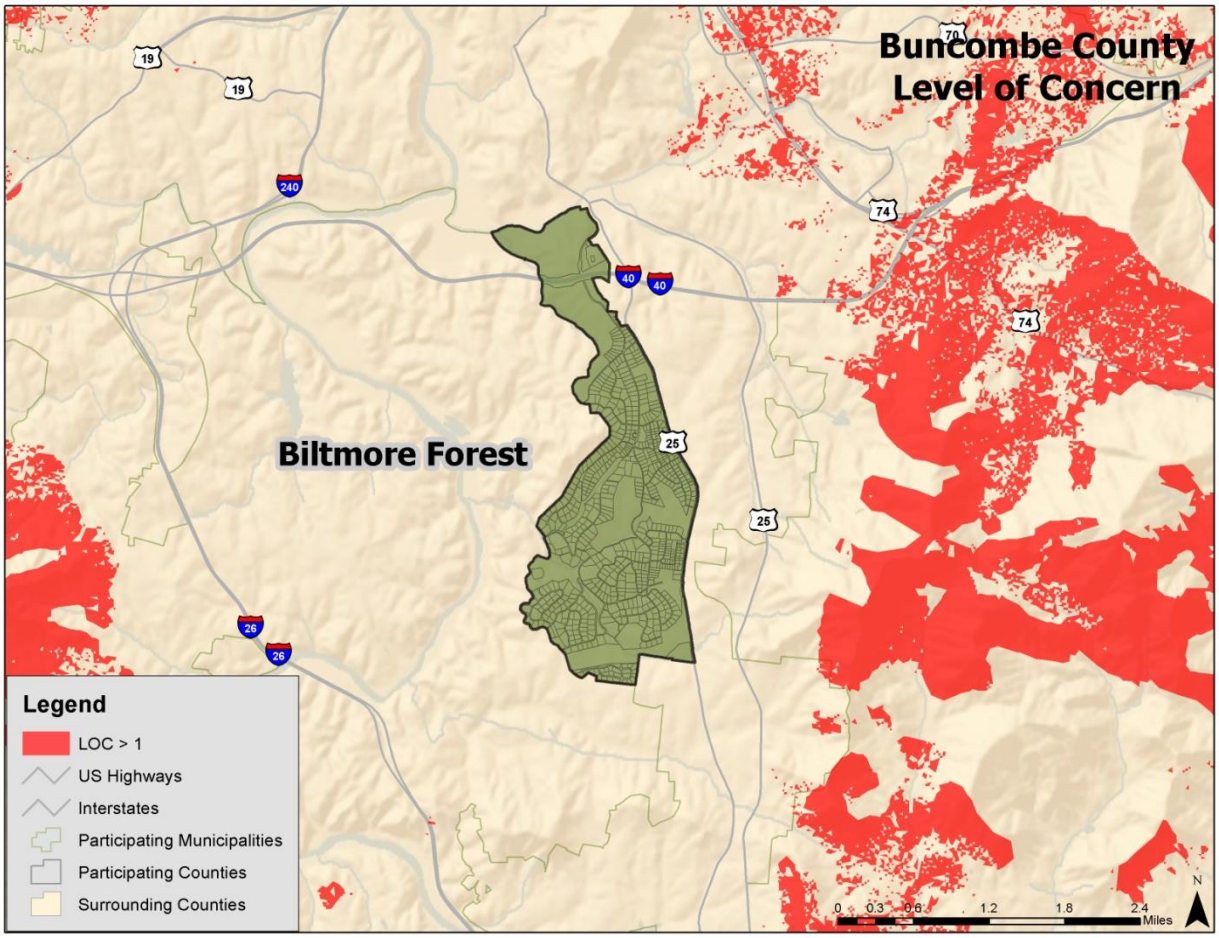
Source: Southern Wildfire Risk Assessment Data

FIGURE A.22: WILDFIRE RISK AREAS IN ASHEVILLE



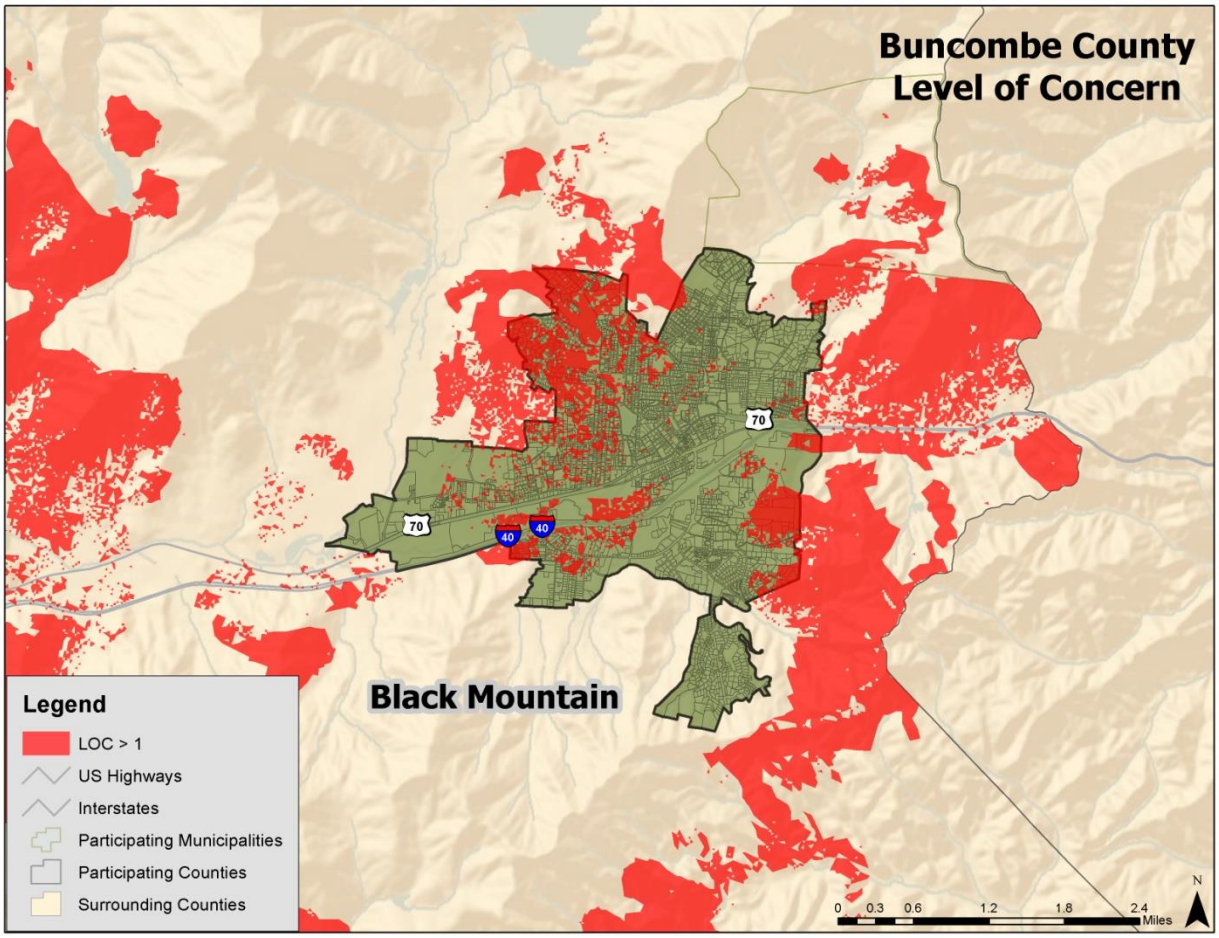
Source: Southern Wildfire Risk Assessment Data

FIGURE A.23: WILDFIRE RISK AREAS IN BILTMORE FOREST



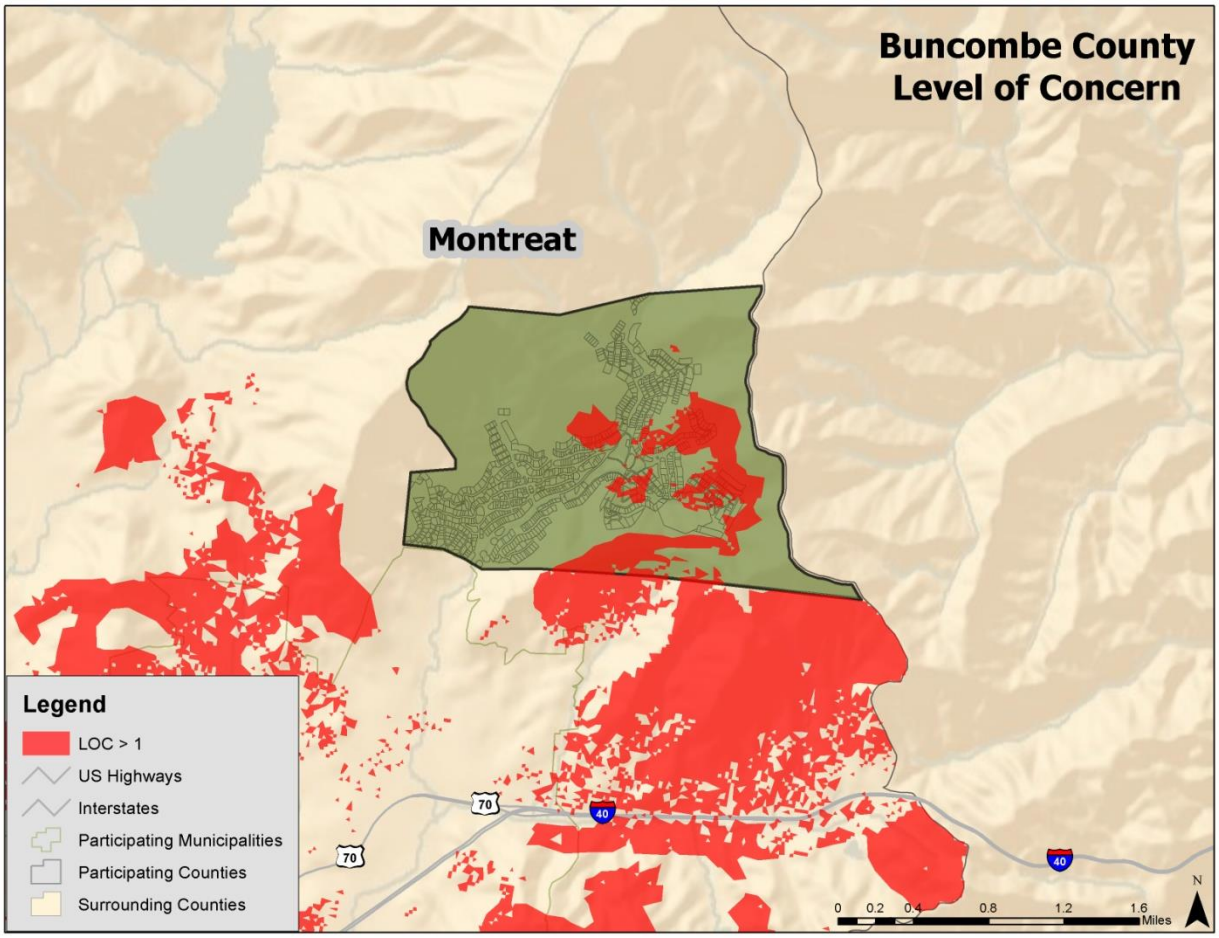
Source: Southern Wildfire Risk Assessment Data

FIGURE A.24: WILDFIRE RISK AREAS IN BLACK MOUNTAIN



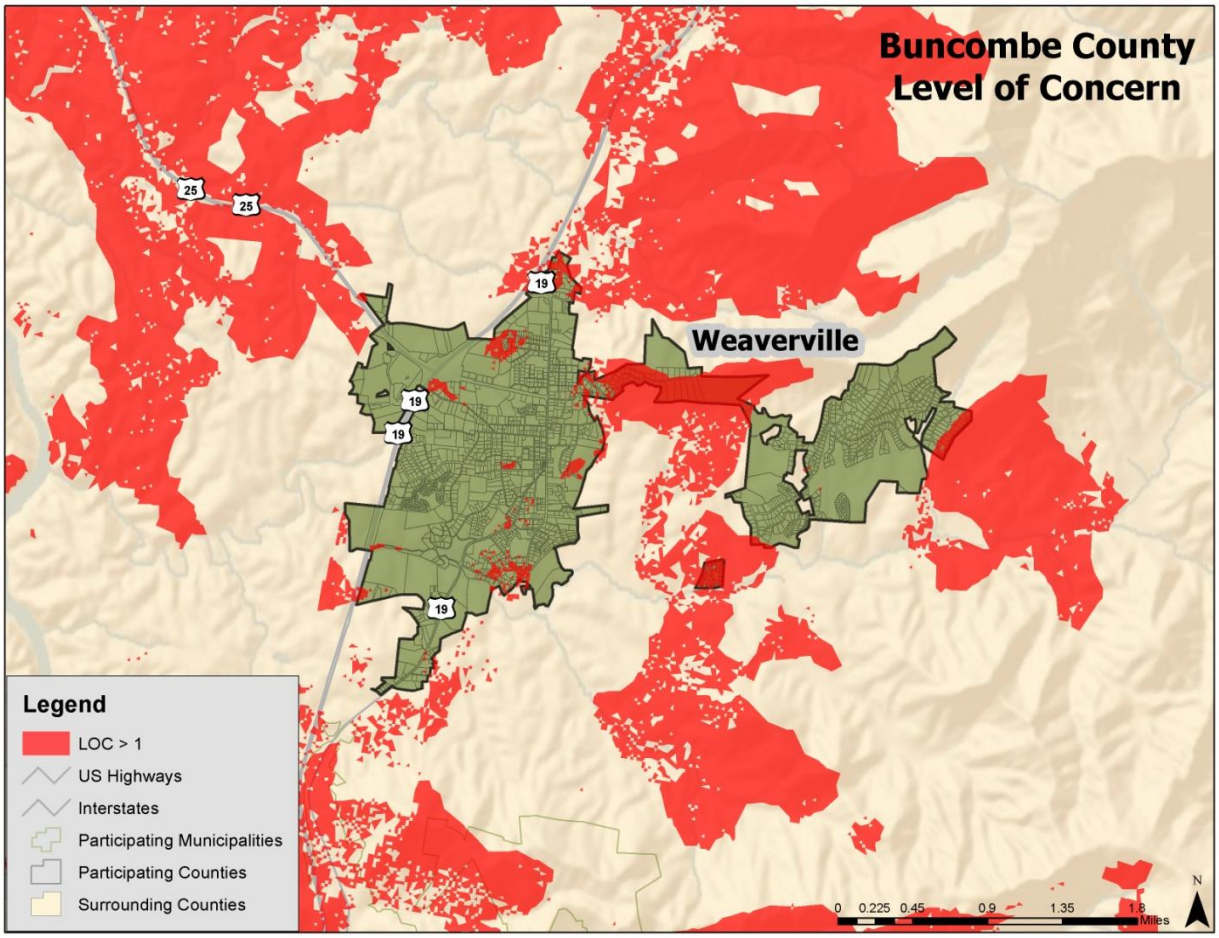
Source: Southern Wildfire Risk Assessment Data

FIGURE A.25: WILDFIRE RISK AREAS IN MONTREAT



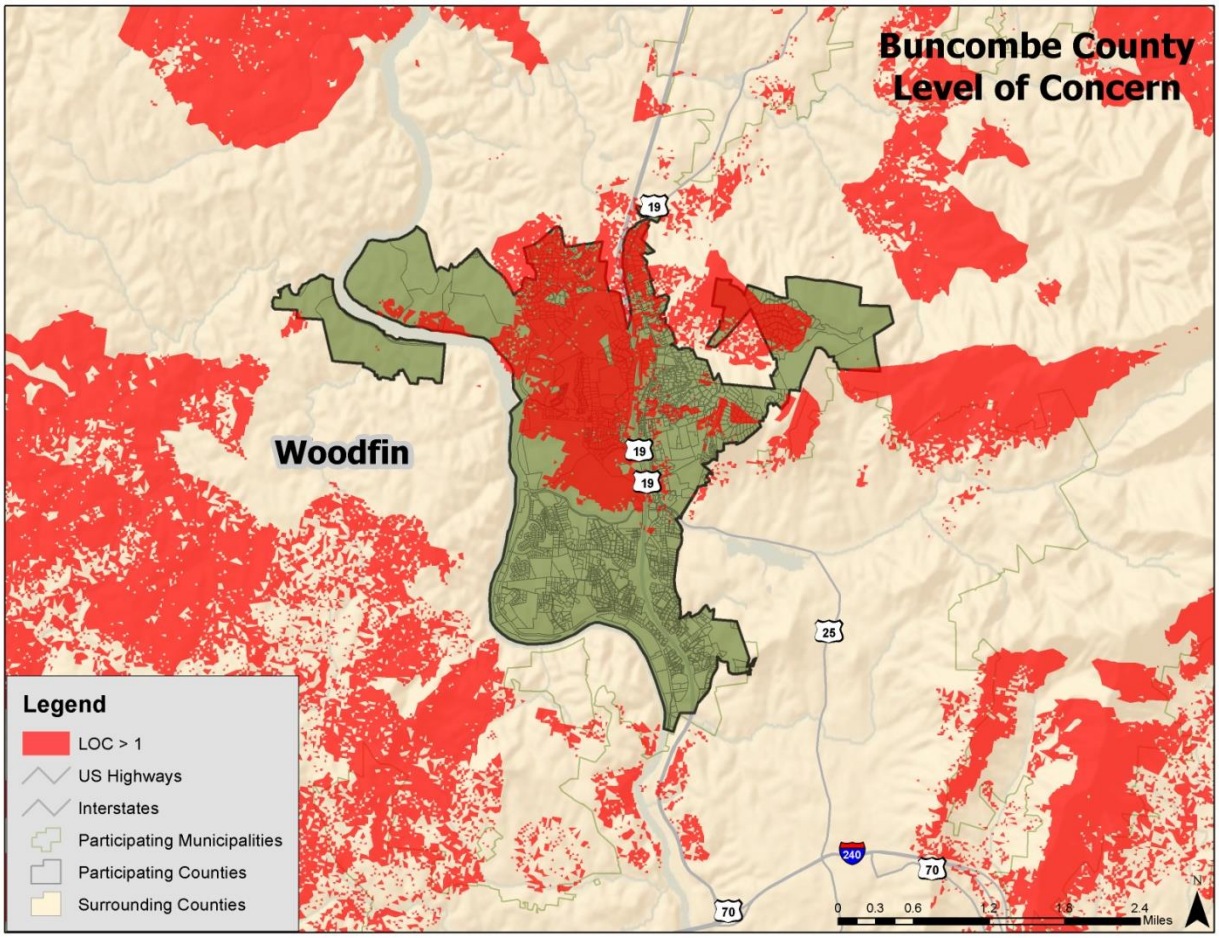
Source: Southern Wildfire Risk Assessment Data

FIGURE A.26: WILDFIRE RISK AREAS IN WEAVERVILLE



Source: Southern Wildfire Risk Assessment Data

FIGURE A.27: WILDFIRE RISK AREAS IN WOODFIN



Source: Southern Wildfire Risk Assessment Data

TABLE A.43: EXPOSURE OF IMPROVED PROPERTY TO WILDFIRE AREAS OF CONCERN

	HIGH WILDFIRE RISK AREA		
Location	**Approx. Number of Parcels**	**Approx. Number of Buildings**	**Approx. Improved Value**
Asheville	4,363	1,957	$612,787,500
Biltmore Forest	0	0	$0
Black Mountain	1,583	681	$103,603,300
Montreat	157	49	$21,310,000
Weaverville	332	118	$25,043,300
Woodfin	959	314	$45,691,100
Unincorporated Area	40,650	20,634	$3,425,534,500
BUNCOMBE COUNTY TOTAL	**48,044**	**23,753**	**$4,233,969,700**

Looking at the jurisdiction level, unincorporated areas of the county face the highest level of concern areas. However, most incorporated areas of the county are surrounded by areas where the level of concern is above 1.

Social Vulnerability
Although not all areas have equal vulnerability, there is some susceptibility across the entire county. It is assumed that the total population is at risk to the wildfire hazard. Determining the exact number of people in certain wildfire zones is difficult with existing data and could be misleading.

Critical Facilities
The critical facility analysis revealed that there are 6 schools, 1 EOC, and 8 fire/EMS stations in the wildfire areas of concern in Buncombe County. It should also be noted, however, that several factors could impact the spread of a wildfire putting all facilities at risk. A list of specific critical facilities and their associated risk can be found in **Table A.45** at the end of this section.

In conclusion, a wildfire event has the potential to impact many existing and future buildings, critical facilities, and populations in Buncombe County.

Conclusions on Hazard Vulnerability
Table A.44 presents a summary of annualized loss for each hazard in Buncombe County. Due to the reporting of hazard damages primarily at the county level, it was difficult to determine an accurate annualized loss estimate for each municipality. Therefore, an annualized loss was determined through the damage reported through historical occurrences at the county level. These values should be used as an additional planning tool or measure risk for determining hazard mitigation strategies throughout the county.

TABLE A.44: ANNUALIZED LOSS FOR BUNCOMBE COUNTY

Event	Buncombe County
Atmospheric Hazards	
Drought	Negligible
Extreme Heat	Negligible
Hailstorm	$407
Hurricane & Tropical Storm	$237,000
Lightning	$26,405
Severe Thunderstorm / High Wind	$78,391
Tornado	$108,278
Winter Storm & Freeze	$323,542
Geologic Hazards	
Earthquake	$129,000
Landslide	$2,906,534
Hydrologic Hazards	
Dam Failure	Negligible
Erosion	Negligible
Flood	$5,379,863
Other Hazards	
HAZMAT Incident	Negligible

Event	Buncombe County
Wildfire	Negligible

*In this table, the term "Negligible" is used to indicate that no records of dollar losses for the particular hazard were recorded. This could be the case either because there were no events that caused dollar damage or because documentation of that particular type of event is not well kept.

As noted previously, all existing and future buildings and populations (including critical facilities) are vulnerable to atmospheric hazards including drought, extreme heat, hailstorm, hurricane and tropical storm, lightning, thunderstorm wind, tornado, and winter storm and freeze. Some buildings may be more vulnerable to these hazards based on locations, construction, and building type. **Table A.45** shows the critical facilities vulnerable to additional hazards analyzed in this section. The table lists those assets that are determined to be exposed to each of the identified hazards (marked with an "**X**").

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TABLE A.45: AT-RISK CRITICAL FACILITIES IN BUNCOMBE COUNTY

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
BUNCOMBE COUNTY																					
Buncombe County EOC	EOC	X	X	X	X	X	X	X	X	X		X									X
Asheville Police Department	Police Station	X	X	X	X	X	X	X	X	X		X					X	X		X	
Buncombe County Government Sheriff's Department	Police Station	X	X	X	X	X	X	X	X	X		X					X	X		X	
Haw Creek	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Skyland	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Beaverdam	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Asheville Fire and Rescue Station 3	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X		X	
NC USAR Task Force 2	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X			
Asheville Fire and Rescue Station 4	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
A-B Tech Community College	School	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	
Charles C. Bell Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X			
Enka Middle	School	X	X	X	X	X	X	X	X	X	X					X	X	X		X	X
Haw Creek Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X			
Johnston Elementary	School	X	X	X	X	X	X	X	X	X		X						X		X	

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
Oakley Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Sand Hill-Venable Elementary	School	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X	
T. C. Roberson High	School	X	X	X	X	X	X	X	X	X		X				X		X		X	
UNCA	School	X	X	X	X	X	X	X	X	X		X					X	X		X	
Valley Springs Middle	School	X	X	X	X	X	X	X	X	X		X				X		X		X	
William W. Estes Elementary	School	X	X	X	X	X	X	X	X	X		X				X		X		X	
Claxton Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X			
Asheville Middle	School	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Asheville High	School	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	
Accelerated Learning Center	School	X	X	X	X	X	X	X	X	X		X					X	X		X	
Hall Fletcher Elementary	School	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	
Isaac Dickson Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Jones Primary Middle	School	X	X	X	X	X	X	X	X	X		X					X	X			
Randolph Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X		X	
Vance Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X		X	
Charles T. Koontz Intermediate	School	X	X	X	X	X	X	X	X	X		X				X		X		X	
Buncombe County Early College	School	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	
Buncombe County Middle College	School	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
Mountain Area Cancer Center	Medical Care Facility	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	
Mission St. Joseph's Hospital	Medical Care Facility	X	X	X	X	X	X	X	X	X		X					X	X		X	
St Joseph's Hospital	Medical Care Facility	X	X	X	X	X	X	X	X	X		X					X	X		X	
Charles George US Veterans Medical Center	Medical Care Facility	X	X	X	X	X	X	X	X	X		X					X	X			
Weaverville Police Department	Police Station	X	X	X	X	X	X	X	X	X		X			X	X	X	X			
Weaverville	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X						X	X			X
Weaverville Company 8	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X						X	X			X
Weaverville	School	X	X	X	X	X	X	X	X	X		X			X	X	X	X			
Weaverville Primary	School	X	X	X	X	X	X	X	X	X		X			X	X	X	X			
Woodfin Police Department	Police Station	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Woodfin	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X						X	X	X	
Woodfin Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Montreat College	School	X	X	X	X	X	X	X	X	X		X									
Black Mountain Police Department	Police Station	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
Black Mountain	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	
Black Mountain Station 2	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X	X	X	X
Black Mountain Station 1	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	
Black Mountain Elementary	School	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	
Black Mountain Primary	School	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	
Biltmore Forest Police Department	Police Station	X	X	X	X	X	X	X	X	X		X					X	X		X	
Barnardsville	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Enka-Candler	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
Fairview	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X			
French Broad	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										X
Garren Creek	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Jupiter	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										
Leicester	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										
Reems Creek	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									X
Reynolds	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X			

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
Riceville	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Swannanoa	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Upper Hominy	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										
West Buncombe	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Leicester - Sandy Mush	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										X
Avery's Creek	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X			X	X					
Hominy	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										
Skyland	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Broad River	Fire/EMS Station	X	X	X	X	X	X	X	X	X											
Enka-Candler	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X						X	X		X	X
Black Mountain Station 3	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Broad River	Fire/EMS Station	X	X	X	X	X	X	X	X	X											
Garren Creek2	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									
Leicester - Newfound	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X										

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
West Buncombe Company 5	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X									X
Enka-Candler Station 1	Fire/EMS Station	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
Reynolds VFD	Fire/EMS Station	X	X	X	X	X	X	X	X	X		X					X	X			
Buncombe Community College	School	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Warren Wilson College	School	X	X	X	X	X	X	X	X	X		X									
A. C. Reynolds High	School	X	X	X	X	X	X	X	X	X		X					X	X			
A. C. Reynolds Middle	School	X	X	X	X	X	X	X	X	X		X					X	X			
Avery's Creek Elementary	School	X	X	X	X	X	X	X	X	X		X									
Barnardsville Elementary	School	X	X	X	X	X	X	X	X	X	X										X
Candler Elementary	School	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
Cane Creek Middle	School	X	X	X	X	X	X	X	X	X		X									
Charles D. Owen Middle	School	X	X	X	X	X	X	X	X	X		X					X	X	X	X	
Charles D. Owen High	School	X	X	X	X	X	X	X	X	X		X								X	
Clyde A. Erwin High	School	X	X	X	X	X	X	X	X	X		X									
Clyde A. Erwin Middle	School	X	X	X	X	X	X	X	X	X		X									
Emma Elementary	School	X	X	X	X	X	X	X	X	X		X			X	X		X	X	X	
Enka High	School	X	X	X	X	X	X	X	X	X	X										
Fairview Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X			X
Glen Arden Elementary	School	X	X	X	X	X	X	X	X	X		X						X		X	

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
Hominy Valley Elementary	School	X	X	X	X	X	X	X	X	X	X					X		X		X	
Leicester Elementary	School	X	X	X	X	X	X	X	X	X	X										
North Buncombe Middle	School	X	X	X	X	X	X	X	X	X	X						X	X			
North Buncombe High	School	X	X	X	X	X	X	X	X	X	X							X			
North Buncombe Elementary	School	X	X	X	X	X	X	X	X	X	X										X
Pisgah Elementary	School	X	X	X	X	X	X	X	X	X	X										
W. D. Williams Elementary	School	X	X	X	X	X	X	X	X	X		X					X	X		X	
West Buncombe Elementary	School	X	X	X	X	X	X	X	X	X		X									
Joe P. Eblen Intermediate	School	X	X	X	X	X	X	X	X	X		X									X
North Windy Ridge Intermediate	School	X	X	X	X	X	X	X	X	X	X						X	X			X

A.4 BUNCOMBE COUNTY CAPABILITY ASSESSMENT

This subsection discusses the capability of Buncombe County to implement hazard mitigation activities. More information on the purpose and methodology used to conduct the assessment can be found in Section 7: *Capability Assessment*.

A.4.1 Planning and Regulatory Capability

Table A.46 provides a summary of the relevant local plans, ordinances, and programs already in place or under development for Buncombe County. A checkmark (✓) indicates that the given item is currently in place and being implemented. An asterisk (*) indicates that the given item is currently being developed for future implementation. Each of these local plans, ordinances, and programs should be considered available mechanisms for incorporating the requirements of the Buncombe Madison Regional Hazard Mitigation Plan.

TABLE A.46: RELEVANT PLANS, ORDINANCES, AND PROGRAMS

Planning Tool/Regulatory Tool	Hazard Mitigation Plan	Comprehensive Land Use Plan	Floodplain Management Plan	Open Space Management Plan (Parks & Rec/Greenway Plan	Stormwater Management Plan/Ordinance	Natural Resource Protection Plan	Flood Response Plan	Emergency Operations Plan	Continuity of Operations Plan	Evacuation Plan	Disaster Recovery Plan	Capital Improvements Plan	Economic Development Plan	Historic Preservation Plan	Flood Damage Prevention Ordinance	Zoning Ordinance	Subdivision Ordinance	Unified Development Ordinance	Post-Disaster Redevelopment Ordinance	Building Code	Fire Code	National Flood Insurance Program (NFIP)	NFIP Community Rating System
BUNCOMBE COUNTY	✓	✓		✓	✓			✓	✓			✓	✓		✓	✓	✓			✓	✓	✓	
Asheville	✓	✓		✓	✓		✓	✓				✓	✓		✓	✓	✓	✓		✓	✓	✓	*
Biltmore Forest	✓	✓		✓	✓			✓					✓		✓	✓	✓			✓	✓	✓	
Black Mountain	✓	✓		✓	✓			✓				✓	✓		✓	✓	✓	✓		✓	✓	✓	
Montreat	✓	✓		✓	✓			✓				✓	✓		✓	✓	✓			✓	✓	✓	
Weaverville	✓	✓		✓	✓			✓				✓	✓		✓	✓	✓	*		✓	✓	✓	
Woodfin	✓	✓		✓	✓			✓							✓	✓	✓			✓	✓	✓	

A more detailed discussion on the county's planning and regulatory capabilities follows.

Emergency Management

Hazard Mitigation Plan
Buncombe County has previously adopted a hazard mitigation plan. The City of Asheville, the Town of Biltmore Forest, the Town of Black Mountain, the Town of Montreat, the Town of Weaverville, and the Town of Woodfin were also included in this plan.

Emergency Operations Plan
Buncombe County maintains an emergency operations plan through its Emergency Management Department. All of the municipalities in Buncombe County have entered into a Civil Preparedness Agreement to implement the county emergency operations plan.

Continuity of Operations Plan
Buncombe County maintains a continuity of operations plan through its Emergency Management Department.

Flood Response Plan
Asheville is the only jurisdiction that has a flood response plan in place. This plan describes temporary and permanent floodproofing measures that may help provide protection to personal safety and property for the Biltmore Village area.

General Planning

Comprehensive Land Use Plan
Buncombe County has adopted a comprehensive land use plan that includes all of its municipalities as well as the unincorporated county. The City of Asheville, the Town of Black Mountain, and the Town of Weaverville each have municipal comprehensive land use plans in place.

Capital Improvements Plan
Buncombe County and all of its municipalities, except the Town of Biltmore Forest and the Town of Woodfin, have capital improvements plans.

Zoning Ordinance
Buncombe County and all of its municipalities have adopted zoning ordinances. The City of Asheville, the Town of Black Mountain, and the Town of Weaverville include zoning regulations as part of their local unified development ordinances. The other municipalities and county have adopted stand-alone zoning ordinances.

Subdivision Ordinance
Buncombe County and all of its municipalities have adopted subdivision regulations. Again, the City of Asheville, the Town of Black Mountain, and the Town of Weaverville include these regulations as part of their local unified development ordinances. The other municipalities and county have adopted stand-alone ordinances.

Building Codes, Permitting, and Inspections
North Carolina has a state compulsory building code which applies throughout the state. The building code is enforced throughout the county by the county building inspector. The City of Asheville, the

Town of Black Mountain, and the Town of Monreat have their own inspections departments that enforce the building code within their town limits.

Floodplain Management

Table A.47 provides NFIP policy and claim information for each participating jurisdiction in Buncombe County.

TABLE A.47: NFIP POLICY AND CLAIM INFORMATION

Jurisdiction	Date Joined NFIP	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Closed Claims	Total Payments to Date
BUNCOMBE COUNTY†	08/01/80	04/03/12	429	$99,682,700	133	$3,299,684
Asheville	07/16/80	01/06/10	456	$127,704,800	227	$13,850,453
Biltmore Forest	03/26/10	01/06/10	3	$395,400	0	$0
Black Mountain	04/15/80	01/06/10	65	$14,309,000	12	$35,989
Montreat	09/19/05	01/06/10	12	$4,210,000	0	$0
Weaverville	05/06/97	01/06/10	14	$3,615,000	0	$0
Woodfin	02/01/80	01/06/10	17	$6,361,700	1	$1,008

†Includes unincorporated areas of county only
Source: NFIP Community Status information as of 10/3/13; NFIP claims and policy information as of 7/31/13

Community Rating System
As of December 2013, the City of Asheville had prepared an application to join the CRS program. Currently, none of the jurisdictions participate in the CRS.

Flood Damage Prevention Ordinance
All communities participating in the NFIP are required to adopt a local flood damage prevention ordinance. Buncombe County and all of its municipalities participate in the NFIP and have adopted flood damage prevention regulations.

Open Space Management Plan
Buncombe County has adopted the Buncombe County Greenways and Trails Master Plan which also includes all of its municipalities. The City of Asheville, the Town of Black Mountain, and the Town of Montreat have each adopted a municipal-level parks or greenways master plan.

Stormwater Management Plan
The Town of Black Mountain is the only jurisdiction with a stormwater management plan in place. However, several jurisdictions have stormwater management ordinances in place. Buncombe County has adopted a stormwater management ordinance that is administered by the county throughout the unincorporated area as well as within the municipal boundaries of the following towns: Biltmore Forest, Montreat, Weaverville, and Woodfin, through interlocal agreement. The City of Asheville, the Town of Black Mountain, and the Town of Montreat administer their own stormwater management ordinances.

A.4.2 Administrative and Technical Capability

Table A.48 provides a summary of the capability assessment results for Buncombe County with regard to relevant staff and personnel resources. A checkmark (✓) indicates the presence of a staff member(s) in that jurisdiction with the specified knowledge or skill.

TABLE A.48: RELEVANT STAFF / PERSONNEL RESOURCES

Staff / Personnel Resource	Planners with knowledge of land development/land management practices	Engineers or professionals trained in construction practices related to buildings and/or infrastructure	Planners or engineers with an understanding of natural and/or human-caused hazards	Emergency Manager	Floodplain Manager	Land Surveyors	Scientists familiar with the hazards of the community	Staff with education or expertise to assess the community's vulnerability to hazards	Personnel skilled in GIS and/or Hazus	Resource development staff or grant writers
BUNCOMBE COUNTY	✓	✓	✓	✓	✓		✓	✓	✓	
Asheville	✓	✓		✓	✓		✓	✓	✓	
Biltmore Forest		✓		✓	✓		✓	✓	✓	
Black Mountain	✓	✓	✓	✓	✓		✓	✓	✓	
Montreat		✓		✓	✓		✓	✓	✓	
Weaverville	✓	✓		✓	✓		✓	✓	✓	
Woodfin		✓		✓	✓					

Credit for having a floodplain manager was given to those jurisdictions that have a flood damage prevention ordinance, and therefore an appointed floodplain administrator, regardless of whether the appointee was dedicated solely to floodplain management. Credit was given for having a scientist familiar with the hazards of the community if a jurisdiction has a Cooperative Extension Service or Soil and Water Conservation Department. Credit was also given for having staff with education or expertise to assess the community's vulnerability to hazards if a staff member from the jurisdiction was a participant on the existing hazard mitigation plan's planning committee.

A.4.3 Fiscal Capability

Table A.49 provides a summary of the results for Buncombe County with regard to relevant fiscal resources. A checkmark (✓) indicates that the given fiscal resource is locally available for hazard mitigation purposes (including match funds for state and federal mitigation grant funds) according to the previous county hazard mitigation plan.

TABLE A.49: RELEVANT FISCAL RESOURCES

Fiscal Tool / Resource	Capital Improvement Programming	Community Development Block Grants (CDBG)	Special Purpose Taxes (or taxing districts)	Gas/Electric Utility Fees	Water/Sewer Fees	Stormwater Utility Fees	Development Impact Fees	General Obligation, Revenue, and/or Special Tax Bonds	Partnering Arrangements or Intergovernmental Agreements	Other: HMGP, FMAP, other Federal and state funding sources, etc.
BUNCOMBE COUNTY	✓	✓							✓	✓
Asheville	✓	✓				✓			✓	✓
Biltmore Forest	✓	✓							✓	✓
Black Mountain	✓	✓							✓	✓
Montreat	✓	✓							✓	✓
Weaverville	✓	✓							✓	✓
Woodfin	✓	✓							✓	✓

A.4.4 Political Capability

The previous hazard mitigation plan indicates that Buncombe County is currently a participant in the NFIP and has adopted the required ordinances related to Flood Damage Prevention, Soil Erosion and Sedimentation Control, Watershed Protection, and Stormwater Management. This demonstrates to some extent both favorable political support and a willingness to adopt hazard mitigation efforts in an active manner.

A.4.5 Conclusions on Local Capability

Table A.50 shows the results of the capability assessment using the designed scoring methodology described in Section 7: *Capability Assessment*. The capability score is based solely on the information found in existing hazard mitigation plans and readily available on the jurisdictions' government

websites. According to the assessment, the average local capability score for the county and its municipalities is 32.4, which falls into the moderate capability ranking.

TABLE A.50: CAPABILITY ASSESSMENT RESULTS

Jurisdiction	Overall Capability Score	Overall Capability Rating
BUNCOMBE COUNTY	40	High
Asheville	39	Moderate
Biltmore Forest	26	Moderate
Black Mountain	37	Moderate
Montreat	30	Moderate
Weaverville	31	Moderate
Woodfin	24	Moderate

A.5 BUNCOMBE COUNTY MITIGATION STRATEGY

This subsection provides the blueprint for Buncombe County to follow in order to become less vulnerable to its identified hazards. It is based on general consensus of the Regional Hazard Mitigation Planning Team and the findings and conclusions of the capability assessment and risk assessment. Additional Information can be found in Section 8: *Mitigation Strategy* and Section 9: *Mitigation Action Plan*.

A.5.1 Mitigation Goals

Buncombe County developed 11 mitigation goals in coordination with the other participating Buncombe Madison Region jurisdictions. The regional mitigation goals are presented in **Table A.51**.

TABLE A.51: BUNCOMBE MADISON REGIONAL MITIGATION GOALS

	Goal
Goal #1	Incorporate hazard mitigation into the planning process of each jurisdiction and continue to carry out hazard mitigation by seeking funding when available.
Goal #2	Evaluate, strengthen, and enforce ordinances.
Goal #3	Increase and enhance public education and awareness regarding disasters and hazard mitigation.
Goal #4	Address stormwater management and impervious surface issues.
Goal #5	Continue participation in the National Flood Insurance Program and investigate participation in the NFIP's Community Rating System.

	Goal
Goal #6	Conduct future development (including infrastructure) in a way that protects human life and property through management of natural features such as floodplains and wetlands and avoids development in known hazard areas. This will also reduce the risk to emergency workers.
Goal #7	Ensure that population growth does not exceed the capacity of evacuation routes.
Goal #8	Protect existing structures through retrofitting or other means.
Goal #9	Enhance the community's capability through the use of mutual aid agreements and sharing of resources at the county and regional level.
Goal #10	Ensure that community officials are well-educated and aware of existing resources, regulations, and procedures related to disasters.
Goal #11	Maintain and monitor the current plan and renew and revise as necessary.

A.5.2 Mitigation Action Plan

The mitigation actions proposed by Buncombe County, the City of Asheville, the Town of Biltmore Forest, the Town of Black Mountain, the Town of Montreat, the Town of Weaverville, and the Town of Woodfin are listed in the following individual Mitigation Action Plans.

Buncombe County Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Incorporate hazard mitigation into the planning process of each jurisdiction.	All	Moderate	Local	County EM	2015, Annual review	In May 2012, Buncombe County adopted the Sustainability Plan. The Plan outlined a five year plan for the County and its residents to make improvements in our community, environment and economy. One of the fourteen goal areas in the Plan is Resistance to Natural and Manmade Hazards". The two objectives under this goal are to: 1) locate critical facilities outside high hazard areas; and 2) Ensure local preparedness for emergencies (floods, fuel shortages, climate change, fire, droughts, earthquakes, food shortages, landslides, hazardous materials incidents, medical epidemics, etc.). In each year's Plan update, current indicators are tracked and strategies for looking forward are shown.
P-2	Continue to carry out the hazard mitigation planning process and seek funding for emerging needs.	All	Moderate	Local	County EM	2015, Annual review	On-going currently as evidenced by update of existing actions and move toward regional plan.
Property Protection							
PP-1	Strengthen the road design and construction as it pertains to the Manufactured Home Park Ordinance.	All	Moderate	Local	County EM/Planning Dept.	Completed	Buncombe County adopted the Manufactured Home Park Ordinance in April 1996. The purpose of the Ordinance is to protect the health, safety and general welfare of citizens of the County, particularly those who are residents of manufactured home parks. New parks and expansions of current parks are required to apply for a manufactured home park permit for construction. Plans are required to contain title block information; project data including the number of lots and acreage disturbed; road and utility information; location of natural features affecting the site, including the location of the 100-year floodplain and floodway; and other information specified in Section 46-65.5 in the Buncombe County Code of Ordinances. In 2006, the requirement was added that all plans or requests must

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							comply with the Buncombe County Fire Prevention Ordinance, and that the County fire marshal provide approval prior to a permit being issued. There are specific street construction standards required in the Ordinance, including a minimum drive width of 16', with all weather surface. Other street considerations include road intersection standards; minimum number of parking spaces per unit; minimum recorded access road right-of-way width; required turnarounds for street lengths over 500'; and road standards determined by road grade. Manufactured home spaces are required to have certain square footage depending on whether the park is served by sewer or septic systems. Each new home space must be located on ground not susceptible to flooding and graded so as to prevent any water from ponding. Each home shall be located at least 20' from any other home, at least 15' from the manufactured home park boundary, and at least 10' from the edge of any interior street. The Ordinance has requirements for all manufactured home parks, related to the provision of solid waste receptacles;the maintenance and safety of the park; adequate potable water supply; and responsibility for ensuring that each home be equipped with anchored steps or stairs from at least two exits. Finally, the Ordinance has penalties for violation and procedures for enforcement. At this time, there is no plan for further amending the road design standards in this Ordinance.
PP-2	Consider strengthening the requirements for road construction for special subdivision through the Subdivision Ordinance	All	Moderate	Local	Planning Dept.	2019	In recent years, Buncombe County has made revisions to its Subdivision Ordinance. The changes to the Subdivision Ordinance included strengthening the requirements for road construction and turn-around specifications to help provide adequate access for emergency vehicles. These changes apply to minor and major subdivisions, and do not apply to subdivisions proposed with three lots or fewer (special subdivisions),

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							or to family subdivisions. Prior to any subdivision being recorded, the Fire Marshal is required to approve the subdivision for emergency services access if the lot is not accessed off a state maintained road. In 2005 requirements were added to require geotechnical reports, soils maps, and compaction testing for roads. Hillside developments on 25% or greater slope were restricted within the 2006 changes. Density is decreased and lot sizes are increased within these areas. Limitations on maximum impervious and disturbed surfaces was added which apply to individual lots with 25% or greater slope within hillside subdivisions. In 2007 changes were made which require that builders on lots subject to the maximum impervious and disturbed areas submit a scaled site plan showing the areas of disturbance and impervious cover. Provisions were included to allow and encourage cluster development in hillside subdivisions. In 2010, additional revisions were made to the Subdivision Ordinance. Pre-application conferences for major subdivisions became a requirement prior to submission of plans. Slope analysis maps became a requirement for all major subdivisions and any subdivision subject to Hillside Development standards. Requirements for minor and major subdivisions during the preliminary plan review to submit proof of permission for waste system and water system were instituted. Also through the 2010 revisions, subdivision roads designated public or private became subject to final approval by the Buncombe County Fire Marshal; the minimum minor subdivision road right-of-way width was increased from 15 feet to 20 feet; and access roads standards to both major and minor subdivisions became eight-inch minimum aggregated base course No. 7 stone with a minimum of 16 feet, subject to Buncombe County Fire Prevention Ordinance and approval by the Buncombe County Fire Marshal. The horizontal

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							centerline design standards for both minor and major subdivisions T-turnaround became a minimum required length of perpendicular cord of 60 feet. Major subdivision road standards minimum pavement width became 18 feet, with two feet of additional drivable surface required capable of supporting the imposed load of fire apparatus weighing at least 75,000 pounds. Any request for variance for road width is now required to be accompanied by a letter from the Fire Marshal approving the alternate method. For minor subdivision roads, and any features such as cul-de-sacs and T-turnarounds, standards for roads less than or equal to ten percent grade began to be required to have an eight-inch minimum aggregated base course. All roads exceeding ten percent grade became required to meet major subdivision road construction standards. Final plan approval is now contingent upon the requirement than an engineer certify compliance with these standards. Within the Hillside Development Standards section of the Subdivision Ordinance (Sec. 70-68), changes were made to the density table for disturbance and minimum lot size. Changes were added to disturbed and impervious surfaces for communal infrastructure. Vegetation removal and re-vegetation requirements were included. Cluster development provisions became one of the types of development within the new Alternative Path Hillside Development standards, which allows for the additional design flexibility and preservation of environmentally sensitive features. The alternative path also recognizes Building and Grading Envelope Conservation development. The alternative path is encouraged in order to limit disturbed areas and preserve ridge tops, woodlands, open spaces, floodplains, moderate and high risk landslide hazard areas and other environmentally sensitive areas. Since the 2010 changes were implemented, road

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							requirements and standards are now being considered for special and family subdivisions. Consideration could be given for a minimum required road width and right-of-way width; road grade and required minimum distance for pull outs for emergency vehicles; requirements for T-turnarounds or cul-desacs; private driveway standards; and minimum access road width standards.
PP-3	Continue to implement the recommendations of the Comprehensive Land Use Plan	All	Moderate	Local	Planning Dept./Board of Commissioners	2015, Annual review	The latest Comprehensive Land Use Plan Update was adopted in September 2013. The Update provides a current assessment of the County while also providing an outlook for future land use patterns and potential strategies to address the County's needs. There is a section in the Comprehensive Land Use Plan Update dedicated to Hazards and the Hazard Mitigation Plan (pages 55-57). The hazards and risks within the County are listed from the Hazard Mitigation Plan. The main regulations identified that the County employs to mitigate these hazards and risks are identified as the zoning overlays, including the Steep Slope/High Elevation Overlay District and the Protected Ridge Overlay District within the Zoning Ordinance, and the Flood Damage Prevention Ordinance. Specific recommendations from the Comprehensive Land Use Plan Update include the following: -Commercial districts should allow a specific height by right, while requests for additional height would be regulated as a Planned Unit Development/Conditional Use Permit. Heights which require a Planned Unit Development/Conditional Use Permit should be subject to specific conditions which protect residential properties, viewsheds, transportation corridors, and regulated airspace; -Modify current land use policies to allow for consideration of potential exemptions and variances as they relate to the Americans with Disability Act; -Align lot sizes to the surrounding land use context

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							including the availability of infrastructure. In areas where public sewer is not available, lot size should be adjusted to allow adequate space for septic facilities. Setbacks should be adjusted to allow for greater flexibility in areas with access to urban infrastructure; -Modify the Zoning Ordinance to create a clear separation between manufactured homes and manufactured home parks within residential districts which are not constrained by environmental factors; -Adopt a policy that defines a permanent single family dwelling as any structure which is utilized as a place of dwelling for more than 180 days each calendar year. Any structure or vehicle which is used in a permanent capacity should adhere to all applicable sections of the North Carolina Building Code or should have the appropriate certifications for HUD-labeled manufactured homes. Structures which are not inspected as permanent single family dwellings should be road ready in order to be utilized as a temporary dwelling. The Zoning Ordinance should prohibit those dwellings which cannot be classified as permanent single-family dwellings or temporary single family dwellings with the exception of tents or other similar amenities that are temporary and incidental to outdoor recreation; -Integrate concepts from cohousing and intentional community models in order to allow for more flexibility in residential options; -Develop a Resort/Conference Center Zoning District in order to accommodate large-scale resort, retreat, or conference facilities; -Adopt a Zoning Overlay District which establishes the limitations required for compliance with Federal Aviation Regulations Part 77, which establishes standards and notification requirements for objects affecting navigable airspace; -Provide an Airport Industrial District which accounts for

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							the land use needs of the Asheville Regional Airport, while allowing industrial and commercial uses which are related to the operation of an airport; -Create incentives for workforce and affordable housing projects through the Planned Unit Development process; -Create a new class of Planned Unit Developments specifically associated with residential development; -Create a new class of Planned Unit Developments specifically associated with Commercial and Mixed Use Developments; -Consider the development of a Conservation District for classification purposes; -Modify the Zoning Ordinance to separate public utility stations and energy generation facilities according to their impact on surrounding neighborhoods; -Continue to encourage and promote the practice of collocation on existing wireless telecommunications towers, and minimize the aesthetic impact by allowing antennas to be added to existing structures and buildings as a means of minimizing the construction of new towers; -Consider incorporating an assessment of a project's connectivity with existing multimodal networks and potential Complete Streets Improvements during the project's review; -Consider incorporating an assessment of a project's interconnectivity potential to the surrounding transportation network, and the potential for coordination with other scheduled projects, during the project's review; -Partner with regional planning initiatives in order to understand efficiencies in service delivery and ensuring citizens needs are met. The Comprehensive Land Use Plan Update addresses the general direction of the County's growth and development; identifies other planning efforts; directs the County's growth and

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							development while considering topographic constraints; and addresses objectives through the specific recommendations which can be made within standing land use policies and regulations.
PP-4	Revise the Erosion Control Ordinance.	FL	Moderate	Local	Planning Dept.	Completed	The County's Soil Erosion and Sedimentation Control Ordinance has been in existence since 1993, and was adopted pursuant to the authority granted in the North Carolina Sedimentation Pollution Control Act of 1973. The purpose of the Ordinance is to regulate certain land disturbing activity to control accelerated erosion and sedimentation in order to prevent the pollution of water and other damage to lakes, watercourses, and other public and private property. The general requirements of the Ordinance include requiring a plan for any land disturbing activity which uncovers one or more acres on a tract of land. In addition, a plan is required for any residential land disturbing activity which uncovers one-quarter acre or more on a lot, parcel, or tract with an average slope of 25% or greater in its natural state, or any residential land disturbing activity which uncovers one-half acre or more on a lot, parcel or tract with an average slope of 15-25% in its natural state, and applies to the Subdivision Ordinance, section 70-68. An additional requirement is that all persons conducting land-disturbing activity shall take all reasonable measures to protect all public and private property from damage caused by such activities. Plans are required to identify critical areas; limit time of exposure; limit exposed areas; control surface water; control sedimentation; and manage stormwater runoff. A notarized statement of financial responsibility and ownership is also required. Maintenance of ground cover following development is required. Civil penalties can be assessed for various violations, with a daily charge, and injunctive relief procedures are outlined. The Ordinance was revised in 2006, and the fee schedule changed in 2011. There are no plans to further

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							revise this Ordinance.
PP-5	Continue to evaluate and revise the stormwater management ordinance in accordance with changes as mandated by state law.	FL	Moderate	Local	Planning Dept.	2015, Annually	Buncombe County adopted the Stormwater Management Ordinance on September 27, 2006. It was adopted to establish minimum requirements for the control of adverse impacts due to stormwater runoff associated with new development. Managing stormwater runoff protects property, lessens stream channel erosion, prevents increased flooding and provides additional protection of floodplains, wetlands and water resources, riparian and aquatic ecosystems. The Ordinance requires permits for residential development activity disturbing one acre or more. Commercial activity requires permits for activities that are on tracts one acre or larger. The Ordinance requires developers to install permanent measures to control the rate of runoff to that which existed prior to development for the 1 year 24 hour storm events.
PP-6	Ensure enforcement of ordinances.	All	Moderate	Local	Planning Dir., Fire Marshal, Erosion Control officer, Storm Water engineer, Building Permits and Inspections Dir., Floodplain Ordinance Administrator, Subdivision Ordinance Administrator, Zoning Staff	2015, Annual review	Each Ordinance is enforced through an individual department. However, the permitting software system Accela can link cases and approvals based on parcel number. There is an order for approval for development activities. The Accela software controls the order for approval of cases and prevents permits from being issued until approvals from other relevant Ordinance administrators is provided. Through this system, for example, building permits are not issued until subdivision approval has been provided, or a building permit for a structure in the floodplain is not issued until floodplain approval has been provided. Another way that Ordinance administrators remain connected is through the Technical Review Committee. The Technical Review Committee consists of representatives from the Fire Marshal's office, Building Permits and Inspections, Planning (Zoning, Subdivision, Floodplain, Stormwater, Erosion Control), and Environmental Health. The Committee meets on a regular basis to review plans before they are presented

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							to the Planning Board, and to discuss changes that are occurring within each of their departments related to Ordinance enforcement.
PP-7	Address the issues of storm water management and impervious surfaces.	FL/ER	Moderate	Local	Stormwater Ordinance Administrator	2015, Annually	This is addressed through the Stormwater Ordinance, see PP-5
PP-8	Continue participation in the National Flood Insurance Program and investigate participation in the NFIP's Community Ratings System.	FL	High	Local	Floodplain Ordinance Administrator	2015, Annual review	The County's Flood Damage Prevention Ordinance regulates development within the 100-year floodplain. The County first adopted the Ordinance in August of 1980 when the County agreed to participate in the National Flood Insurance Program (NFIP). By the joining the NFIP, flood insurance and federal assistance became available to the County and its residents. The Ordinance regulates development within the 100-year floodplain with the purpose of promoting public health, safety, and general welfare and to minimize public and private losses due to flood conditions within flood prone areas. As a condition of continued eligibility in the NFIP, the County must maintain floodplain management regulations that meet the standards of the NFIP regulations. In conjunction with adopting the revised floodplain maps that became effective in January 2010, the County adopted revisions to the Ordinance aimed at improving safety of residents and businesses within and surrounding the 100-year floodplain. Revisions included requiring an additional foot of freeboard (i.e., requiring elevations 2 feet above the base flood elevation) for new structures and utilities within the 100-year floodplain; prohibiting new habitable structures within the floodway; and requiring submission of an elevation certificate for new structures constructed in the 100-year floodplain. Procedurally, when the new maps and revised ordinance were adopted, the Planning Board and subsequently the Board of Commissioners found that these revisions and updates were reasonable, in the public interest, and

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							consistent with the Comprehensive Land Use Plan because they furthered the principles of managing sensitive environmental areas and conservation of critical environmental resources by restricting activities within the 100-year floodplain. It is anticipated that within this Hazard Mitigation Plan Update period, the floodplain maps for Buncombe County will again be updated, and our Ordinance reviewed for compliance with the NFIP requirements and compared with the State's model ordinance for floodplain management standards. With each new remapping, opportunities become available for communicating risk to persons whose property borders rivers and streams. Through public meetings and established communication channels (television, web, Twitter, e-zines, newspaper, etc.), many residents can be reached. For those properties within the 100-year floodplain, and especially for those properties that will be newly placed in the 100-year floodplain through the remapping effort, direct mail notices will be sent, informing residents of the new maps and proposed changes. The continued goals for floodplain management in the County include the following: -Effectively communicate risk for persons who are considering buying or building on properties within the 100-year floodplain; -Locate critical facilities and large scale development outside the 100-year floodplain; -Protect water resources and ecological systems/wildlife through the enforcement of the Flood Damage Prevention Ordinance; -Restore the natural resources and function of floodplains by promoting and working in collaboration with stream restoration and hazard mitigation grant programs; and -Educate the public to help them reduce their

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
							environmental footprints by locating businesses and residences outside the 100-year floodplain when possible.
Public Education and Awareness							
PEA-1	Educate the public regarding hazard mitigation.	All	High	Local	County EM	2015, Annual review and update	Public education is a continuous effort. Information is provided during key time periods such as severe weather awareness week, winter storm season, and severe storm/hurricane season as well as throughout the year as requested by various community groups. Information is provided via brochures and information on the county website regarding grant programs and preparedness efforts individual citizens can take to be ready when a hazard impacts the community.

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City of Asheville Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Incorporate hazard mitigation into the planning process.	All	Moderate	Local	Stormwater Services Manager/ Assistant Fire Chief/Development Services Department	2015, Annual review	Ordinances are developed to address stormwater and flood for new developments, city staff is working with the Army Corps of Engineers in the Swannanoa River Valley to potentially identify and address flood mitigation projects.
P-2	Continue to carry out the hazard mitigation planning process and seek funding for emerging needs.	All	Moderate	Local	Public Works Director/Fire Chief/Planning Director/Chief Code Enforcement Officer	2015	City Staff is working with the Corps of Engineers in identifying future flood mitigation projects and seeking funding for these projects will continue. The city has not received any funding from mitigation programs in the last 5 years.
Property Protection							
PP-1	Ensure enforcement of ordinances.	All	Moderate	Local	Planning, Fire Marshal, Erosion Control Officer, Stormwater Engineer, Building Permits and Inspections, Floodplain Ordinance Administrator , Zoning Staff	2015, Annual review	City Staff actively pursues enforcement issues and maintains records & metrics and will continue to do so going forward.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-2	Address the issues of storm water management and impervious surfaces.	FL/ER	Moderate	Local	Director Public Works and staff	2015, Annually	City Staff has an active stormwater program to identify projects and maintain current public infrastructure. Many improvements have been made to the stormwater system in the past 5 years including drain upgrades, pipe replacements, etc. The city will continue to implement that program going forward.
PP-3	Continue participation in the National Flood Insurance Program and investigate participation in the NFIP's Community Ratings System.	FL	High	Local	Public Relations Staff/Public Works Staff/Development Services Staff	2015, Annual review	Participation in NFIP is on-going. CRS Application filed (score pending). Once achieved, the city will work to enhance rating where possible.
PP-4	Revise the flood hazard ordinance.	FL	High	Local	Chief Code Enforcement Officer/Public Works Staff/Development Services Staff	Completed 1/6/2010	Enforce the current ordinance (no revisions planned at this time)
PP-5	Administer & enforce International Building Codes and Fire Codes for new construction.	All	Moderate	City's General Fund	Chief Code Enforcement Officer	Completed NC State Building Code was adopted in 2012; The International Building Code was adopted in 2009	The city has adopted the NC State Building Code and International Building Code. This action is complete.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Public Education and Awareness Activities							
PEA-1	Educate the public regarding hazard mitigation.	All	High	Local staff	City Public Information Staff	2015, Annually review program	The city has made many efforts to reach out to and educate the public and will continue to do so going forward. Information is provided via brochures and information on the city website regarding grant programs and preparedness efforts individual citizens can take to be ready when a hazard impacts the community.
PEA-2	Manually disperse and have a website plus social media posting which provides information about relevant emergency response and preparedness actions the public can take.	All	High	Local staff	City and Fire Public Information Officer	2015, Annual review and update	New Action
PEA-3	Manually disperse and have a website plus social media posting which provides information about Buncombe County's Hazard Mitigation Plan and relevant mitigation measures the public can take.	All	High	Local staff	City and Fire Public Information Officer	2015, Annual review and update	New Action

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Town of Biltmore Forest Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Incorporate hazard mitigation into the planning process.	All	Moderate	Local	Assistant to Town Administrator	2015, Annual review	In May 2012, Buncombe County adopted the Sustainability Plan. The Plan outlined a five year plan for the County and its residents to make improvements in our community, environment and economy. One of the fourteen goal areas in the Plan is Resistance to Natural and Manmade Hazards". The two objectives under this goal are to: 1) locate critical facilities outside high hazard areas; and 2) Ensure local preparedness for emergencies (floods, fuel shortages, climate change, fire, droughts, earthquakes, food shortages, landslides, hazardous materials incidents, medical epidemics, etc.). In each year's Plan update, current indicators are tracked and strategies for looking forward are shown.
P-2	Continue to carry out the hazard mitigation planning process and seek funding for emerging needs.	All	Moderate	Local	Director of Public Works	2015	This is happening currently as evidenced by update of existing actions and move toward regional plan. The town was a part of applying for funding for this regional plan.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Property Protection							
PP-1	Ensure enforcement of ordinances.	All	Moderate	Local	Zoning Administrator	2015, Annual review	Town Staff actively pursues enforcement issues and maintains records & metrics and will continue to do so going forward.
PP-2	Address the issues of storm water management and impervious surfaces.	FL/ER	Moderate	Local	Director Public Works	2015, Annually	Town Staff has an active stormwater program to identify projects and maintain current public infrastructure. The town will continue to implement that program going forward.
PP-3	Adopt the Stormwater Management Ordinance.	FL	High	Local	Board of Commissioners	Completed	The town has adopted a Stormwater Management Ordinance.
PP-4	Adopt the Flood Damage Prevention Ordinance.	FL	High	Local	Board of Commissioners	Completed	The town has adopted a Flood Damage Prevention Ordinance.
Public Education and Awareness Activities							
PEA-1	Educate the public regarding hazard mitigation.	All	High	Local	Assistant to Town Admin./Town Administrator	2015, Annually review program	The town has made many efforts to reach out to and educate the public and will continue to do so going forward. Information is provided via brochures and information on the county/town websites regarding grant programs and preparedness efforts individual citizens can take to be ready when a hazard impacts the community.

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Town of Black Mountain Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Incorporate hazard mitigation into the Black Mountain planning process by continuing to Integrate HM planning into development plan review processes within the Planning and Development Department.	All	Moderate	Local	Building & Zoning Dept/Planning & Development Dept	2015, Annual review	This is done as the projects develop. For instance, if a developer wants to build in an area that is prone to flooding, the P&D Department will work with the developer to look at different options for construction such as relocating or elevating. The town will continue to work to incorporate hazard mitigation into the overall planning process.
P-2	Update the Land Use Ordinances (including building regulations, subdivision ordinances and zoning regulations) to be consistent with the 2005 NCGS updates to authorizing statutes and to better incorporate HM and public safety needs into land use policies.	All	Moderate	Local	Building & Zoning Dept/Planning & Development Dept	2015, Annual review	Our land use code was updated in 2010. We will continue to incorporate HM planning into development process
P-3	Establish/Continue to implement Best Management Practices and Measurable Goals for each of the six required components for the Black Mountain Stormwater Plan.	FL	Moderate	Local	Stormwater Manager	2015, Annual review	The town has made great strides towards implementing best practices and continues to work on this. Any new projects are subject to our storm water ordinance. Among other requirements, this ordinance requires larger development projects to include a plan for retaining the first inch of rainwater runoff.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-4	Participate in regional work to mitigate flooding through Senate Bill 7 funding.	FL	Moderate	Local	Building & Zoning Dept/Planning & Development Dept	2019	Thus far, the town has not participated in regional work to mitigate flooding due to lack of staff time. This will continue to be a goal going forward.
P-5	Record and maintain all tax parcel information and floodplain locations in a GIS system in order to build the Town's capability to identify areas needing future mitigation.	FL	Moderate	Local	GIS	Completed	This has been done and is in our on-site GIS.
p-6	Develop a database that identifies each property that has received damage due to hazards identified within this mitigation plan. The database should also include a tax identification number of the property, a description of the property damage, the value of the damage, and links to photographs of the damage. Developing this database will allow the Town to easily identify properties at high risk of damage from certain hazards as well as properties, which receive repetitive damage from multiple hazards.	All	Moderate	Local	Building & Zoning Dept/Planning & Development Dept	2019	The town has been w/o a planning director since 2010, so this hasn't been done. This action will remain in the plan going forward.
Property Protection							
PP-1	Ensure consistency in zoning and building inspections enforcement and continue to enforce the International Building Code. Involve local emergency staff and HM principles in development and permitting review.	All	Moderate	Local	Building & Zoning Dept/Planning & Development Dept	2015, Annual review	This is done on a daily basis and as projects develop. The town will continue to ensure consistency in zoning and building inspections in the future.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-2	Investigate participation in the National Flood Insurance Programs Community Ratings System.	FL	Moderate	Local	County Project Impact Coord./EM Planner/Town Floodplain Administrator	2019	The town does not currently participate in the CRS but it will continue to evaluate the viability of participating in the future. There has not been sufficient staff availability to pursue this action.
Public Education and Awareness Activities							
PEA-1	Educate contractors, developers and designers on code changes and new development issues.	All	High	Local	Building & Zoning Dept/Planning & Development Dept	2019	Our building inspector does a good job with this and will continue to do so as part of his job duties. The town will continue to outreach to contractors/developers
PEA-2	Provide new homebuilders with information on quality redevelopment and safe housing development.	All	High	Local	Building Inspections Dept.	2019	We do provide builders with information via our website as well as in office materials. The town will continue to outreach to its citizens.
PEA-3	Manually disperse and have a website posting which provides information about relevant emergency response and preparedness actions the public can take.	All	High	Local	Fire Prevention Officer	2019	This has been done to some extent w/Code Red. Code Red is the town's emergency notification system. The town will continue to outreach to its citizens.
PEA-4	Manually disperse and have a website posting which provides information about Buncombe County's Project Impact and the County's Hazard Mitigation Plan and relevant mitigation measures the public can take.	All	High	Local	Town Manager/Fire Chief/Police Chief	2019	This hasn't been done due to lack of staff time, but we do provide a link to Buncombe County's on our website. The town will continue to outreach to its citizens.

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Town of Montreat Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Appoint a representative to the Hazard Mitigation Plan Evaluation and Revision Committee. Continue to meet as needed.	All	High	Local	Town Administrator /Public Works Director	2015, Annual review	The town has appointed a representative to the Hazard Mitigation Plan Committee and that representative participated in the plan update process. The town will continue to provide a representative to HMP Committee going forward.
P-2	Review resources discussing hazard mitigation concepts.	All	High	Local	Town Administrator	2015, Annual review	The town has annually reviewed all resources discussing hazard mitigation concepts. The town will continue to review these resources and integrate new resources as necessary.
P-3	Develop a mechanism that will ensure review of appropriate policies and procedures following a natural disaster event.	All	High	Local	Town Administrator	Completed	The town has developed a mechanism in conjunction with the county to ensure appropriate policies and procedures are followed in the wake of a disaster event. In the future, the town will continue to follow these policies. This action will be removed from the next update as a capability.
P-4	Develop a checklist in our zoning and building inspections department to ensure consistency in zoning enforcement and to prevent omissions in the evaluation of projects.	All	High	Local	Building Inspector/ Code Administrator	2015, Annual review	The town has developed a building/zoning checklist to ensure consistency in zoning enforcement. This checklist will need to be reviewed and updated annually to ensure applicability of checklist.
P-5	Develop a tracking system in the building inspections department to record the number of plans accepted and rejected and the number of warning and citation issued.	All	High	Local	Building Inspector/ Code Administrator	Completed	The town has developed a tracking system for building inspections to record plans that were accepted/rejected. Since this system is in place, this action will be removed from the next update as a capability.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-6	Report results of inspection/enforcement measures to the Project Impact Coordinator/Emergency Management Planner on a semi-annual basis.	All	High	Local	Town Administrator	2015, Semi-Annual review	On a semi-annual basis, the town has reported the results of inspection/enforcement measures to the PIC or EM Planner. In the future, this reporting process will continue to take place semi-annually.
P-7	Continue to enforce the International Building Code.	All	High	Local	Building Inspector/ Code Administrator	Completed	The International Building Code has been adopted and will continue to be enforced. This action will be removed from the next update as a capability.
P-8	Continue to update the Town of Montreat Emergency Response Ordinance on an annual basis including relevant positions and contact information changes.	All	High	Local	Building Inspector/ Code Administrator	2015, Annual review	The town has worked on updating its ERO an annual basis and will continue to make updates and changes to the ordinance during an annual review period.
P-9	Create a storm sewer system map that identifies and locates stormwater drainage components that include outfalls and receiving streams.	FL	High	Local	Town	Completed	The stormwater sewer system map has been created, so this action will be removed from the next update as a capability.
P-10	Establish a system for inspecting illicit discharges, which shall include employee cross-training for town staff on detecting and reporting illicit discharges.	FL	High	Local	Town	Completed	A system for inspecting illicit discharges has been established, so this action will be removed from the next update as a capability.
P-11	Establish a reporting mechanism for the public to report illicit discharges.	FL	High	Local	Town	Completed	A mechanism has been established for the public to report illicit discharges, so this action will be removed from the next update as a capability.
P-12	Provide a reporting mechanism for the public to notify the appropriate authorities of observed erosion and sedimentation problems.	ER	High	Local	Town	Completed	A reporting mechanism for the public to report erosion/sedimentation problems has been put in place, so this action will be removed from the next update as a capability.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-13	Conduct annual review and update plans for permitted facilities as needed for the Stormwater Management Plan.	FL	High	Local	Town	Completed	The town has developed a list of facilities that need to have plans updated for the Stormwater Management Plan, so this action will be removed from the next update as a capability.
P-14	Purchase a complete GPS setup and provide training on said setup to all pertinent town personnel.	All	High	General Fund Revenue/ Grants	Town	2019	Although some GPS technology is available, the town would like to look into additional components. The town will continue to work to train all pertinent town staff in the latest updates in GPS technology.
Property Protection							
PP-1	Update the zoning ordinance to reflect mitigation planning and safety factors.	All	High	Local	Town Administrator	2019	The zoning ordinance has been updated in many ways to reflect mitigation planning, however there are additional measures that could be added to improve mitigation so the town will work to include those going forward.
PP-2	Develop, implement and enforce an Illicit Discharge Ordinance.	FL	High	Local	Town	Completed	An Illicit Discharge Ordinance has been implemented, so this action will be removed from the next update as a capability.
PP-3	Develop an ordinance to implement and enforce post-construction runoff controls for new development and redevelopment.	FL	High	Local	Town	Completed	An ordinance has been developed to regulate post-construction runoff, so this action will be removed from the next update as a capability.
PP-4	Inspect all facilities and operations with the potential for generating polluted stormwater runoff. Document deficiencies and corrective actions.	FL	High	Local	Town	Completed	A system is in place to have regular inspections for stormwater runoff, so this action will be removed from the next update as a capability.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-5	Investigate participation in the National Flood Insurance Programs Community Ratings System.	FL	High	Local	Town	2019	The town has not joined the CRS, but it will continue to look into the program and work towards developing the necessary programs to join. There has not been sufficient staff availability to pursue this action.
PP-6	Maintain all tax parcel information and floodplain locations in a GIS system in order to build the Towns capability to identify areas needing future mitigation.	All	High	Local	Town	Completed	All tax parcel information is maintained in GIS, so this action will be removed from the next update as a capability.
PP-7	Develop a database that identifies each property that has received damage due to hazards identified within this mitigation plan. The database should also include a tax identification number of the property, a description of the property damage, the value of the damage, and links to photographs of the damage.	All	High	Local	Town	2017	The town has not fully developed a database that identifies properties that have been damaged by past events, in large part because there have not been enough historic events to gain a full perspective of risk. The town will work to continue to develop this database over the next several years.
Natural Resource Protection							
NRP-1	Develop post-construction runoff control measures for protecting Trout Waters in accordance with 15A NCAC .0126	FL	High	Local	Town	Completed	An ordinance has been developed to regulate post-construction runoff, so this action will be removed from the next update as a capability
Public Education and Awareness Activities							
PEA-1	Educate contractors, developers and designers on code changes and new development issues.	All	High	Local	Planning and Inspections Department	2015, Annually	The town has worked to ensure developers and contractors are well-educated on code changes and will continue to keep these interests up to date as new information is developed.
PEA-2	Provide new homebuilders with information on quality redevelopment and safe housing development.	All	High	Local	Planning and Inspections Department	2015, Annual review	The town has provided information on quality redevelopment and safe housing to homebuilders over the past several years and will continue to provide this information. Updates to information will be integrated as well.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PEA-3	Manually disperse and have a website posting which provides information about relevant emergency response and preparedness actions the public can take.	All	High	Local	Planning and Inspections Department	2015, Annual review and update	The town has developed a number or resources for the public to utilize to help with preparedness and these have been dispersed both manually and through the website. The town will work to reach out in new ways going forward, such as through social media, and will also maintain current outreach strategies.
PEA-4	Manually disperse and have a website posting which provides information on Buncombe County's Project Impact and the County's HMP and relevant mitigation measures the public can take.	All	High	Local	Planning and Inspections Department	2015, Annual review and update	The town has developed a number or resources for the public to utilize to help with understanding Project Impact and mitigation and these have been dispersed both manually and through the website. The town will work to reach out in new ways going forward, such as through social media, and will also maintain current outreach strategies.
PEA-5	Prepare a public education program for the Stormwater Management Plan.	FL	High	Local	Regional Stormwater Planning Committee	Completed	The town has implemented the public education program for the Stormwater Management Plan, so this action will be removed from the next update as a capability
PEA-6	Develop and maintain a web site that will offer information on water quality, stormwater projects and activities and ways to contact stormwater program staff.	FL	High	Local	Regional Stormwater Planning Committee	Completed	The town has developed a website on water quality and stormwater projects, so this action will be removed from the next update as a capability
PEA-7	Develop general stormwater educational material targeting school children, homeowners and business.	FL	High	Local	Regional Stormwater Planning Committee	Completed	Educational information on stormwater has been developed, so this action will be removed from the next update as a capability
PEA-8	Distribute written material on stormwater management through utility mail outs and at special events.	FL	High	Local	Regional Stormwater Planning Committee	Completed	Material on stormwater has been distributed through a number of ways, so this action will be removed from the next update as a capability

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PEA-9	Conduct at least one public meeting during the application process to explain the Phase II program. Allow the public an opportunity to review and comment on the stormwater management program.	FL	High	Local	Regional Stormwater Planning Committee	Completed	Public meetings were held during the application process for Phase II to allow review and comment, so this action will be removed from the next update as a capability
PEA-10	Develop educational materials for local developers explaining the local post-construction approval process for stormwater management.	FL	High	Local	Town	Completed	Educational materials have been developed for local developers, so this action will be removed from the next update as a capability
PEA-11	Conduct training on pollution prevention and good housekeeping procedures for the Stormwater Management Plan.	L	High	Local	Town	Completed	Training on pollution prevention and housekeeping procedures for the Stormwater Management Plan have taken place, so this action will be removed from the next update as a capability

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Town of Weaverville Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Incorporate hazard mitigation into the planning process.	All	High	Local	Town Manager	2015, Annual review	In May 2012, Buncombe County adopted the Sustainability Plan. The Plan outlined a five year plan for the County and its residents to make improvements in our community, environment and economy. One of the fourteen goal areas in the Plan is Resistance to Natural and Manmade Hazards". The two objectives under this goal are to: 1) locate critical facilities outside high hazard areas; and 2) Ensure local preparedness for emergencies (floods, fuel shortages, climate change, fire, droughts, earthquakes, food shortages, landslides, hazardous materials incidents, medical epidemics, etc.). In each year's Plan update, current indicators are tracked and strategies for looking forward are shown.
P-2	Identify storm water management best practices, develop a storm water management program, and adopt a stormwater ordinance.	FL	High	Local	Town Manager	Completed	The town has developed a stormwater management program and ordinance and enforces on a regular basis, so this action will be removed from the next update as a capability.
P-3	Refine the Stormwater Management Program and enforce the regulations.	FL	High	Local	Town Manager	2015, Annual review	The town is always working to enforce the regulations of the Stormwater Management Program and will look at refining the program on an annual basis. No major refinements have been made over the past 5 years.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-4	Continue to carry out the hazard mitigation planning process and seek funding for emerging needs.	All	High	Local	Town Manager	2015	This is happening currently as evidenced by update of existing actions and move toward regional plan. The town was a part of applying for funding for this regional plan.
Property Protection							
PP-1	Evaluate and strengthen existing ordinances as needed.	All	High	Local	Town Manager	2015, Annual review	The town has attempted to provide strong ordinances to reduce risk and will continue to look at how it can integrate more mitigation-oriented practices going forward. No major changes to ordinances were made during the past 5 years.
PP-2	Ensure enforcement of ordinances.	All	High	Local	Town Manager	2015, Annual review	Town Staff actively pursues enforcement issues and maintains records & metrics and will continue to do so going forward.
Public Education and Awareness Activities							
PEA-1	Educate the public regarding hazard mitigation using newsletters and special alerts, etc.	All	High	Local	Town Manager	2015, Annually review program	The town has made many efforts to reach out to and educate the public and will continue to do so going forward. Information is provided via brochures and information on the county/town websites regarding grant programs and preparedness efforts individual citizens can take to be ready when a hazard impacts the community.

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Town of Woodfin Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Incorporate hazard mitigation into the planning process.	All	High	Local	Town Administrator/ Board of Aldermen	2015, Annual review	In May 2012, Buncombe County adopted the Sustainability Plan. The Plan outlined a five year plan for the County and its residents to make improvements in our community, environment and economy. One of the fourteen goal areas in the Plan is Resistance to Natural and Manmade Hazards". The two objectives under this goal are to: 1) locate critical facilities outside high hazard areas; and 2) Ensure local preparedness for emergencies (floods, fuel shortages, climate change, fire, droughts, earthquakes, food shortages, landslides, hazardous materials incidents, medical epidemics, etc.). In each year's Plan update, current indicators are tracked and strategies for looking forward are shown.
P-2	Identify storm water management best practices will be and develop a storm water management program and adopt a stormwater ordinance.	FL	High	Local	Town Administrator/ Board of Aldermen	Completed	The town has developed a stormwater management program and ordinance and enforces on a regular basis, so this action will be removed from the next update as a capability.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-3	Refine the Stormwater Management Program and enforce the regulations.	FL	High	Local	Town Administrator/ Board of Aldermen	2015, Annual review	The town is always working to enforce the regulations of the Stormwater Management Program and will look at refining the program on an annual basis. No major changes to stormwater management were made over the past 5 years.
P-4	Continue to carry out the hazard mitigation planning process and seek funding for emerging needs.	All	High	Local	Town Administrator/ Board of Aldermen	2015	This is happening currently as evidenced by update of existing actions and move toward regional plan. The town was a part of applying for funding for this regional plan.
Property Protection							
PP-1	Evaluate and strengthen existing ordinances as needed.	All	High	Local	Town Administrator/ Board of Aldermen	2015, Annual review	The town has attempted to provide strong ordinances to reduce risk and will continue to look at how it can integrate more mitigation-oriented practices going forward.
PP-2	Ensure enforcement of ordinances.	All	High	Local	Town Administrator/ Board of Aldermen	2015, Annual review	Town Staff actively pursues enforcement issues and maintains records & metrics and will continue to do so going forward.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Public Education and Awareness Activities							
PEA-1	Educate the public regarding hazard mitigation. Woodfin should have readily available information on floodplain location, flood insurance, soil conditions, zoning, and long range planning available at Town Hall. The Town can refer citizens to the County's web site which includes information on hazard mitigation. Buncombe County has also supplied hazard mitigation information for airing on its Government Access cable television channel.	All	High	Local	Town Administrator/ Board of Aldermen	2015, Annually review program	The town has made many efforts to reach out to and educate the public and will continue to do so going forward. Information is provided via brochures and information on the county/town websites regarding grant programs and preparedness efforts individual citizens can take to be ready when a hazard impacts the community.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees TS = Thunderstorms EM = Buncombe County Emergency Management Town = Town of Woodfin

Annex B
Madison County

This annex includes jurisdiction-specific information for Madison County and its participating municipalities. It consists of the following five subsections:

- B.1 Madison County Community Profile
- B.2 Madison County Risk Assessment
- B.3 Madison County Vulnerability Assessment
- B.4 Madison County Capability Assessment
- B.5 Madison County Mitigation Strategy

B.1 MADISON COUNTY COMMUNITY PROFILE

B.1.1 Geography and the Environment

Madison County is a western county in the state of North Carolina with its northern edge bordering the state of Tennessee. It comprises three small towns, Hot Springs, Mars Hill, and Marshall, as well as additional small communities

The county is situated in the heart of the Blue Ridge Mountains of the Appalachian Range. The county's terrain consists of relatively steep mountains and beautiful rivers. The county's elevations range from about 1,200 feet to over 5,000 feet. The total area of the county is 451 square miles, with 2 square miles being covered by water.

Summer temperatures in the valley portion of the county range from highs around 85˚Farenheit to lows in the 60s. Winter temperatures in the valley range from highs around 50˚F to lows around 30˚F. Year round, average temperatures in the mountainous areas of the county are typically 10˚F lower than the valley. The county averages over 3 inches of rainfall each month.

B.1.2 Population and Demographics

According to the 2010 Census, Madison County has a population of 20,764 people. The county has seen around 6% growth between 2000 and 2010, and the average population density is 46 people per square mile. Population counts from the US Census Bureau for 1990, 2000, and 2010 for the county and all of the participating jurisdictions are presented in **Table B.1**.

TABLE B.1: POPULATION COUNTS FOR MADISON COUNTY

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Madison County	**16,953**	**19,635**	**20,764**	**5.7%**
Town of Hot Springs	478	645	560	-13.2%
Town of Mars Hill	1,611	1,764	1,869	6.0%

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Town of Masrhall	809	840	872	3.8%

Source: United States Census Bureau

Based on the 2010 Census, the median age of residents of Madison County is 43.3 years. The racial characteristics of the county are presented in **Table B.2**. Whites make up the majority of the population in the county, accounting for around 97 percent of the population.

TABLE B.2: DEMOGRAPHICS OF MADISON COUNTY

Jurisdiction	White, Percent (2010)	Black or African American, Percent (2010)	American Indian or Alaska Native, Percent (2010)	Asian, Percent (2010)	Native Hawaiian or Other Pacific Islander, Percent (2010)	Other Race, Percent (2010)	Two or More Races, percent (2010)	Persons of Hispanic Origin, Percent (2010)*
Madison County	**96.5%**	**1.2%**	**0.2%**	**0.3%**	**0.0%**	**0.5%**	**1.3%**	**2.0%**
Town of Hot Springs	97.9%	0.2%	0.0%	0.0%	0.0%	0.4%	1.6%	2.3%
Town of Mars Hill	87.1%	9.0%	0.2%	1.0%	0.2%	0.6%	1.9%	3.4%
Town of Marshall	97.5%	0.0%	0.8%	0.1%	0.1%	0.0%	1.5%	1.4%

*Hispanics may be of any race, so also are included in applicable race categories
Source: United States Census Bureau

B.1.3 Housing

According to the 2010 US Census, there are 10,608 housing units in Madison County, the majority of which are single family homes or mobile homes. Housing information for the county and towns is presented in **Table B.3**. As shown in the table, the Town of Hot Springs has a higher percentage of seasonal units compared to the rest of county.

TABLE B.3: HOUSING CHARACTERISTICS OF MADISON COUNTY

Jurisdiction	Housing Units (2000)	Housing Units (2010)	Seasonal Units, Percent (2010)	Median Home Value (2007-2011)
Madison County	**9,722**	**10,608**	**9.5%**	**$163,100**
Town of Hot Springs	368	361	16.3%	$100,800
Town of Mars Hill	586	619	2.4%	$179,800
Town of Marshall	868	484	3.5%	$156,100

Source: United States Census Bureau

B.1.4 Infrastructure

Transportation

The Madison County transportation system consists of a few primary roadways. The largest roadway in the county is Interstate 26. Since its completion in 2003, Interstate 26 runs north to south and carries an average of more than 9,300 vehicles per day through the county. The next most traveled roadway is US 25/70. US 25/70 carries an average of 8,300 vehicles per day between the Buncombe County line and

Marshall. Other main roads in the county include NC 213 connecting Mars Hill and Marshall, NC 209 running from Haywood County to Hot Springs, NC 208 in the northwestern portion of the county, and US 19 connecting Mars Hill and Interstate 26 to Burnsville (in Yancey County) and beyond.

In addition to the primary roadways, Madison County also contains three designated North Carolina Scenic Byways. The "Appalachian Medley," along NC 209 and US 25/70, is located in the western part of the county; Interstate 26 from Mars Hill north to Tennessee; and the "French Broad Overview" which mainly follows NC 251 between Alexander and Marshall.

There is currently no airport located within Madison County; however, there is one nearby in Buncombe County. The Asheville Regional Airport is a city-owned public-use airport located in Fletcher. The airport currently offers non-stop commercial flights on four airlines to six major cities.

The Madison County Transportation Authority (MCTA) is the main public transportation provider throughout the county. The MCTA offers transportation services from the populated to remote areas within the county, including outside county boundaries to Haywood, Yancey, and Buncombe Counties as well as the Towns of Newport and Greenville, Tennessee. Northern Southern also operates an active freight train line within Madison County; however, there is currently no passenger service available.

Utilities

Electrical power is provided by the French Broad Electric Membership Corporation. The Public Service Gas of North Carolina (PSNC) only serves the Mars Hill area with natural gas service at this time.

Madison County does not provide water or wastewater services at this time nor does it have any plans to do so in the foreseeable future. The Towns of Hot Springs, Mars Hill, and Marshall each operate their own water and wastewater facilities. Individual wells and septic systems service the remainder of county residents.

Community Facilities

There are a number of buildings and community facilities located throughout Madison County. According to the data collected for the vulnerability assessment (Section 6.4.1), there are 11 fire/EMS stations, 5 police stations, 4 medical care facilities, and 8 public schools located within the county.

The nearest major medical facilities are located in Buncombe County. Several of these facilities are concentrated in the Asheville area; including Mission Hospital and Asheville Surgery Center; a 744-bed general medical and surgical provider; Asheville Specialty Hospital, a 34-bed facility offering long-term acute care; and CarePartners Rehabilitation Hospital, an 80-bed rehabilitation facility. Other medical facilities in the county include Mountain Area Health Education Center (MAHEC), in Asheville, which provides healthcare education and services and The Sisters of Mercy Urgent Care with facilities in West Asheville, South Asheville, and Weaverville.

Madison County also contains several recreation areas. Madison County oversees the Marshall Community Center, Beech Glen, Ebbs Chapel Ball Field, Rock Building (gym), and Barnard Park facilities. Marshall has its own ball field, walking trail, playground, and picnic area. Mars Hill also has its own pool, playground, ball field, picnic area, volleyball court, tennis court, and walking trail facility as well as the Rollins Community Picnic Area and Playground. In addition, there are 10 walking trails located at various community parks and public schools throughout the community.

B.1.5 Land Use

Madison County is a rural, mountains area that is mostly covered with farms, forests, and residents on large parcels. Commercial development primarily occurs within the Towns of Hot Springs, Mars Hill, and Marshall located on the main transportation corridors of US 25/70 and NC 123. Public facilities including schools and medical facilities are predominately located in the towns as well. In addition, there is a small amount of industrial land use and a few manufacturing businesses in the county.

Madison has established various zoning districts; however, only five of them are currently in use. The five in use are: Residential-Agriculture, Residential-Resort, Retail Business, Industrial, and Manufactured Home Park. Approximately 96% of the land in the county's zoning jurisdiction is zoned as Residential-Agriculture. The county along with the Towns of Hot Springs, Mars Hill, and Marshall control land use through zoning and other ordinances to maintain the area's natural beauty.

Local land use (and associated regulations, or lack thereof) is further discussed in *Section 7: Capability Assessment*.

B.1.6 Employment and Industry

Madison County had an average annual employment of 9,223 workers and an average unemployment rate of 9.2 percent in 2012. According to the NCESC, in 2012, the Education and Health Services industry was again the largest employment sector with 40.6 percent of the County's workforce. The other leading industries were Trade, Transportation, and Utilities (14.7%); Public Administration (11.6%); Leisure and Hospitality (10.8%); and Manufacturing (9.5%). The average annual median household income in Madison County was $36,961 from 2010 to 2012.

B.2 MADISON COUNTY RISK ASSESSMENT

This subsection includes hazard profiles for each of the significant hazards identified in Section 4: *Hazard Identification* as they pertain to Madison County. Each hazard profile includes a description of the hazard's location and extent, notable historical occurrences, and the probability of future occurrences. Additional information can be found in Section 5: *Hazard Profiles*.

B.2.1 Drought

Location and Spatial Extent

Drought typically covers a large area and cannot be confined to any geographic or political boundaries. Local areas may experience much more severe and/or frequent drought events than what is represented on the Palmer Drought Severity Index map. Furthermore, it is assumed that the county would be uniformly exposed to drought, making the spatial extent potentially widespread. It is also notable that drought conditions typically do not cause significant damage to the built environment.

Historical Occurrences

According to the North Carolina Drought Monitor, Madison County has had drought occurrences in thirteen of the last fourteen years (2000-2013). **Table B.4** shows the most severe drought classification for each year, according to North Carolina Drought Monitor classifications. It should be noted that the North Carolina Drought Monitor also estimates what percentage of the county is in each classification of

drought severity. For example, the most severe classification reported may be exceptional but a majority of the county may actually be in a less severe condition.

TABLE B. 4: HISTORICAL DROUGHT OCCURRENCES IN MADISON COUNTY

Abnormally Dry **Moderate Drought** **Severe Drought** **Extreme Drought** **Exceptional Drought**

	Madison County
2000	**EXCEPTIONAL**
2001	**EXTREME**
2002	**EXTREME**
2003	NORMAL
2004	ABNORMAL
2005	ABNORMAL
2006	SEVERE
2007	**EXCEPTIONAL**
2008	**EXCEPTIONAL**
2009	SEVERE
2010	MODERATE
2011	MODERATE
2012	MODERATE
2013	ABNORMAL

Source: North Carolina Drought Monitor

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that Madison County has a probability level of likely (10 to 100 percent annual probability) for future drought events. This hazard may vary slightly by location but each area has an equal probability of experiencing a drought. However, historical information also indicates that there is a much lower probability for extreme, long-lasting drought conditions.

B.2.2 Extreme Heat

Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. All of Madison County is susceptible to extreme heat conditions.

Historical Occurrences

Data from the National Climatic Data Center was used to determine historical extreme heat and heat wave events in Madison County. There were no events reported.

In addition, information from the State Climate Office of North Carolina was reviewed to obtain historical temperatures in the county. Temperature information has been reported since 1898. The recorded maximum for Madison County can be found below in **Table B.5**:

TABLE 5.5: HIGHEST RECORDED TEMPERATURE IN MADISON COUNTY

Location	Date	Temperature (F)
Hot Springs 2	6/30/1936	105
MADISON COUNTY MAXIMUM	--	**105**

Source: State Climate Office of North Carolina

The State Climate Office also reports average maximum temperatures in various locations in the county. The most centralized location is Marshall. **Table B.6** shows the average maximum temperatures from 1971 to 2000 at the Marshall observation station which can be used as a general comparison for the county.

TABLE B.6: AVERAGE MAXIMUM TEMPERATURE IN MARSHALL, MADISON COUNTY

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Avg. Max (°F)	45.5	49.9	58.3	66.8	74.6	81.3	84.9	83.8	78.3	68.6	58.2	49.1

Source: State Climate Office of North Carolina

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Madison County has a probability level of unlikely (less than 1 percent annual probability) for future extreme heat events to impact the county.

B.2.3 Hailstorm

Location and Spatial Extent

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. It is assumed that Madison County is uniformly exposed to severe thunderstorms; therefore, all areas of the county are equally exposed to hail which may be produced by such storms.

Historical Occurrences

According to the National Climatic Data Center, 63 recorded hailstorm events have affected Madison County since 1974.[1] **Table B.7** is a summary of the hail events in Madison County. **Table B.8** provides detailed information about each event that occurred in the county. In all, hail occurrences resulted in almost $28,000 (2013 dollars) in property damages. Hail ranged in diameter from 0.75 inches to 1.75 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Climatic Data Center. Therefore, it is likely that damages are greater than the reported value.

TABLE B.7: SUMMARY OF HAIL OCCURRENCES IN MADISON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Hot Springs	4	0/0	$0
Marshall	19	0/0	$27,685

[1] These hail events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional hail events have affected Madison County. In addition to NCDC, the North Carolina Department of Insurance office was contacted for information. As additional local data becomes available, this hazard profile will be amended.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Mars Hill	12	0/0	$0
Unincorporated Area	28	0/0	$0
MADISON COUNTY TOTAL	**63**	**0/0**	**$27,685**

Source: National Climatic Data Center

TABLE B.8: HISTORICAL HAIL OCCURRENCES IN MADISON COUNTY

	Date	Magnitude	Deaths / Injuries	Property Damage*
Hot Springs				
HOT SPGS	20-JUN-97	0.75 in.	0/0	$0
HOT SPGS	30-JUN-98	1.00 in.	0/0	$0
HOT SPGS	14-MAR-06	0.88 in.	0/0	$0
(HSS)HOT SPGS	08-MAY-09	0.75 in.	0/0	$0
Marshall				
MARSHALL	28-JUL-97	0.75 in.	0/0	$0
MARSHALL	07-MAY-98	1.75 in.	0/0	$0
MARSHALL	07-MAY-98	0.75 in.	0/0	$0
MARSHALL	07-MAY-98	1.00 in.	0/0	$0
MARSHALL	23-APR-99	1.00 in.	0/0	$0
MARSHALL	24-JUL-99	0.88 in.	0/0	$0
MARSHALL	04-JUN-02	1.00 in.	0/0	$0
MARSHALL	04-JUN-02	1.25 in.	0/0	$27,685
MARSHALL	15-MAY-03	1.75 in.	0/0	$0
MARSHALL	15-MAY-03	0.75 in.	0/0	$0
MARSHALL	22-APR-05	0.75 in.	0/0	$0
MARSHALL	03-AUG-05	0.75 in.	0/0	$0
MARSHALL	05-AUG-05	0.75 in.	0/0	$0
MARSHALL	03-APR-06	0.75 in.	0/0	$0
MARSHALL	03-MAY-07	1.00 in.	0/0	$0
MARSHALL	12-JUN-07	0.75 in.	0/0	$0
MARSHALL	20-MAY-08	0.75 in.	0/0	$0
MARSHALL	09-JUN-08	0.75 in.	0/0	$0
MARSHALL	09-JUN-11	1.00 in.	0/0	$0
Mars Hill				
MARS HILL	16-JUL-97	0.75 in.	0/0	$0
MARS HILL	08-JAN-98	0.75 in.	0/0	$0
MARS HILL	24-JUL-99	0.88 in.	0/0	$0
MARS HILL	03-JUL-02	1.75 in.	0/0	$0
MARS HILL	22-JUL-02	1.25 in.	0/0	$0
MARS HILL	27-JUN-07	0.75 in.	0/0	$0
MARS HILL	27-JUN-08	0.75 in.	0/0	$0
MARS HILL	20-JUL-09	0.75 in.	0/0	$0
MARS HILL	08-JUN-11	0.75 in.	0/0	$0
MARS HILL	15-MAR-12	1.00 in.	0/0	$0
MARS HILL	15-MAR-12	1.00 in.	0/0	$0
MARS HILL	15-MAR-12	1.00 in.	0/0	$0

	Date	Magnitude	Deaths / Injuries	Property Damage*
Unincorporated Area				
MADISON COUNTY	28-JUN-74	0.75 in.	0/0	$0
MADISON COUNTY	04-JUL-75	0.75 in.	0/0	$0
MADISON COUNTY	15-JUN-80	0.75 in.	0/0	$0
MADISON COUNTY	16-JUN-80	1.75 in.	0/0	$0
MADISON COUNTY	16-JUN-80	1.50 in.	0/0	$0
MADISON COUNTY	27-JUL-81	1.00 in.	0/0	$0
MADISON COUNTY	05-JUN-85	0.88 in.	0/0	$0
BIG LAUREL	07-MAY-98	0.75 in.	0/0	$0
BIG LAUREL	07-MAY-98	0.88 in.	0/0	$0
SPRING CREEK	07-MAY-98	1.75 in.	0/0	$0
SPRING CREEK	25-MAY-98	1.00 in.	0/0	$0
SPRING CREEK	04-JUN-02	1.00 in.	0/0	$0
SPRING CREEK	02-JUL-02	0.75 in.	0/0	$0
BARNARD	03-JUN-09	0.75 in.	0/0	$0
PETERSBURG	03-JUN-09	0.75 in.	0/0	$0
BELVA	09-SEP-09	0.75 in.	0/0	$0
HALLS STORE	09-APR-11	1.75 in.	0/0	$0
BARNARD	09-APR-11	1.50 in.	0/0	$0
PAINT FORK	09-APR-11	1.00 in.	0/0	$0
WALNUT	09-APR-11	1.75 in.	0/0	$0
BARNARD	05-JUN-11	1.00 in.	0/0	$0
WALNUT	21-JUN-11	1.00 in.	0/0	$0
WALNUT	14-AUG-11	1.00 in.	0/0	$0
GRAPEVINE	02-MAR-12	1.25 in.	0/0	$0
BETHEL	02-MAR-12	1.00 in.	0/0	$0
IVY	15-MAR-12	0.75 in.	0/0	$0
IVY	15-MAR-12	1.00 in.	0/0	$0
IVY	15-MAR-12	0.75 in.	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

Based on historical occurrence information, it is assumed that the probability of future hail occurrences is highly likely (100 percent annual probability). Since hail is an atmospheric hazard (coinciding with thunderstorms), it is assumed that Madison County has equal exposure to this hazard. It can be expected that future hail events will continue to cause minor damage to property and vehicles throughout the county.

B.2.4 Hurricane and Tropical Storm

Location and Spatial Extent

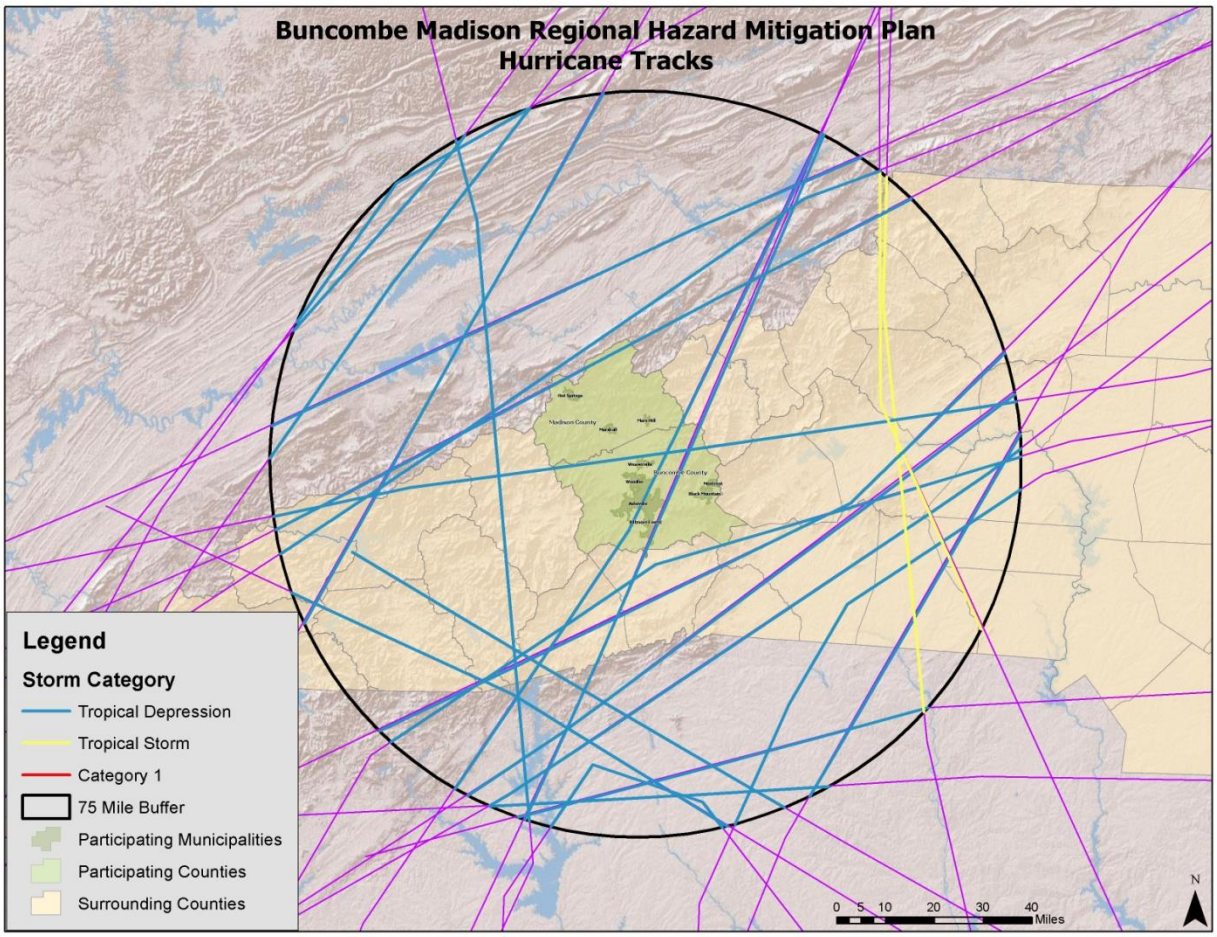
Hurricanes and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect Madison County. The entire county is equally susceptible to hurricane and tropical storms.

Historical Occurrences

According to the National Hurricane Center's historical storm track records, 24 tropical storm tracks have passed within 75 miles of Buncombe Madison Region since 1896.[2] This includes 2 tropical storms and 22 tropical depressions.

Of the recorded storm events, two tropical depressions have traversed directly through Madison County as shown in **Figure B.1**. **Table B.9** provides the date of occurrence, name (if applicable), maximum wind speed (as recorded within 75 miles of the Buncombe Madison Region) and Category of the storm based on the Saffir-Simpson Scale for each event.

FIGURE B.1: HISTORICAL HURRICANE STORM TRACKS WITHIN 75 MILES OF THE BUNCOMBE MADISON REGION



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

[2] These storm track statistics do not include extra-tropical storms. Though these related hazard events are less severe in intensity, they may cause significant local impact in terms of rainfall and high winds.

TABLE B.9: HISTORICAL STORM TRACKS WITHIN 75 MILES OF THE BUNCOMBE MADISON REGION (1850–2008)

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
7/17/1896	NOT NAMED	26.4	Tropical Depression
9/28/1901	NOT NAMED	30.8	Tropical Depression
10/7/1902	NOT NAMED	30.8	Tropical Depression
10/5/1905	NOT NAMED	22	Tropical Depression
9/3/1906	NOT NAMED	26.4	Tropical Depression
9/21/1907	NOT NAMED	30.8	Tropical Depression
8/26/1911	NOT NAMED	22	Tropical Depression
8/30/1913	NOT NAMED	22	Tropical Depression
8/4/1916	NOT NAMED	30.8	Tropical Depression
8/7/1928	NOT NAMED	26.4	Tropical Depression
10/7/1932	NOT NAMED	13.2	Tropical Depression
5/27/1934	NOT NAMED	22	Tropical Depression
8/23/1949	NOT NAMED	--	Tropical Depression
9/20/1959	GRACIE	39.6	Tropical Storm
7/18/1968	CELESTE	22	Tropical Depression
9/14/1975	ELOISE	17.6	Tropical Depression
9/3/1977	BABE	22	Tropical Depression
8/20/1985	ONE-C	22	Tropical Depression
9/22/1989	HUGO	48.4	Tropical Storm
8/14/1994	BERYL	13.2	Tropical Depression
7/6/2003	DOLORES	17.6	Tropical Depression
9/5/2004	FRANCES	22	Tropical Depression
9/6/2004	IVAN	17.6	Tropical Depression
7/3/2005	CINDY	17.6	Tropical Depression

Source: National Hurricane Center

The National Climatic Data Center did not report any events associated with a hurricane or tropical storm in Madison County between 1950 and 2013.

Federal records indicate that two disaster declarations were made in 2004 (Tropical Storm Frances and Hurricane Ivan) for the county.[3]

Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in Madison County. Most events do not carry winds that are above that of the winter storms and straight line winds received by the county. Some anecdotal information is available for the major storms that have impacted that area as found below:

Tropical Storm Frances – September 7-8, 2004
Tropical Storm Frances was a slow-moving, relatively large storm that dumped heavy rains over the eastern United States. The remnants of Frances produced a swath of 5 to 15 inches of rain across the North Carolina Mountains with reports of 12 to 15 inches of rain along the higher terrain and isolated reports in excess of 18 inches. Wind gusts reached between 40 and 60 mph along the Appalachian

[3] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Identification*.

Mountains and numerous trees were downed. Frances caused significant crop damages totaling $55 million statewide. North Carolina residents received almost $20.6 million in federal disaster assistance following the storm.

Hurricane Ivan – September 16-17, 2004
Just a week and a half following Tropical Storm Frances, the remnants of Hurricane Ivan hit western North Carolina when many streams and rivers were already well above flood stage. The widespread flooding forced many roads to be closed and landslides were common across the mountain region. Wind gusts reached between 40 and 60 mph across the higher elevations of the Appalachian Mountains resulting in numerous downed trees. More than $13.8 million of federal aid was dispersed across North Carolina following Ivan.

Probability of Future Occurrences
Given the inland location of the county, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to Madison County due to induced events like flooding and landsliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). Given the regional nature of the hazard, all areas in the county are equally exposed to this hazard. However, when the county is impacted, the damage could be catastrophic, threatening lives and property throughout the planning area.

B.2.5 Lightning

Location and Spatial Extent
Lightning occurs randomly, therefore it is impossible to predict where and with what frequency it will strike. It is assumed that all of Madison County is uniformly exposed to lightning.

Historical Occurrences
According to the National Climatic Data Center, there have been three recorded lightning events in Madison County since 2000.[4] These events resulted in 1 death and almost $308,000 (2013 dollars) in damages, as listed in summary **Table B.10**. Detailed information on those events can be found in **Table B.11.** Many of the reported events are those that caused damage, and it should be expected that damages are likely much higher for this hazard than what is reported.

TABLE B.10: SUMMARY OF LIGHTNING OCCURRENCES IN MADISON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Hot Springs	0	0/0	$0
Marshall	1	0/0	$13,842
Mars Hill	1	0/0	$293,707
Unincorporated Area	1	1/0	$0

[4] These lightning events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional lightning events have occurred in Madison County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
MADISON COUNTY TOTAL	**3**	**1/0**	**$307,549**

Source: National Climatic Data Center

TABLE B.11: HISTORIC LIGHTNING OCCURRENCES IN MADISON COUNTY

	Date	Deaths / Injuries	Property Damage*	Details
Hot Springs				
None Reported	--	--	--	--
Marshall				
MARSHALL	02-JUL-02	0/0	$13,842	Lightning ignited a housefire.
Mars Hill				
MARS HILL	14-JUL-00	0/0	$293,707	Lightning struck a home in Mars Hill, destroying the home and its contents.
Unincorporated Area				
JOE	04-JUN-10	1/0	$0	A 25-year-old woman was struck and killed by lightning while hiking on Max Patch.

Property Damage is reported in 2013 dollars; All damages have not likely been reported.*
Source: National Climatic Data Center

Probability of Future Occurrences

Although there were not a high number of historical lightning events reported throughout Madison County via NCDC data, it is considered a regular occurrence, especially accompanied by thunderstorms. In fact, lightning events will assuredly happen on an annual basis, though not all events will cause damage. According to Vaisala's U.S. National Lightning Detection Network (NLDN®), Madison County is located in an area of the country that experienced an average of 2 to 4 lightning flashes per square kilometer per year between 1997 and 2010. Therefore, the probability of future events is highly likely (100 percent annual probability). It can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the county.

B.2.6 Thunderstorm Wind/High Wind

Location and Spatial Extent

A wind event is an atmospheric hazard, and thus has no geographic boundaries. It is typically a widespread event that can occur in all regions of the United States. However, thunderstorms are most common in the central and southern states because atmospheric conditions in those regions are favorable for generating these powerful storms. Also, Madison County typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that Madison County has uniform exposure to an event and the spatial extent of an impact could be large.

Historical Occurrences

Severe storms have resulted in three disaster declarations in Madison County.[5] According to NCDC, there have been 99 reported thunderstorm and high wind events since 1974 in Madison County.[6] These events caused almost $2.0 million (2013 dollars) in damages. There were reports of five injuries and one fatality. **Table B.12** summarizes this information. **Table B.13** presents detailed thunderstorm and high wind event reports including date, magnitude, and associated damages for each event.[7]

TABLE B.12: SUMMARY OF THUNDERSTORM / HIGH WIND OCCURRENCES IN MADISON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Hot Springs	12	0/0	$0
Marshall	17	0/0	$24,597
Mars Hill	8	0/0	$2,610
Unincorporated Area	62	1/5	$1,951,122
MADISON COUNTY TOTAL	**99**	**1/5**	**$1,978,329**

Source: National Climatic Data Center

TABLE B.13: HISTORICAL THUNDERSTORM / HIGH WIND OCCURRENCES IN MADISON COUNTY

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
Hot Springs					
HOT SPGS	11-MAY-96	TSTM WIND	50 kts.	0/0	$0
HOT SPGS	03-AUG-96	TSTM WIND	50 kts.	0/0	$0
HOT SPGS	30-JUN-98	TSTM WIND	50 kts.	0/0	$0
HOT SPGS	06-JUL-00	TSTM WIND	50 kts.	0/0	$0
HOT SPGS	08-JUL-01	TSTM WIND	60 kts.	0/0	$0
HOT SPGS	26-MAY-04	TSTM WIND	50 kts.	0/0	$0
HOT SPGS	10-MAY-05	TSTM WIND	50 kts.	0/0	$0
HOT SPGS	30-JAN-08	THUNDERSTORM WIND	50 kts.	0/0	$0
HOT SPGS	09-JUN-08	THUNDERSTORM WIND	50 kts.	0/0	$0
HOT SPGS	28-JUN-08	THUNDERSTORM WIND	50 kts.	0/0	$0
(HSS)HOT SPGS	21-JUL-08	THUNDERSTORM WIND	50 kts.	0/0	$0
(HSS)HOT SPGS	01-APR-12	THUNDERSTORM WIND	60 kts.	0/0	$0
Marshall					
MARSHALL	05-MAR-97	TSTM WIND	50 kts.	0/0	$0
MARSHALL	04-JUL-97	TSTM WIND	50 kts.	0/0	$0
MARSHALL	30-JUN-98	TSTM WIND	50 kts.	0/0	$0
MARSHALL	24-JUL-99	TSTM WIND	60 kts.	0/0	$0
MARSHALL	10-AUG-00	TSTM WIND	50 kts.	0/0	$0
MARSHALL	08-JUL-01	TSTM WIND	60 kts.	0/0	$0
MARSHALL	24-JAN-02	TSTM WIND	50 kts.	0/0	$0

[5] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[6] These thunderstorm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional thunderstorm events have occurred in Madison County. As additional local data becomes available, this hazard profile will be amended.
[7] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
MARSHALL	02-JUL-02	TSTM WIND	50 kts.	0/0	$0
MARSHALL	04-JUL-02	TSTM WIND	50 kts.	0/0	$0
MARSHALL	26-MAY-04	TSTM WIND	50 kts.	0/0	$0
MARSHALL	02-AUG-04	TSTM WIND	55 kts.	0/0	$0
MARSHALL	02-APR-06	TSTM WIND	55 kts.	0/0	$24,597
MARSHALL	18-MAY-06	TSTM WIND	50 kts.	0/0	$0
MARSHALL	10-AUG-06	TSTM WIND	50 kts.	0/0	$0
MARSHALL	28-SEP-06	TSTM WIND	55 kts.	0/0	$0
MARSHALL	03-APR-07	THUNDERSTORM WIND	50 kts.	0/0	$0
MARSHALL	26-JUN-08	THUNDERSTORM WIND	50 kts.	0/0	$0
Mars Hill					
MARS HILL	22-JUN-98	TSTM WIND	50 kts.	0/0	$0
MARS HILL	24-JUL-99	TSTM WIND	60 kts.	0/0	$0
MARS HILL	14-JUL-00	TSTM WIND	50 kts.	0/0	$0
MARS HILL	24-JAN-02	TSTM WIND	50 kts.	0/0	$0
MARS HILL	02-JUL-02	TSTM WIND	50 kts.	0/0	$0
MARS HILL	25-JUL-04	TSTM WIND	55 kts.	0/0	$2,610
MARS HILL	20-MAY-06	TSTM WIND	50 kts.	0/0	$0
MARS HILL	31-MAY-06	TSTM WIND	50 kts.	0/0	$0
Unincorporated Area					
MADISON COUNTY	28-JUN-74	TSTM WIND	0 kts.	0/0	$0
MADISON COUNTY	07-MAY-84	TSTM WIND	0 kts.	0/0	$0
MADISON COUNTY	05-JUN-85	TSTM WIND	0 kts.	0/0	$0
MADISON COUNTY	10-JUL-85	TSTM WIND	0 kts.	0/0	$0
MADISON COUNTY	23-APR-88	TSTM WIND	0 kts.	0/0	$0
MADISON COUNTY	26-MAY-89	TSTM WIND	0 kts.	0/0	$0
MADISON COUNTY	09-APR-91	TSTM WIND	0 kts.	0/0	$0
S Portion	20-AUG-93	THUNDERSTORM WINDS	0 kts.	0/0	$0
MADISON COUNTY	05-OCT-95	HIGH WINDS	0 kts.	1/5	$1,657,168
Mountains and Foothillls	11-NOV-95	HIGH WINDS	0 kts.	0/0	$34,524
MADISON COUNTY	18-JAN-96	HIGH WIND	0 kts.	0/0	$5,028
BIG PINE	21-JUN-97	TSTM WIND	50 kts.	0/0	$0
BIG LAUREL	04-JUL-97	TSTM WIND	50 kts.	0/0	$0
MADISON COUNTY	02-NOV-99	HIGH WIND	55 kts.	0/0	$0
MADISON COUNTY	19-MAR-00	HIGH WIND	55 kts.	0/0	$0
MADISON COUNTY	16-DEC-00	HIGH WIND	55 kts.	0/0	$0
MADISON COUNTY	06-MAR-01	HIGH WIND	55 kts.	0/0	$0
SPRING CREEK	09-JUL-01	TSTM WIND	55 kts.	0/0	$0
MADISON COUNTY	13-OCT-01	HIGH WIND	50 kts.	0/0	$0
MADISON COUNTY	29-NOV-01	HIGH WIND	50 kts.	0/0	$0
MADISON COUNTY	04-FEB-02	HIGH WIND	50 kts.	0/0	$0
COUNTYWIDE	02-MAY-02	TSTM WIND	60 kts.	0/0	$6,921
MADISON COUNTY	27-SEP-02	HIGH WIND	50 kts.	0/0	$0
MADISON COUNTY	30-NOV-02	HIGH WIND	50 kts.	0/0	$0
MADISON COUNTY	25-DEC-02	HIGH WIND	50 kts.	0/0	$0

	Date	Type	Magnitude	Deaths / Injuries	Property Damage*
MADISON COUNTY	23-JAN-03	HIGH WIND	60 kts.	0/0	$3,072
ENGLISH	02-MAY-03	TSTM WIND	50 kts.	0/0	$1,344
MADISON COUNTY	14-OCT-03	HIGH WIND	50 kts.	0/0	$1,512
MADISON COUNTY	13-NOV-03	HIGH WIND	50 kts.	0/0	$2,993
MADISON COUNTY	18-NOV-03	HIGH WIND	50 kts.	0/0	$2,496
MADISON COUNTY	07-MAR-04	HIGH WIND	50 kts.	0/0	$9,242
SPRING CREEK	12-JUN-04	TSTM WIND	50 kts.	0/0	$0
SPRING CREEK	05-JUL-04	TSTM WIND	50 kts.	0/0	$0
MADISON COUNTY	05-JUL-04	HIGH WIND	55 kts.	0/0	$1,305
MADISON COUNTY	16-SEP-04	HIGH WIND	55 kts.	0/0	$168,533
MADISON COUNTY	17-SEP-04	HIGH WIND	50 kts.	0/0	$6,116
MADISON COUNTY	01-DEC-04	HIGH WIND	50 kts.	0/0	$0
MADISON COUNTY	23-DEC-04	HIGH WIND	50 kts.	0/0	$6,524
MADISON COUNTY	22-JAN-05	HIGH WIND	60 kts.	0/0	$0
MADISON COUNTY	08-MAR-05	HIGH WIND	60 kts.	0/0	$0
BIG LAUREL	20-MAY-05	TSTM WIND	50 kts.	0/0	$0
SPRING CREEK	19-APR-06	TSTM WIND	50 kts.	0/0	$0
MADISON COUNTY	07-FEB-07	HIGH WIND	55 kts.	0/0	$0
MADISON COUNTY	15-APR-07	HIGH WIND	55 kts.	0/0	$0
MADISON COUNTY	16-APR-07	HIGH WIND	60 kts.	0/0	$28,430
MADISON COUNTY	10-FEB-08	HIGH WIND	55 kts.	0/0	$0
MADISON COUNTY	11-MAY-08	HIGH WIND	60 kts.	0/0	$0
ALLENSTAND	11-FEB-09	THUNDERSTORM WIND	55 kts.	0/0	$0
BARNARD	18-JUN-09	THUNDERSTORM WIND	55 kts.	0/0	$0
BARNARD	18-JUN-09	THUNDERSTORM WIND	50 kts.	0/0	$0
BARNARD	04-AUG-09	THUNDERSTORM WIND	50 kts.	0/0	$0
REVERE	11-AUG-09	THUNDERSTORM WIND	50 kts.	0/0	$0
ALLEGHENY	04-AUG-10	THUNDERSTORM WIND	55 kts.	0/0	$0
BIG LAUREL	05-AUG-10	THUNDERSTORM WIND	50 kts.	0/0	$0
PETERSBURG	05-AUG-10	THUNDERSTORM WIND	50 kts.	0/0	$0
ANTIOCH	25-OCT-10	THUNDERSTORM WIND	55 kts.	0/0	$0
ANTIOCH	27-APR-11	THUNDERSTORM WIND	65 kts.	0/0	$15,914
REDMON	05-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
LONE RIDGE	08-JUN-11	THUNDERSTORM WIND	50 kts.	0/0	$0
LUCK	01-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
FAUST	05-JUL-12	THUNDERSTORM WIND	50 kts.	0/0	$0
BELVA	02-SEP-12	THUNDERSTORM WIND	60 kts.	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

Given the high number of previous events, it is certain that wind events, including straight-line wind and thunderstorm wind, will occur in the future. This results in a probability level of highly likely (100 percent annual probability) for future wind events for the entire county.

B.2.7 Tornado

Location and Spatial Extent

Tornadoes occur throughout the state of North Carolina, and thus in Madison County. Tornadoes typically impact a relatively small area, but damage may be extensive. Event locations are completely random and it is not possible to predict specific areas that are more susceptible to tornado strikes over time. Therefore, it is assumed that Madison County is uniformly exposed to this hazard.

Historical Occurrences

Tornadoes are a fairly rare occurrence in mountainous areas. However, they have and do occur in the Madison County. Tornadoes have not resulted in any disaster declarations in Madison County.[8] According to the National Climatic Data Center, there have been a total of four recorded tornado events in Madison County since 1977 (**Table B.14**), resulting 5 fatalities and in nearly $2.2 million (2013 dollars) in property damages.[9] The magnitude of these tornadoes were all F1 in intensity (**Table B.15**), although an F2 through F5 event is possible. It is important to note that only tornadoes that have been reported are factored into this risk assessment. It is likely that a high number of occurrences have gone unreported over the past 63 years.

TABLE B.14: SUMMARY OF TORNADO OCCURRENCES IN MADISON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Hot Springs	0	0/0	$0
Marshall	0	0/0	$0
Mars Hill	0	0/0	$0
Unincorporated Area	4	0/5	$2,188,556
MADISON COUNTY TOTAL	**4**	**0/5**	**$2,188,556**

Source: National Climatic Data Center

TABLE B.15: HISTORICAL TORNADO IMPACTS IN MADISON COUNTY

	Date	Magnitude	Deaths/ Injuries	Property Damage*	Details
Hot Springs					
None Reported	--	--	--	--	--
Marshall					
None Reported	--	--	--	--	--
Mars Hill					
None Reported	--	--	--	--	--
Unincorporated Area					
MADISON COUNTY	06-JUN-77	F1	0/3	$1,042,170	
MADISON COUNTY	06-JUN-77	F1	0/2	$1,042,170	
MADISON COUNTY	06-JUN-77	F1	0/0	$104,217	

[8]A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.

[9] These tornado events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional tornadoes have occurred in Madison County. As additional local data becomes available, this hazard profile will be amended.

	Date	Magnitude	Deaths/ Injuries	Property Damage*	Details
SPRING CREEK	07-MAY-98	F1	0/0	$0	A tornado pulled a roof partly off a house and damaged three other houses. Debris from the houses was found about a half mile away on another ridge. Numerous trees were blown down through 4:37 pm EDT.

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Probability of Future Occurrences

According to historical information, tornado events are not an annual occurrence for the county. Furthermore, the mountainous terrain of the county makes tornadoes a rare occurrence. While the majority of the reported tornado events are small in terms of size, intensity, and duration, they do pose a significant threat should Madison County experience a direct tornado strike. The probability of future tornado occurrences affecting Madison County is possible (1 to 10 percent annual probability).

B.2.8 Winter Storm and Freeze

Location and Spatial Extent

Nearly the entire continental United States is susceptible to winter storm and freeze events. Some ice and winter storms may be large enough to affect several states, while others might affect limited, localized areas. The degree of exposure typically depends on the normal expected severity of local winter weather. Madison County is accustomed to severe winter weather conditions and frequently receives severe winter weather during the winter months. Given the atmospheric nature of the hazard, the entire county has uniform exposure to a winter storm.

Historical Occurrences

Winter weather has resulted in three disaster declarations in Madison County. This includes the Blizzard of 1996, one subsequent 1996 winter storm, and severe winter storms and flooding in 2010.[10] According to the National Climatic Data Center, there have been a total of 194 recorded winter storm events in Madison County since 1993 (**Table B.16**).[11] These events resulted in nearly $6.4 million (2013 dollars) in damages.[12] Detailed information on the recorded winter storm events can be found in **Table B.17**.

TABLE B.16: SUMMARY OF WINTER STORM EVENTS IN MADISON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Madison County	194	0/0	$6,391,342

Source: National Climatic Data Center

[10] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[11] These ice and winter storm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is certain that additional winter storm conditions have affected Madison County.
[12] The dollar amount of damages provided by NCDC is divided by the number of affected counties to reflect a damage estimate for the county.

TABLE B.17: HISTORICAL WINTER STORM IMPACTS IN MADISON COUNTY

	Date	Type of Storm	Deaths / Injuries	Property Damage*
Hot Springs				
None Reported	--	--	--	--
Marshall				
None Reported	--	--	--	--
Mars Hill				
None Reported	--	--	--	--
Unincorporated Area				
Statewide	12-MAR-93	WINTER STORM	2/10†	$874,516
Northern and Central	03-JAN-94	HEAVY SNOW	0/0	$0
Northern Interior and	10-FEB-94	ICE STORM	0/0	$0
Mountains	14-NOV-95	SNOW	0/0	$0
Mountains and Foothills	09-DEC-95	FREEZING RAIN	0/0	$3,314
Northern Mountains &	23-DEC-95	SNOW	0/0	$0
MADISON COUNTY	27-DEC-95	SNOW	0/0	$0
MADISON COUNTY	06-JAN-96	WINTER STORM	0/0	$0
MADISON COUNTY	11-JAN-96	WINTER STORM	0/0	$0
MADISON COUNTY	26-JAN-96	ICE STORM	0/0	$0
MADISON COUNTY	02-FEB-96	ICE STORM	0/0	$5,363,700
MADISON COUNTY	07-FEB-96	SNOW	0/0	$0
MADISON COUNTY	11-FEB-96	Other	0/0	$0
MADISON COUNTY	12-FEB-96	HEAVY SNOW	0/0	$0
MADISON COUNTY	16-FEB-96	SNOW	0/0	$0
MADISON COUNTY	16-FEB-96	HEAVY SNOW	0/0	$0
MADISON COUNTY	08-MAR-96	HEAVY SNOW	0/0	$0
MADISON COUNTY	20-MAR-96	HEAVY SNOW	0/0	$0
MADISON COUNTY	20-MAR-96	HEAVY SNOW	0/0	$0
MADISON COUNTY	01-APR-96	SNOW	0/0	$0
MADISON COUNTY	08-APR-96	SNOW	0/0	$0
MADISON COUNTY	09-NOV-96	Snow	0/0	$0
MADISON COUNTY	10-NOV-96	Snow	0/0	$0
MADISON COUNTY	05-DEC-96	Snow and Ice	0/0	$0
MADISON COUNTY	08-DEC-96	HEAVY SNOW	0/0	$0
MADISON COUNTY	18-DEC-96	HEAVY SNOW	0/0	$0
MADISON COUNTY	08-JAN-97	Snow and sleet	0/0	$0
MADISON COUNTY	09-JAN-97	ICE STORM	0/0	$149,811
MADISON COUNTY	10-JAN-97	HEAVY SNOW	0/0	$0
MADISON COUNTY	15-JAN-97	Freezing rain	0/0	$0
MADISON COUNTY	05-DEC-97	HEAVY SNOW	0/0	$0
MADISON COUNTY	08-DEC-97	WINTRY MIX	0/0	$0
MADISON COUNTY	27-DEC-97	HEAVY SNOW	0/0	$0
MADISON COUNTY	29-DEC-97	HEAVY SNOW	0/0	$0
MADISON COUNTY	30-DEC-97	HEAVY SNOW	0/0	$0
MADISON COUNTY	18-JAN-98	SNOW	0/0	$0
MADISON COUNTY	18-JAN-98	HEAVY SNOW	0/0	$0

	Date	Type of Storm	Deaths / Injuries	Property Damage*
MADISON COUNTY	24-JAN-98	SNOW	0/0	$0
MADISON COUNTY	27-JAN-98	HEAVY SNOW	0/0	$0
MADISON COUNTY	03-FEB-98	SNOW	0/0	$0
MADISON COUNTY	02-MAR-98	SNOW	0/0	$0
MADISON COUNTY	11-MAR-98	SNOW	0/0	$0
MADISON COUNTY	17-DEC-98	SNOW	0/0	$0
MADISON COUNTY	23-DEC-98	FREEZING RAIN/SLEET	0/0	$0
MADISON COUNTY	31-JAN-99	SNOW AND SLEET	0/0	$0
MADISON COUNTY	13-FEB-99	SNOW	0/0	$0
MADISON COUNTY	19-FEB-99	SNOW	0/0	$0
MADISON COUNTY	24-FEB-99	SNOW	0/0	$0
MADISON COUNTY	28-FEB-99	SNOW	0/0	$0
MADISON COUNTY	01-MAR-99	SNOW	0/0	$0
MADISON COUNTY	03-MAR-99	SNOW	0/0	$0
MADISON COUNTY	03-MAR-99	HEAVY SNOW	0/0	$0
MADISON COUNTY	09-MAR-99	SNOW AND SLEET	0/0	$0
MADISON COUNTY	13-MAR-99	HEAVY SNOW	0/0	$0
MADISON COUNTY	15-MAR-99	SNOW	0/0	$0
MADISON COUNTY	26-MAR-99	HEAVY SNOW	0/0	$0
MADISON COUNTY	29-APR-99	SNOW	0/0	$0
MADISON COUNTY	24-DEC-99	SNOW	0/0	$0
MADISON COUNTY	16-JAN-00	FREEZING RAIN/SLEET	0/0	$0
MADISON COUNTY	18-JAN-00	SNOW	0/0	$0
MADISON COUNTY	20-JAN-00	HEAVY SNOW	0/0	$0
MADISON COUNTY	22-JAN-00	HEAVY SNOW	0/0	$0
MADISON COUNTY	25-JAN-00	HEAVY SNOW	0/0	$0
MADISON COUNTY	29-JAN-00	ICE STORM	0/0	$0
MADISON COUNTY	31-JAN-00	SNOW	0/0	$0
MADISON COUNTY	04-FEB-00	SNOW	0/0	$0
MADISON COUNTY	08-APR-00	SNOW	0/0	$0
MADISON COUNTY	19-NOV-00	SNOW	0/0	$0
MADISON COUNTY	03-DEC-00	SNOW	0/0	$0
MADISON COUNTY	17-DEC-00	SNOW	0/0	$0
MADISON COUNTY	19-DEC-00	HEAVY SNOW	0/0	$0
MADISON COUNTY	30-DEC-00	HEAVY SNOW	0/0	$0
MADISON COUNTY	01-JAN-01	SNOW	0/0	$0
MADISON COUNTY	08-JAN-01	SNOW	0/0	$0
MADISON COUNTY	08-JAN-01	SNOW	0/0	$0
MADISON COUNTY	20-JAN-01	HEAVY SNOW	0/0	$0
MADISON COUNTY	25-JAN-01	SNOW	0/0	$0
MADISON COUNTY	22-FEB-01	SNOW/SLEET	0/0	$0
MADISON COUNTY	06-MAR-01	BLIZZARD	0/0	$0
MADISON COUNTY	20-MAR-01	HEAVY SNOW	0/0	$0
MADISON COUNTY	20-MAR-01	HEAVY SNOW	0/0	$0
MADISON COUNTY	01-APR-01	SNOW	0/0	$0
MADISON COUNTY	06-JAN-02	HEAVY SNOW	0/0	$0

	Date	Type of Storm	Deaths / Injuries	Property Damage*
MADISON COUNTY	03-FEB-02	SNOW	0/0	$0
MADISON COUNTY	06-FEB-02	WINTER WEATHER	0/0	$0
MADISON COUNTY	26-FEB-02	SNOW	0/0	$0
MADISON COUNTY	17-NOV-02	SNOW	0/0	$0
MADISON COUNTY	22-NOV-02	SNOW	0/0	$0
MADISON COUNTY	04-DEC-02	HEAVY SNOW	0/0	$0
MADISON COUNTY	14-DEC-02	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	22-DEC-02	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	25-DEC-02	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	03-JAN-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	06-JAN-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	16-JAN-03	HEAVY SNOW	0/0	$0
MADISON COUNTY	19-JAN-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	23-JAN-03	HEAVY SNOW	0/0	$0
MADISON COUNTY	26-JAN-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	01-FEB-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	06-FEB-03	HEAVY SNOW	0/0	$0
MADISON COUNTY	09-FEB-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	14-FEB-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	18-FEB-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	23-FEB-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	30-MAR-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	30-MAR-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	30-MAR-03	HEAVY SNOW	0/0	$0
MADISON COUNTY	10-APR-03	HEAVY SNOW	0/0	$0
MADISON COUNTY	28-NOV-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	03-DEC-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	04-DEC-03	WINTER STORM	0/0	$0
MADISON COUNTY	05-DEC-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	17-DEC-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	18-DEC-03	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	18-DEC-03	HEAVY SNOW	0/0	$0
MADISON COUNTY	09-JAN-04	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	25-JAN-04	HEAVY SNOW	0/0	$0
MADISON COUNTY	27-JAN-04	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	02-FEB-04	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	07-FEB-04	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	12-FEB-04	HEAVY SNOW	0/0	$0
MADISON COUNTY	15-FEB-04	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	26-FEB-04	HEAVY SNOW	0/0	$0
MADISON COUNTY	18-MAR-04	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	30-MAR-04	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	11-DEC-04	HEAVY SNOW	0/0	$0
MADISON COUNTY	14-DEC-04	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	19-DEC-04	HEAVY SNOW	0/0	$0
MADISON COUNTY	21-DEC-04	WINTER WEATHER/MIX	0/0	$0

	Date	Type of Storm	Deaths / Injuries	Property Damage*
MADISON COUNTY	16-JAN-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	22-JAN-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	02-FEB-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	10-FEB-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	27-FEB-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	28-FEB-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	01-MAR-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	01-MAR-05	HEAVY SNOW	0/0	$0
MADISON COUNTY	08-MAR-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	11-MAR-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	17-MAR-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	02-APR-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	23-APR-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	21-NOV-05	WINTER WEATHER/MIX	0/0	$0
MADISON COUNTY	03-DEC-05	WINTER WEATHER	0/0	$0
MADISON COUNTY	08-DEC-05	WINTER WEATHER	0/0	$0
MADISON COUNTY	11-DEC-05	WINTER WEATHER	0/0	$0
MADISON COUNTY	15-DEC-05	WINTER WEATHER	0/0	$0
MADISON COUNTY	26-DEC-05	WINTER WEATHER	0/0	$0
MADISON COUNTY	14-JAN-06	HEAVY SNOW	0/0	$0
MADISON COUNTY	14-JAN-06	WINTER WEATHER	0/0	$0
MADISON COUNTY	30-JAN-06	WINTER WEATHER	0/0	$0
MADISON COUNTY	04-FEB-06	WINTER WEATHER	0/0	$0
MADISON COUNTY	08-FEB-06	WINTER WEATHER	0/0	$0
MADISON COUNTY	11-FEB-06	WINTER WEATHER	0/0	$0
MADISON COUNTY	11-FEB-06	HEAVY SNOW	0/0	$0
MADISON COUNTY	18-FEB-06	WINTER WEATHER	0/0	$0
MADISON COUNTY	20-MAR-06	WINTER WEATHER	0/0	$0
MADISON COUNTY	22-MAR-06	WINTER WEATHER	0/0	$0
MADISON COUNTY	25-MAR-06	HEAVY SNOW	0/0	$0
MADISON COUNTY	19-NOV-06	WINTER WEATHER	0/0	$0
MADISON COUNTY	07-DEC-06	WINTER WEATHER	0/0	$0
MADISON COUNTY	26-DEC-06	HEAVY SNOW	0/0	$0
MADISON COUNTY	09-JAN-07	HEAVY SNOW	0/0	$0
MADISON COUNTY	21-JAN-07	WINTER WEATHER	0/0	$0
MADISON COUNTY	25-JAN-07	WINTER WEATHER	0/0	$0
MADISON COUNTY	28-JAN-07	WINTER WEATHER	0/0	$0
MADISON COUNTY	01-FEB-07	WINTER WEATHER	0/0	$0
MADISON COUNTY	17-FEB-07	HEAVY SNOW	0/0	$0
MADISON COUNTY	06-APR-07	HEAVY SNOW	0/0	$0
MADISON COUNTY	08-APR-07	FROST/FREEZE	0/0	$0
MADISON COUNTY	15-APR-07	HEAVY SNOW	0/0	$0
MADISON COUNTY	01-JAN-08	HEAVY SNOW	0/0	$0
MADISON COUNTY	19-JAN-08	WINTER WEATHER	0/0	$0
MADISON COUNTY	26-FEB-08	HEAVY SNOW	0/0	$0
MADISON COUNTY	27-OCT-08	WINTER WEATHER	0/0	$0

	Date	Type of Storm	Deaths / Injuries	Property Damage*
MADISON COUNTY	16-NOV-08	WINTER WEATHER	0/0	$0
MADISON COUNTY	18-NOV-08	WINTER WEATHER	0/0	$0
MADISON COUNTY	21-NOV-08	WINTER WEATHER	0/0	$0
MADISON COUNTY	01-DEC-08	HEAVY SNOW	0/0	$0
MADISON COUNTY	23-DEC-08	WINTER WEATHER	0/0	$0
MADISON COUNTY	18-JAN-09	HEAVY SNOW	0/0	$0
MADISON COUNTY	01-MAR-09	HEAVY SNOW	0/0	$0
MADISON COUNTY	07-APR-09	HEAVY SNOW	0/0	$0
MADISON COUNTY	17-OCT-09	WINTER WEATHER	0/0	$0
MADISON COUNTY	30-DEC-09	WINTER WEATHER	0/0	$0
MADISON COUNTY	02-JAN-10	WINTER WEATHER	0/0	$0
MADISON COUNTY	04-JAN-10	WINTER WEATHER	0/0	$0
MADISON COUNTY	15-FEB-10	HEAVY SNOW	0/0	$0
MADISON COUNTY	05-NOV-10	HEAVY SNOW	0/0	$0
MADISON COUNTY	15-DEC-10	WINTER WEATHER	0/0	$0
MADISON COUNTY	10-JAN-11	HEAVY SNOW	0/0	$0
MADISON COUNTY	07-DEC-11	WINTER WEATHER	0/0	$0
MADISON COUNTY	29-OCT-12	HEAVY SNOW	0/0	$0
MADISON COUNTY	05-NOV-12	WINTER WEATHER	0/0	$0

*Property damage is reported in 2013 dollars; All damage may not have been reported.
†Deaths/injuries were not reported at the county level; potentially outside of the county.
Source: National Climatic Data Center

There have been several severe winter weather events in Madison County. The text below describes one of the major events and associated impacts on the county. Similar impacts can be expected with severe winter weather.

1996 Winter Storm

This storm left two feet of snow and several thousand citizens without power for up to nine days. Although shelters were opened, some roads were impassible for up to four days. This event caused considerable disruption to business, industry, schools, and government services.

Winter storms throughout the planning area have several negative externalities including hypothermia, cost of snow and debris cleanup, business and government service interruption, traffic accidents, and power outages. Furthermore, citizens may resort to using inappropriate heating devices that could to fire or an accumulation of toxic fumes.

Probability of Future Occurrences

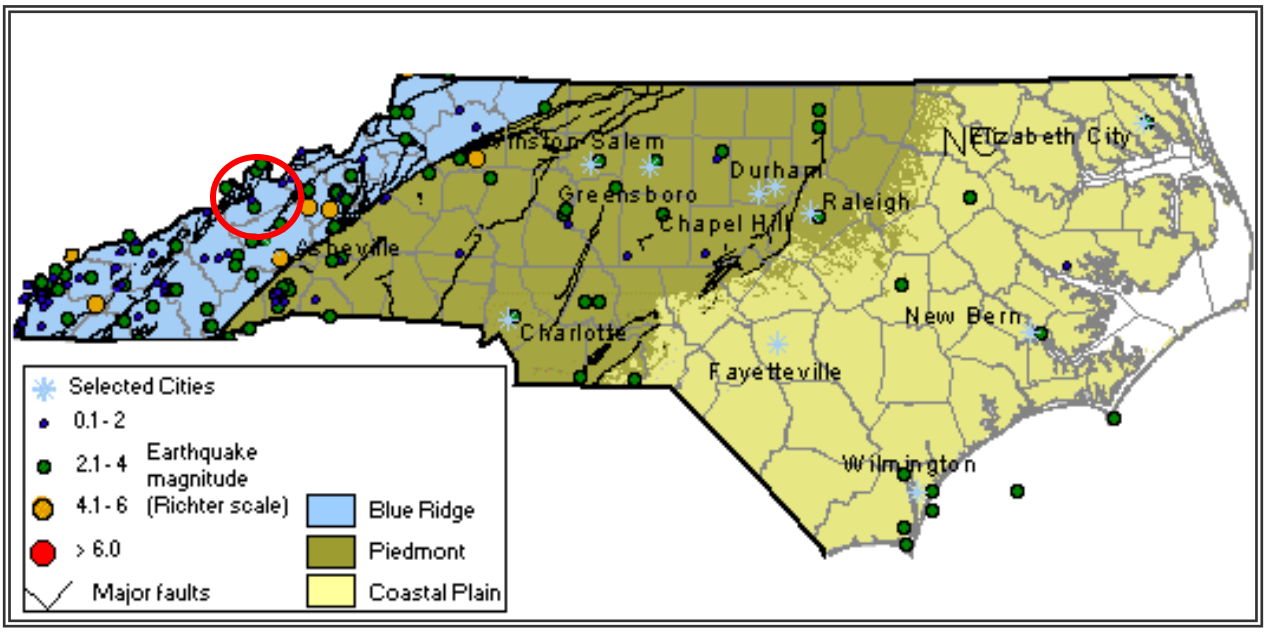
Winter storm events will remain a regular occurrence in Madison County due to location and elevation. According to historical information, Madison County generally experiences almost 10 winter storm events each year. Therefore, the annual probability is highly likely (100 percent).

B.2.9 Earthquake

Location and Spatial Extent

Approximately two-thirds of North Carolina is subject to earthquakes, with the western and southeast region most vulnerable to a very damaging earthquake. The state is affected by both the Charleston Fault in South Carolina and New Madrid Fault in Tennessee. Both of these faults have generated earthquakes measuring greater than 8 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines throughout North Carolina. **Figure B.2** is a map showing geological and seismic information for North Carolina.

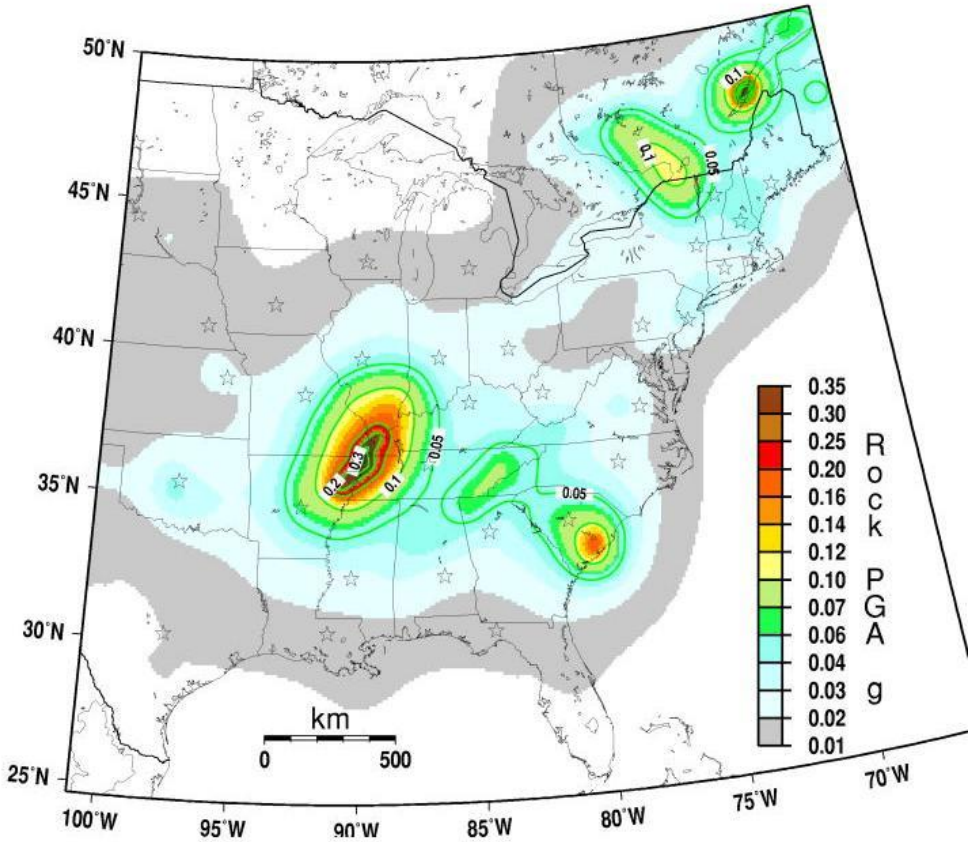
FIGURE B.2: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure B.3 shows the intensity level associated with Madison County, based on the national USGS map of peak acceleration with 10 percent probability of exceedance in 50 years. It is the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The map was compiled by the U.S. Geological Survey (USGS) Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards. According to this map, Madison County lies within an approximate zone of level "5" to "7" ground acceleration. This indicates that the county exists within an area of low to moderate seismic risk.

FIGURE B.3: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: United States Geological Survey, 2008

Historical Occurrences

At least 17 earthquakes are known to have affected Madison County since 1915. The strongest of these measured a VI on the Modified Mercalli Intensity (MMI) scale. **Table B.18** provides a summary of earthquake events reported by the National Geophysical Data Center between 1638 and 1985. **Table B.19** presents a detailed occurrence of each event including the date, distance for the epicenter, magnitude, and Modified Mercalli Intensity (if known).[13]

TABLE B.18: SUMMARY OF SEISMIC ACTIVITY IN MADISON COUNTY

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Hot Springs	4	IV	4.7
Marshall	8	VI	--
Mars Hill	5	V	--
Unincorporated Area	0	--	--
MADISON COUNTY TOTAL	**17**	**VI**	**--**

Source: National Geophysical Data Center

[13] Due to reporting mechanisms, not all earthquakes events were recorded during this time. Furthermore, some are missing data, such as the epicenter location, due to a lack of widely used technology. In these instances, a value of "unknown" is reported.

TABLE B.19: SIGNIFICANT SEISMIC EVENTS IN MADISON COUNTY (1638 -1985)

Location	Date	Epicentral Distance	Magnitude	MMI
Hot Springs				
Hot Springs	2/21/1916	52.0 km		IV
Hot Springs	11/20/1928	48.0 km		IV
Hot Springs	7/13/1969	81.0 km	3.5	III
Hot Springs	11/30/1973	102.0 km	4.7	IV
Marshall				
Marshall	10/29/1915			V
Marshall	2/21/1916	37.0 km		IV
Marshall	11/3/1928	23.0 km		V
Marshall	1/2/1954	127.0 km		IV
Marshall	5/13/1957	61.0 km		IV
Marshall	7/2/1957	37.0 km		VI
Marshall	7/13/1969	97.0 km	3.5	III
Marshall	11/30/1973	115.0 km	4.7	IV
Mars Hill				
Mars Hill	9/7/1956	136.0 km		III
Mars Hill	5/13/1957	50.0 km		IV
Mars Hill	7/2/1957	37.0 km		V
Mars Hill	7/13/1969	107.0 km	3.5	III
Mars Hill	11/30/1973	127.0 km	4.7	IV
Unincorporated Area				
None Reported	--	--	--	--

Source: National Geophysical Data Center

Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting Madison County is unlikely. However, it is likely that future earthquakes resulting in light to moderate perceived shaking and damages ranging from none to very light will affect the county. The annual probability level for the county is estimated between 10 and 100 percent (likely).

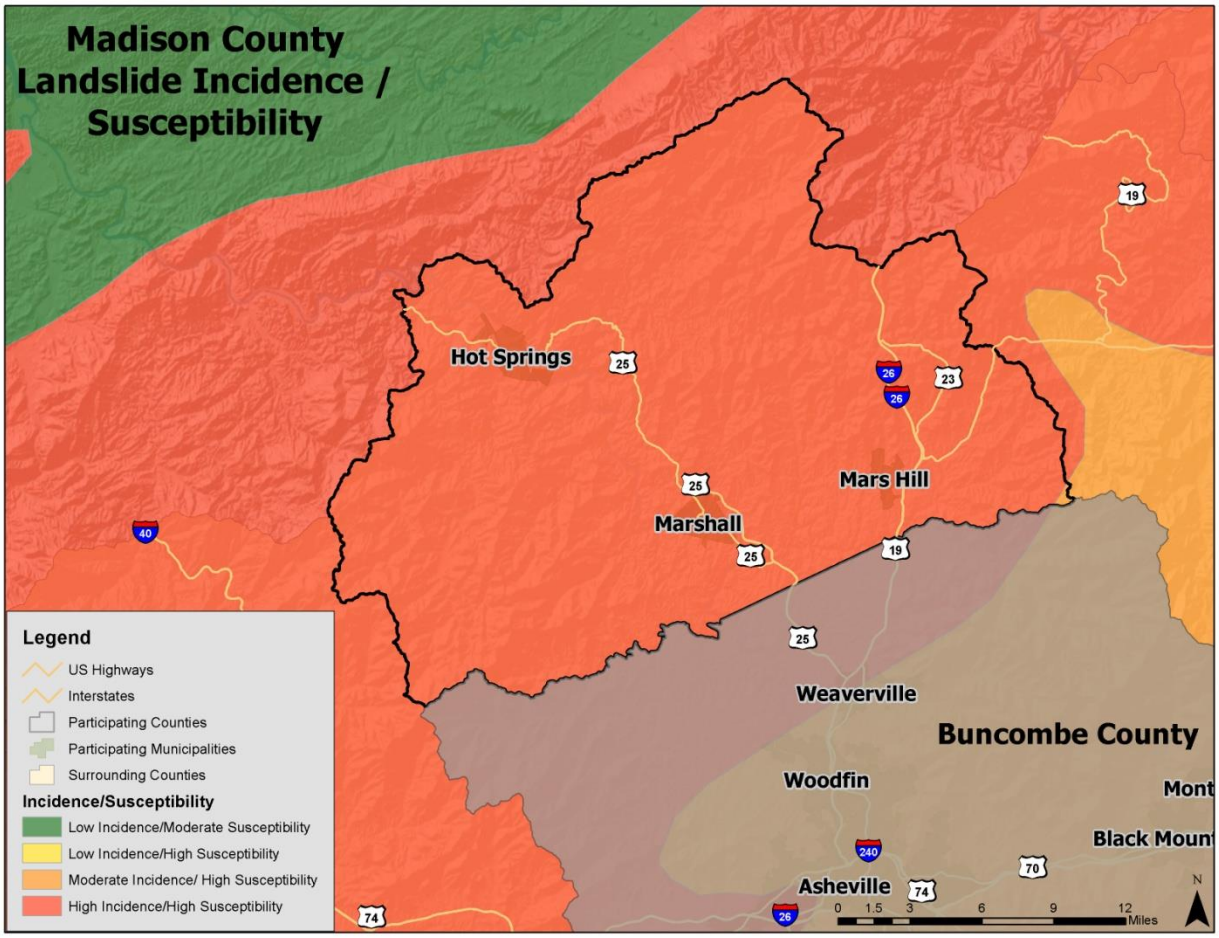
B.2.10 Landslide

Location and Spatial Extent

Landslides occur along steep slopes when the pull of gravity can no longer be resisted (often due to heavy rain). Human development can also exacerbate risk by building on previously undevelopable steep slopes and constructing roads by cutting through mountains. Landslides are possible throughout Madison County.

According to **Figure B.4** below, nearly the entire county has high landslide activity, although there is a small area in the southeast corner with a moderate incidence occurrence rate. There is also high susceptibility throughout the entire county.

FIGURE B.4: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF MADISON COUNTY



Source: United States Geological Survey

Historical Occurrences

Steep topography throughout Madison County makes the planning area susceptible to landslides. Most landslides are caused by heavy rainfall in the area. Building on steep slopes that was not previously possible also contributes to risk. **Table B.20** presents a summary of the landslide occurrence events as provided by the North Carolina Geological Survey[14]. The georeferenced locations of the landslide events presented in the aforementioned tables are presented in **Figure B.5**. Some incidence mapping has also been completed throughout the western portion of North Carolina though it is not complete. Therefore, it should be noted that many more incidents than what is reported are likely to have occurred in Madison County.

TABLE B.20: SUMMARY OF LANDSLIDE ACTIVITY IN MADISON COUNTY

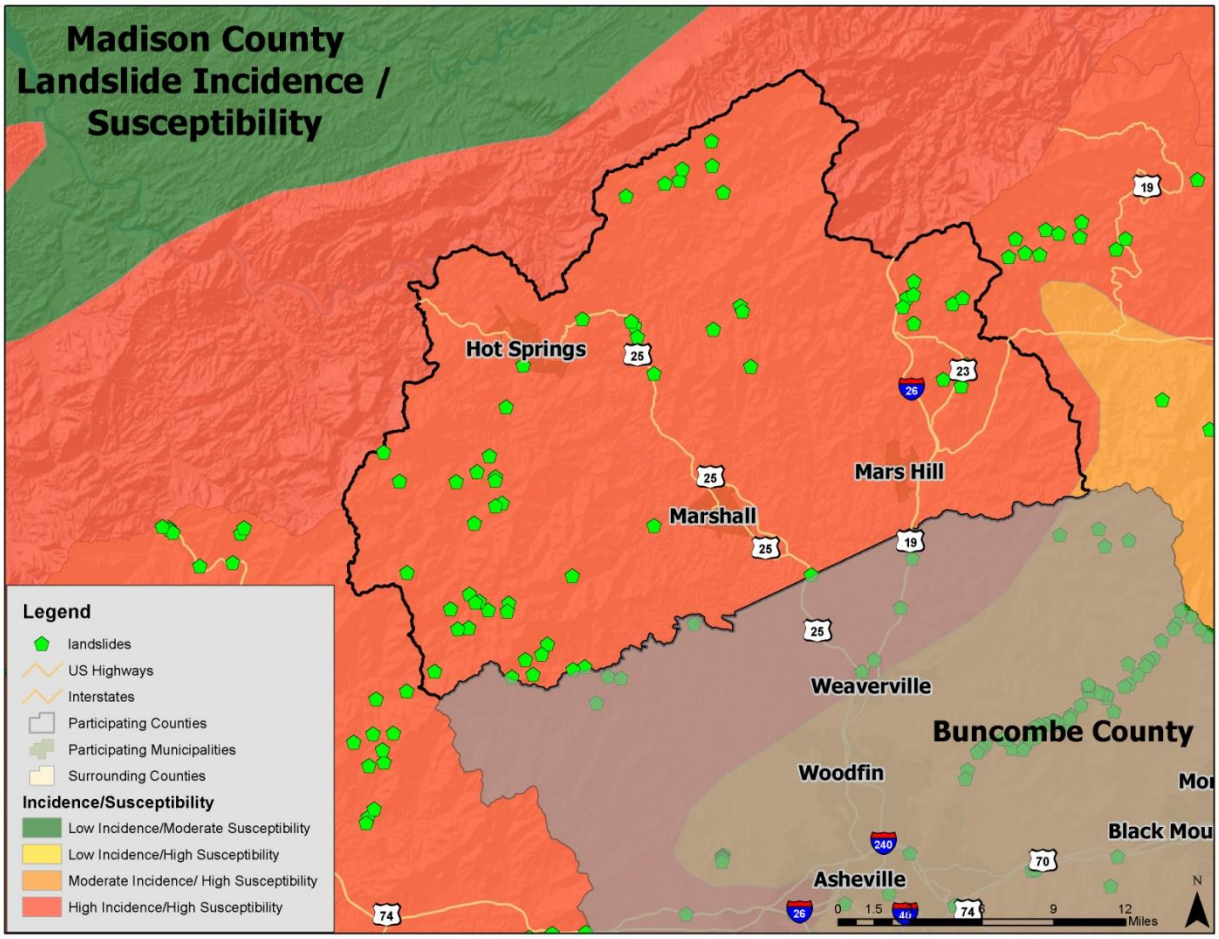
Location	Number of Occurrences
Hot Springs	1
Marshall	0

[14] It should be noted that the North Carolina Geological Survey (NCGS) emphasized the dataset provided was incomplete. Therefore, there may be additional historical landslide occurrences. Furthermore, dates were not included for every event. The earliest date reported was 1940. No damage information was provided by NCGS.

Location	Number of Occurrences
Mars Hill	0
Unincorporated Area	60
MADISON COUNTY TOTAL	**61**

Source: North Carolina Geological Survey

FIGURE B.5: LOCATION OF PREVIOUS LANDSLIDE OCCURRENCES IN MADISON COUNTY



Source: North Carolina Geological Survey

The information below identifies additional historical information reported in the previous hazard mitigation plan.

Madison County

Although Madison County is susceptible to large landslides, there have been no major occurrences. Small landslides (10 to 40 cubic yards) are occasional during times of higher than normal precipitation. Data shows that landslides have resulted in the loss of three homes recently in Mars Hill Fire District.

Probability of Future Occurrences

Based on historical information and the USGS susceptibility index, the probability of future landslide events is highly likely (100 percent probability). Local conditions may become more favorable for

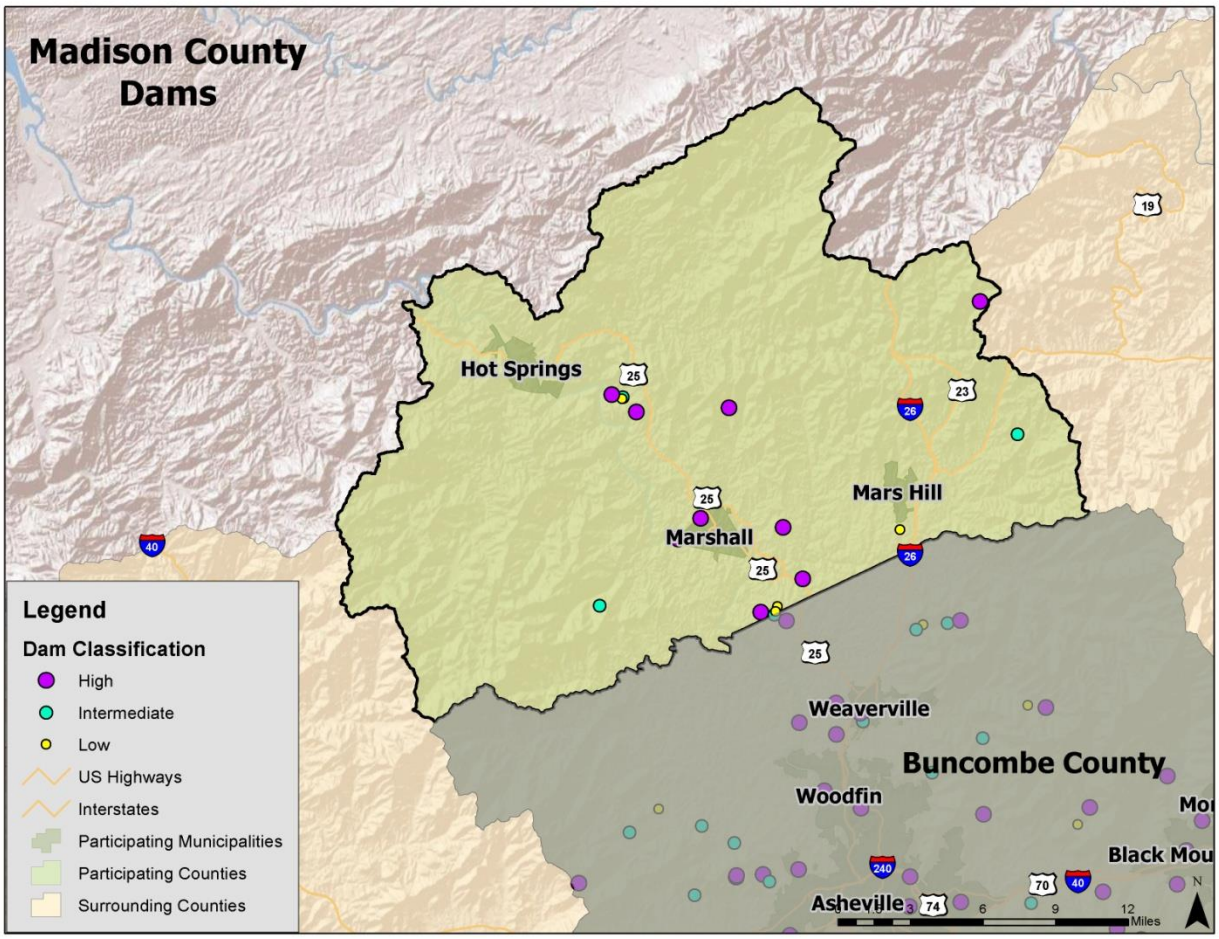
landslides due to heavy rain, for example. This would increase the likelihood of occurrence. It should also be noted that some areas in Madison County have greater risk than others given factors such as steepness on slope and modification of slopes.

B.2.11 Dam and Levee Failure

Location and Spatial Extent

According to the North Carolina Division of Land Management there are 16 dams in Madison County.[15] **Figure B.6** shows the dam location and the corresponding hazard ranking for each. Of these dams, nine are classified as high hazard potential. These high hazard dams are listed in **Table B.21**.

FIGURE B.6: MADISON COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources, 2012

[15] The February 8, 2012 list of high hazard dams obtained from the North Carolina Division of Energy, Mineral, and Land Resources (http://portal.ncdenr.org/web/lr/dams) was reviewed and amended by local officials to the best of their knowledge.

TABLE B.21: MADISON COUNTY HIGH HAZARD DAMS

Dam Name	Hazard Potential	Surface Area (acres)	Max Impoundment (Ac-ft)	Owner Type
Madison County				
Hunter Creek Dam	High	0	0	Local Gov
Mars Hill Water Supply Dam	High	2.8	40	Local Gov
Chestnut Hill Dam	High	3	50	Private
Ivy Dam	High	0	40	Private
Ross Dam	High	0.5	5.5	Private
Stackhouse Dam Upper	High	--	26	Private
French Broad Crossing Dam	High	0	0	Private
Ward Dam	High	0	0	Private
Redmon Dam	High	0	0	Utility

Source: North Carolina Division of Land Resources, 2012

It should also be noted that the North Carolina dam classification regulations were recently updated. As a result of the change, more dams are generally classified as high hazard.

Historical Occurrences

There is no record of significant dam failures in Madison County; however, several breach scenarios in the area could be catastrophic.

Probability of Future Occurrences

Given the current dam inventory and historic data, a dam breach is unlikely (less than 1 percent annual probability) in the future. However, as has been demonstrated in the past, regular monitoring is necessary to prevent these events.

B.2.12 Erosion

Location and Spatial Extent

Erosion in Madison County is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine grained particles such as sand, Madison County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs in the county, particularly along the banks of rivers and streams, but it is not an extreme threat. No areas of concern were reported by the planning team.

Historical Occurrences

Several sources were vetted to identify areas of erosion in Madison County. This includes searching local newspapers, interviewing local officials, and reviewing the previous hazard mitigation plan. Little information could be found and erosion was not addressed in the previous Madison County hazard mitigation plan.

Probability of Future Occurrences

Erosion remains a natural, dynamic, and continuous process for Madison County, and it will continue to occur. The annual probability level assigned for erosion is possible (between 1 and 10 percent).

B.2.13 Flood

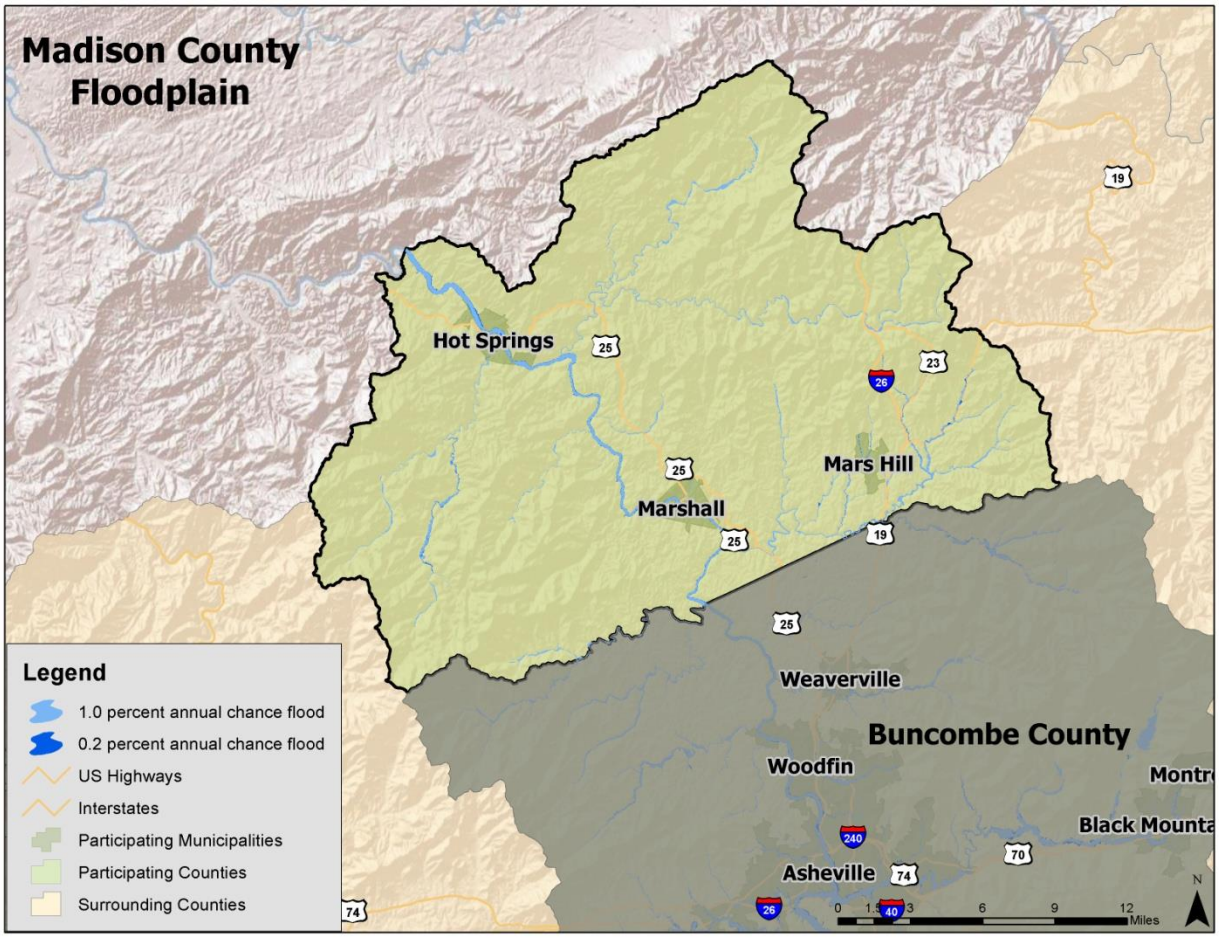
Location and Spatial Extent

There are areas in madison County that are susceptible to flood events. Special flood hazard areas in the county were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM).[16] This includes Zone A (1-percent annual chance floodplain), Zone AE (1-percent annual chance floodplain with elevation), and Zone X500 (0.2-percent annual chance floodplain). According to GIS analysis, of the 451 square miles that make up Madison County, there are 9.1 square miles of land in zones A and AE (1-percent annual chance floodplain/100-year floodplain) and 0.8 square miles of land in zone X500 (0.2-percent annual chance floodplain/500-year floodplain).

These flood zone values account for 2.2 percent of the total land area in Madison County. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas. **Figure B.7**, **Figure B.8**, **Figure B.9**, and **Figure B.10** illustrate the location and extent of currently mapped special flood hazard areas for Madison County and its municipalities based on best available FEMA Digital Flood Insurance Rate Map (DFIRM) data.

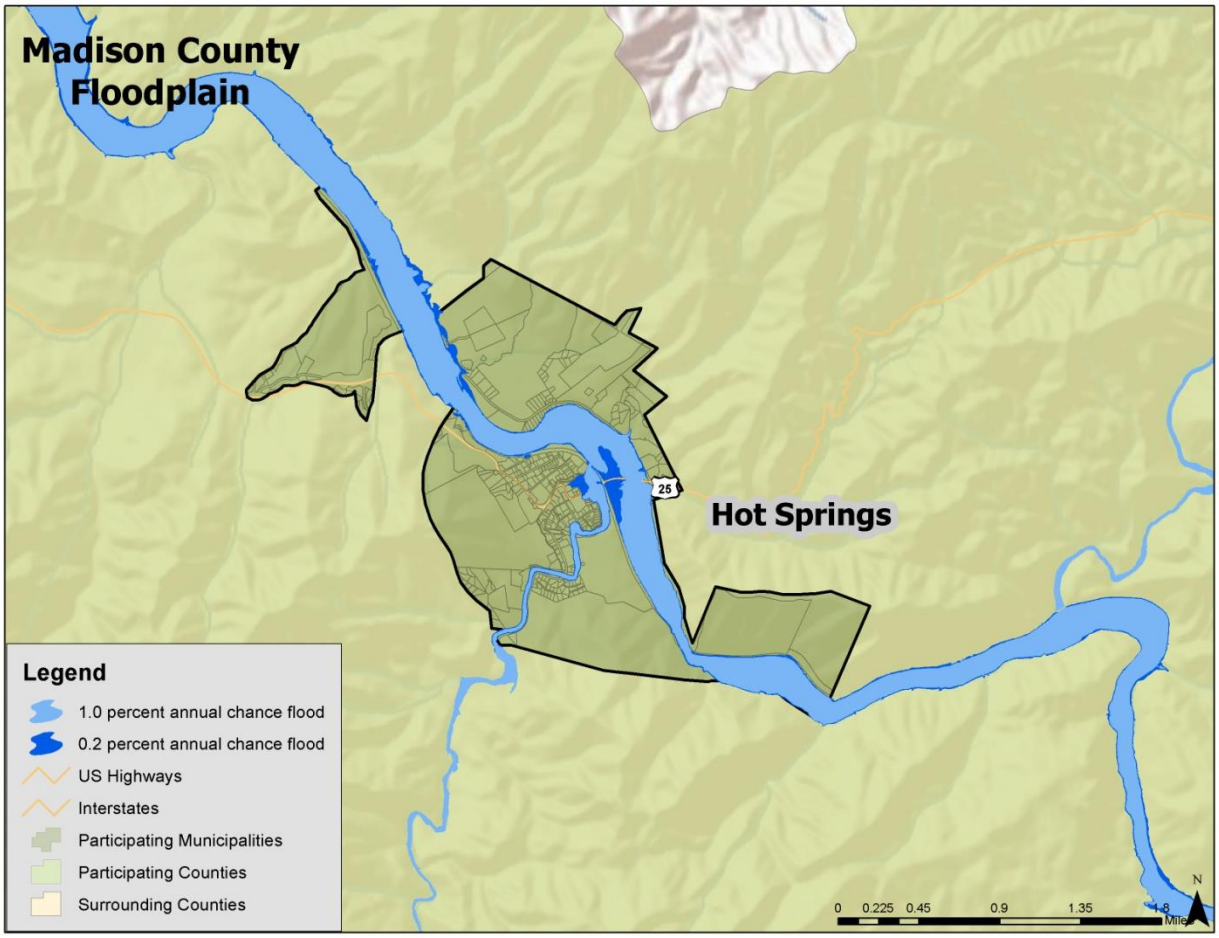
[16] The county-level DFIRM data used for Madison County were updated in 2011.

FIGURE B.7: SPECIAL FLOOD HAZARD AREAS IN MADISON COUNTY



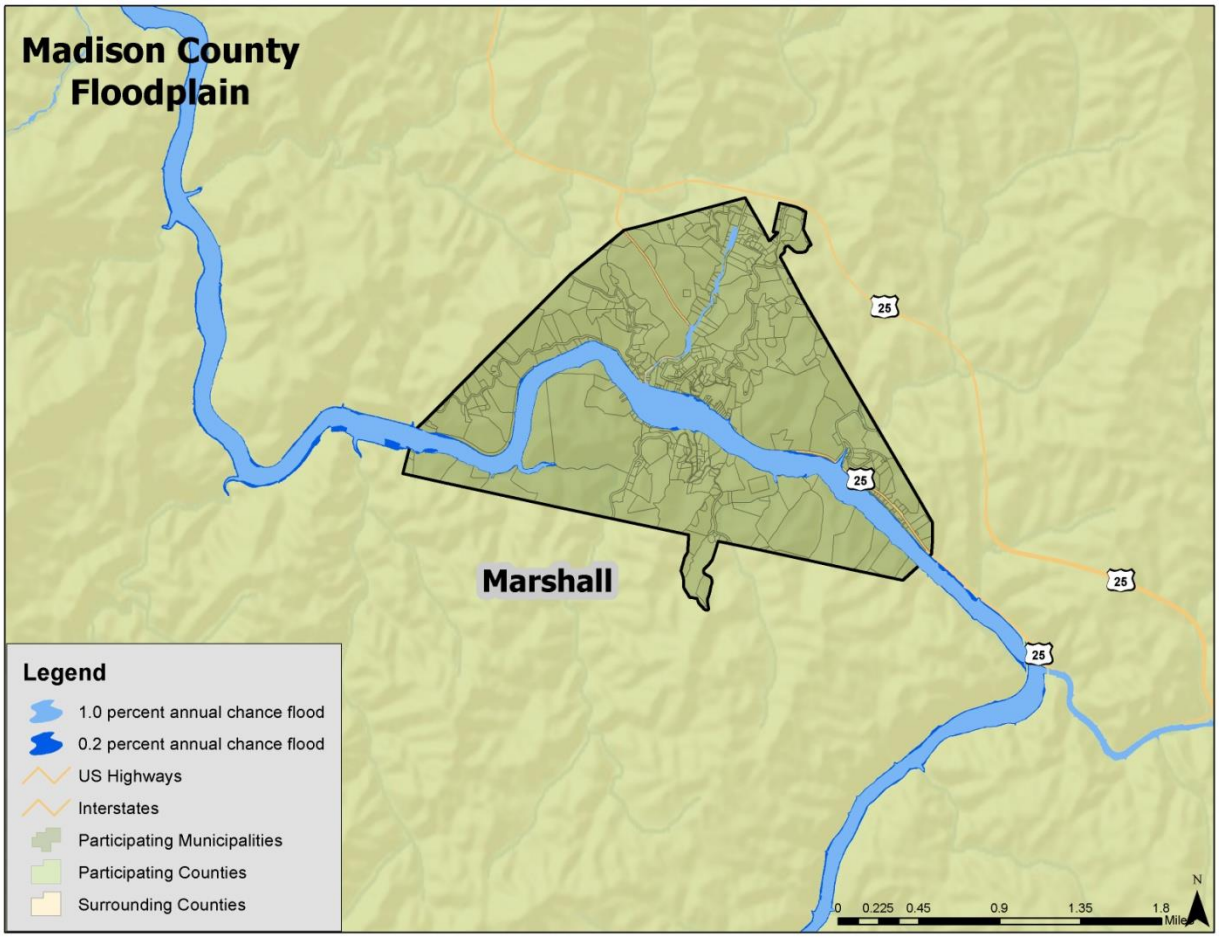
Source: Federal Emergency Management Agency

FIGURE B.8: SPECIAL FLOOD HAZARD AREAS IN HOT SPRINGS



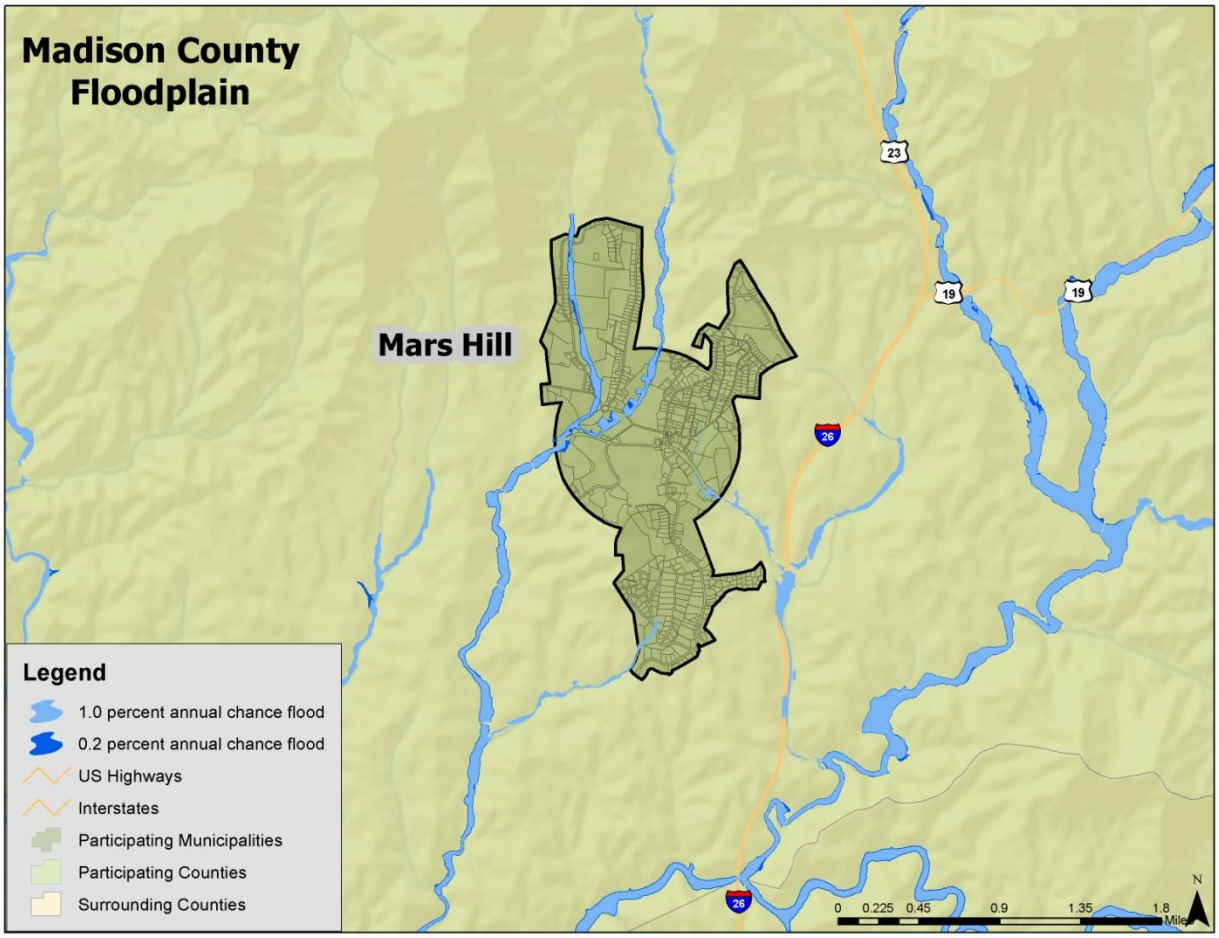
Source: Federal Emergency Management Agency

FIGURE B.9: SPECIAL FLOOD HAZARD AREAS IN MARSHALL



Source: Federal Emergency Management Agency

FIGURE B.10: SPECIAL FLOOD HAZARD AREAS IN MARS HILL



Source: Federal Emergency Management Agency

Historical Occurrences

Flooding has resulted in four disaster declarations in Madison County.[17] Information from the National Climatic Data Center was used to ascertain additional historical flood events. The National Climatic Data Center reported a total of 37 events in Madison County since 1993.[18] A summary of these events is presented in **Table B.22**. These events accounted for more than $20.5 million (2013 dollars) in property damage in the county.[19] In addition, one fatality and two injuries were reported. Specific information on flood events, including date, type of flooding, and deaths and injuries, can be found in **Table B.23**.

TABLE B.22: SUMMARY OF FLOOD OCCURRENCES IN MADISON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Hot Springs	2	0/0	$0

[17] A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.
[18] These events are only inclusive of those reported by NCDC. It is likely that additional occurrences have occurred and have gone unreported.
[19] The total damage amount was averaged over the number of affected counties when multiple counties were involved in the flood event.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Marshall	14	0/0	$4,038,229
Mars Hill	2	0/0	$0
Unincorporated Area	19	1/2	$16,483,560
MADISON COUNTY TOTAL	**37**	**1/2**	**$20,521,789**

Source: National Climatic Data Center

TABLE B.23: HISTORICAL FLOOD EVENTS IN MADISON COUNTY

	Date	Type	Deaths / Injuries	Property Damage*
Hot Springs				
HOT SPGS	12-AUG-01	FLASH FLOOD	0/0	$0
HOT SPGS	06-MAY-03	FLASH FLOOD	0/0	$0
Marshall				
MARSHALL	27-JUN-01	FLASH FLOOD	0/0	$0
MARSHALL	30-JUL-01	FLASH FLOOD	0/0	$142,576
MARSHALL	29-JUL-01	FLASH FLOOD	0/0	$1,425,761
MARSHALL	04-AUG-01	FLASH FLOOD	0/0	$2,423,794
MARSHALL	18-MAR-02	FLASH FLOOD	0/0	$20,764
MARSHALL	04-JUN-02	FLASH FLOOD	0/0	$0
MARSHALL	09-JUL-03	FLASH FLOOD	0/0	$0
MARSHALL	06-JUL-03	FLASH FLOOD	0/0	$0
MARSHALL	22-FEB-03	FLASH FLOOD	0/0	$0
MARSHALL	12-JUN-04	FLASH FLOOD	0/0	$0
MARSHALL	02-AUG-04	FLASH FLOOD	0/0	$0
MARSHALL	20-JUN-05	FLASH FLOOD	0/0	$0
MARSHALL	27-JUN-05	FLASH FLOOD	0/0	$25,335
MARSHALL	19-JUL-05	FLASH FLOOD	0/0	$0
Mars Hill				
MARS HILL	17-JUN-96	FLASH FLOOD	0/0	$0
MARS HILL	05-JUL-03	FLASH FLOOD	0/0	$0
Unincorporated Area				
MADISON COUNTY	23-MAR-93	FLASH FLOODS	0/0	$0
MADISON COUNTY	26-JAN-96	FLOOD	0/0	$3,218
MADISON COUNTY	08-JAN-98	FLOOD	0/1	$77,445
MADISON COUNTY	19-NOV-03	FLOOD	0/0	$0
MADISON COUNTY	06-MAY-03	FLOOD	0/0	$0
MADISON COUNTY	16-SEP-04	FLOOD	0/0	$10,438,185
MADISON COUNTY	07-SEP-04	FLOOD	0/0	$1,304,773
ALLENSTAND	06-JUL-99	FLASH FLOOD	0/0	$4,537,769
BIG PINE	29-JUN-01	FLASH FLOOD	0/0	$0
COUNTYWIDE	29-JUL-01	FLASH FLOOD	0/0	$0
COUNTYWIDE	17-MAR-02	FLASH FLOOD	0/0	$0
NORTHWEST PORTION	23-JAN-02	FLASH FLOOD	0/0	$0
PETERSBURG	06-JUL-03	FLASH FLOOD	1/1	$67,196

	Date	Type	Deaths / Injuries	Property Damage*
PETERSBURG	31-JUL-03	FLASH FLOOD	0/0	$0
WALNUT	26-JUL-04	FLASH FLOOD	0/0	$0
LUCK	13-MAY-05	FLASH FLOOD	0/0	$0
FAUST	14-MAY-09	FLASH FLOOD	0/0	$22,510
ENGLISH	17-AUG-10	FLASH FLOOD	0/0	$21,855
BIG LAUREL	19-JUN-11	FLASH FLOOD	0/0	$10,609

*Property damage is reported in 2013 dollars; All damage may not have been reported.
Source: National Climatic Data Center

Historical Summary of Insured Flood Losses

According to FEMA flood insurance policy records as of July 2013, there have been 48 flood losses reported in Madison County through the National Flood Insurance Program (NFIP) since 1978, totaling over $936,000 in claims payments. A summary of these figures for the county is provided in **Table B.24**. It should be emphasized that these numbers include only those losses to structures that were insured through the NFIP policies, and for losses in which claims were sought and received. It is likely that many additional instances of flood loss in Madison County were either uninsured, denied claims payment, or not reported.

TABLE B.24: SUMMARY OF INSURED FLOOD LOSSES IN MADISON COUNTY

Location	Flood Losses	Claims Payments
Hot Springs	1	$2,361
Marshall	36	$517,815
Mars Hill	0	$0
Unincorporated Area	11	$416,269
MADISON COUNTY TOTAL	**48**	**$936,445**

Source: Federal Emergency Management Agency, National Flood Insurance Program

Repetitive Loss Properties

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Currently there are over 140,000 repetitive loss properties nationwide.

As of November 2013, there are 27 non-mitigated repetitive loss property located in Madison County, which accounted for 64 losses and more than $4.4 million in claims payments under the NFIP. The average claim amount for this property is $69,260. Twenty-four of the twenty-seven properties are commercial and the remaining three are multi-family residential. Without mitigation these properties will likely continue to experience flood losses. **Table B.25** presents detailed information on repetitive loss properties and NFIP claims and policies for Madison County.

TABLE B.25: REPETITIVE LOSS PROPERTIES IN MADISON COUNTY

Location	Number of Properties	Types of Properties	Number of Losses	Building Payments	Content Payments	Total Payments	Average Payment
Hot Springs	0	--	0	$0	$0	$0	$0
Marhsall	4	4 institutional	14	$63,828.63	$58,897.40	$122,726.03	$8,766.15

Location	Number of Properties	Types of Properties	Number of Losses	Building Payments	Content Payments	Total Payments	Average Payment
Mars Hill	0	--	0	$0	$0	$0	$0
Unincorporated Area	0	--	0	$0	$0	$0	$0
MADISON COUNTY TOTAL	**4**		**14**	**$63,828.63**	**$58,897.40**	**$122,726.03**	**$8,766.15**

Source: National Flood Insurance Program

Probability of Future Occurrences

Flood events will remain a threat in areas prone to flooding in Madison County, and the probability of future occurrences will remain likely (between 10 and 100 percent annual probability). The participating jurisdictions and unincorporated areas of the county have risk to flooding, though not all areas will experience flood. The probability of future flood events based on magnitude and according to best available data is illustrated in the figures above**,** which indicates those areas susceptible to the 1-percent annual chance flood (100-year floodplain) and the 0.2-percent annual chance flood (500-year floodplain).

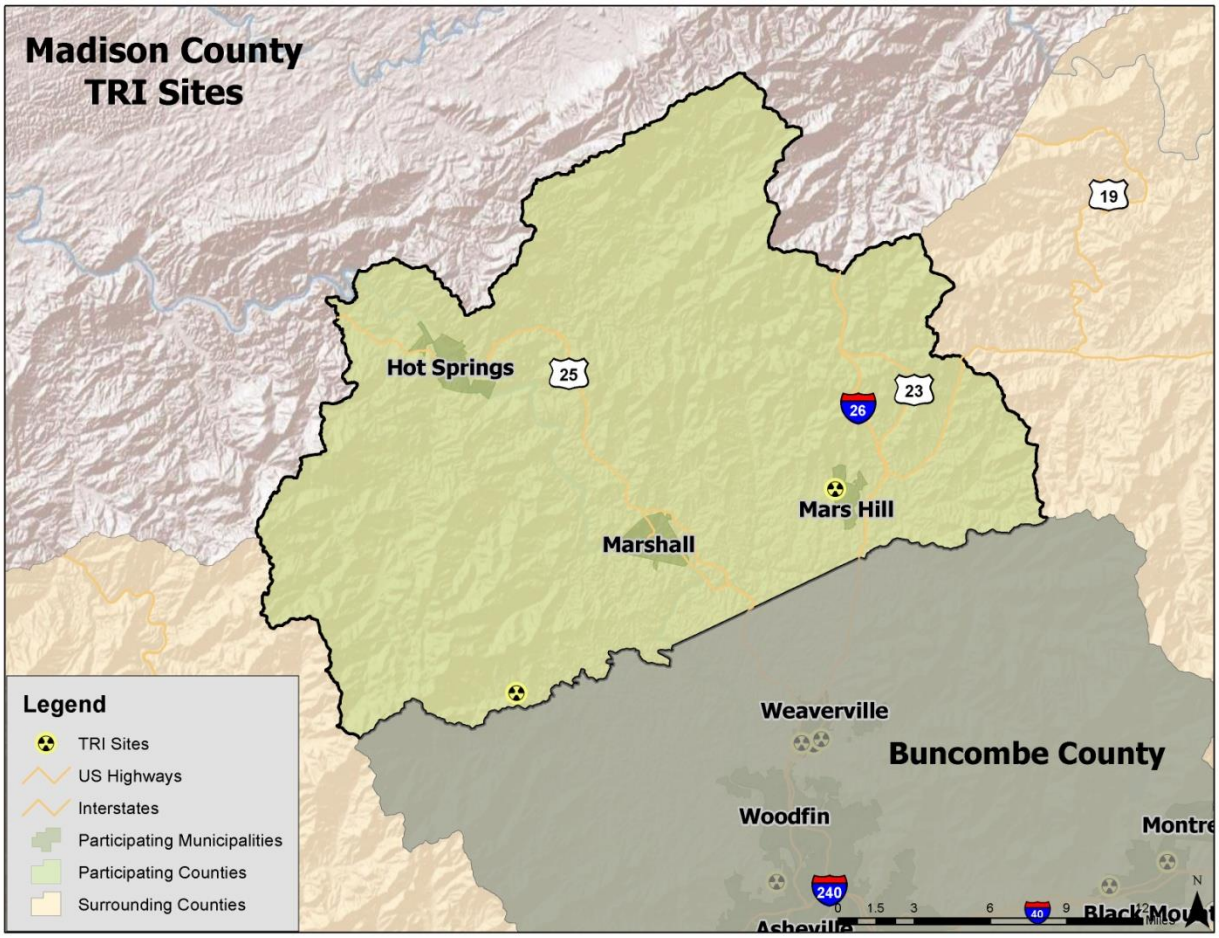
It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the county and participating jurisdictions. For example, Marshall has a higher risk of flood than other municipalities. Flood is not the greatest hazard of concern but will continue to occur and cause damage. Therefore, mitigation actions may be warranted, particularly for repetitive loss properties.

B.2.14 Hazardous Materials Incidents

Location and Spatial Extent

Madison County has two TRI sites. These sites are shown in **Figure B.11.**

FIGURE B.11: TOXIC RELEASE INVENTORY (TRI) SITES IN MADISON COUNTY



Source: Environmental Protection Agency

In addition to "fixed" hazardous materials locations, hazardous materials may also impact the county via roadways and rail. Many roads in the county are narrow and winding, making hazardous material transport in the area especially treacherous. All roads that permit hazardous material transport are considered potentially at risk to an incident.

Historical Occurrences

There has been a total of one recorded HAZMAT incident in Madison County since 1984 (**Table B.26**). **Table B.27** presents detailed information on historic HAZMAT incidents in Madison County as reported by the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA).

TABLE B.26: SUMMARY OF HAZMAT INCIDENTS IN MADISON COUNTY

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Hot Springs	0	0/0	$0
Marshall	0	0/0	$0
Mars Hill	1	0/0	$0

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2013)
Unincorporated Area	0	0/0	$0
MADISON COUNTY TOTAL	**1**	**0/0**	**$0**

Source: United States Department of Transportation Pipelines and Hazardous Materials Safety Administration

TABLE B.27: HAZMAT INCIDENTS IN MADISON COUNTY

Report Number	Date	City	Mode	Serious Incident?	Fatalities / Injuries	Damages ($)	Quantity Released
Hot Springs							
None Reported	--	--	--	--	--	--	--
Marshall							
None Reported	--	--	--	--	--	--	--
Mars Hill							
I-1984050490	5/3/1984	MARS HILL	Highway	No	0/0	$0	0 LGA
Unincorporated Area							
None Reported	--	--	--	--	--	--	--

Source: United States Department of Transportation Pipelines and Hazardous Materials Safety Administration

Probability of Future Occurrences

Given the location of one toxic release inventory site in Madison County and one roadway incident, it is possible that a hazardous material incident may occur in the county (between 1 and 10 percent annual probability). County and municipal officials are mindful of this possibility and take precautions to prevent such an event from occurring. Furthermore, there are detailed plans in place to respond to an occurrence. The county may also be impacted by neighboring counties which also face risk due to TRI sites.

B.2.15 Wildfire

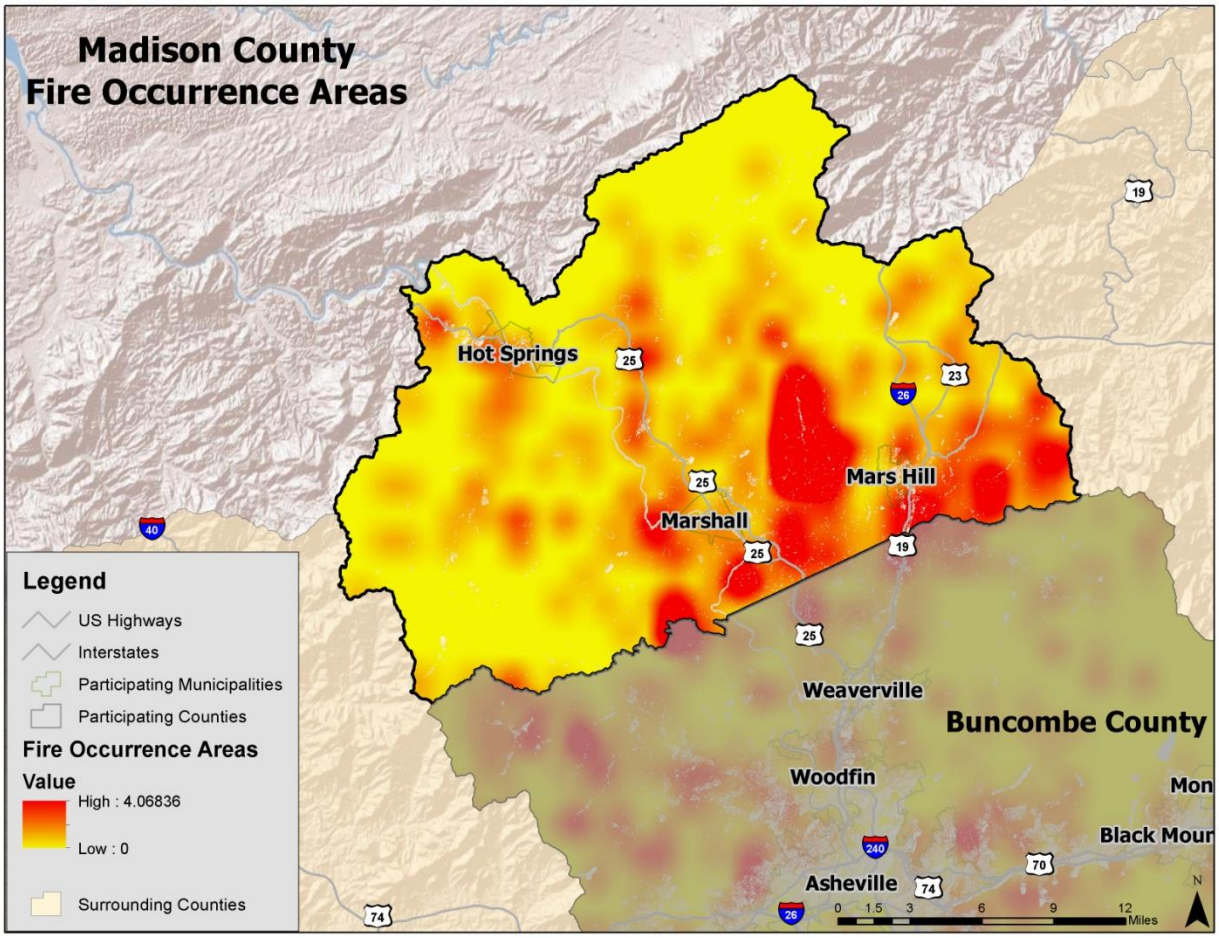
Location and Spatial Extent

The entire county is at risk to a wildfire occurrence. However, several factors such as drought conditions or high levels of fuel on the forest floor, may make a wildfire more likely. Furthermore, areas in the urban-wildland interface are particularly susceptible to fire hazard as populations abut formerly undeveloped areas. The Fire Occurrence Areas in the figure below give an indication of historic location.

Historical Occurrences

Figure B.12 shows the Fire Occurrence Areas (FOA) in Madison County based on data from the Southern Wildfire Risk Assessment. This data is based on historical fire ignitions and is reported as the number of fires that occur per 1,000 acres each year.

FIGURE B.12: HISTORIC WILDFIRE EVENTS IN MADISON COUNTY



Source: Southern Wildfire Risk Assessment

Based on data from the North Carolina Division of Forest Resources from 2003 to 2012, Madison County experiences an average of 52 wildfires annually which burn an average of 284 acres per year. The data indicates that most of these fires are small, averaging six acres per fire. **Table B.28** lists the number of reported wildfire occurrences in the county between the years 2003 and 2012.

TABLE B.28: HISTORICAL WILDFIRE OCCURRENCES IN MADISON COUNTY

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Madison County										
Number of Fires	28	66	40	76	84	44	49	34	60	34
Number of Acres	122.8	274.2	216.8	286.7	792.5	680.4	140.4	80.8	156.9	87.8

Source: North Carolina Division of Forest Resources

Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Madison County. The likelihood of wildfires increases during drought cycles and abnormally dry conditions. Fires are likely to stay small in size but could

increase due local climate and ground conditions. Dry, windy conditions with an accumulation of forest floor fuel (potentially due to ice storms or lack of fire) could create conditions for a large fire that spreads quickly. It should also be noted that some areas do vary somewhat in risk. For example, highly developed areas are less susceptible unless they are located near the urban-wildland boundary. The risk will also vary due to assets. Areas in the urban-wildland interface will have much more property at risk, resulting in increased vulnerability and need to mitigate, compared to rural, mainly forested areas. The southeast portion of the county, around Marshall and Mars Hill, appears to have the highest risk in the county. The probability assigned to Madison County for future wildfire events is likely (10 to 100 percent annual probability).

B.2.16 Conclusions on Hazard Risk

The hazard profiles presented above were developed using best available data and result in what may be considered principally a qualitative assessment as recommended by FEMA in its "How-to" guidance document titled *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA Publication 386-2). It relies heavily on historical and anecdotal data, stakeholder input, and professional and experienced judgment regarding observed and/or anticipated hazard impacts. It also carefully considers the findings in other relevant plans, studies, and technical reports.

Hazard Extent

Table B.29 describes the extent of each natural hazard identified for Madison County. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE B.29: EXTENT OF MADISON COUNTY HAZARDS

Atmospheric Hazards	
Drought	Drought extent is defined by the North Carolina Drought Monitor Classifications which include Abnormally Dry, Moderate Drought, Severe Drought, Extreme Drought, and Exceptional Drought (page 5:6). According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Madison County has received this ranking three times over the fourteen-year reporting period.
Extreme Heat	The extent of extreme heat can be defined by the maximum temperature reached. The highest temperature recorded in Madison County is 105 degrees Fahrenheit in reported on June 30, 1936.
Hailstorm	Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Madison County was 1.75 inches (last reported on April 9, 2011). It should be noted that future events may exceed this.
Hurricane and Tropical Storm	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5 (Table 5.9). The greatest classification of hurricane to traverse directly through Madison County was One-C in 1985 which reached a maximum wind speed of 22 knots in the county. It should be noted that stronger storms could impact the region without a direct hit.
Lightning	According to the Vaisala flash density map (Figure 5.5), Madison County is located in an area that experiences 2 to 4 lightning flashes per square kilometer per year. It should be noted that future lightning occurrences may exceed these figures.

Thunderstorm Wind / High Wind	Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Climatic Data Center, the strongest recorded wind event in Madison County was reported on April 27, 2011 at 65 knots (approximately 75 mph). It should be noted that future events may exceed these historical occurrences.
Tornado	Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA (Figure 5.6) as well as the Fujita/Enhanced Fujita Scale (Tables 5.14 and 5.15). The greatest magnitude reported was an F1 (last reported on May 7, 1998).
Winter Storm and Freeze	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall was reported in Madison County was 22 inches reported on March 14, 1993. Due to extreme variations in elevation throughout the county, extent totals will vary for each participating jurisdiction and reliable data on snowfall totals is not available.
Geologic Hazards	
Earthquake	Earthquake extent can be measured by the Richter Scale (Table 5.18) and the Modified Mercalli Intensity (MMI) scale (Table 5.19) and the distance of the epicenter from Madison County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact the county was VI (slightly strong) with a correlating Richter Scale measurement of approximately 5.4 (reported on July 2, 1957). The epicenter of this earthquake was located 37 km away.
Landslide	As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is high across nearly all of Madison County (there is a very small area of moderate incidence in the southeast corner of the county). There is also high susceptibility throughout the entire county.
Hydrologic Hazards	
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria (Table 5.23). Of the 16 dams in Madison County, 9 are classified as high-hazard.
Erosion	The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records located in Madison County.
Flood	Flood extent can be measured by the amount of land and property in the floodplain as well as flood height and velocity. The amount of land in the floodplain accounts for 2.2 percent of the total land area in Madison County. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the county. While a gage does not exist for each participating jurisdiction, there is one at or near several areas. The greatest peak discharge recorded for the county was reported on July 16, 1916. Water reached a discharge of 115,000 cubic feet per second and the stream gage height was recorded at 22.0 feet.
Other Hazards	
Hazardous Materials Incident	According to USDOT PHMSA, the largest hazardous materials incident reported in the county is 0 LGA released on the highway on May 3, 1984. It should be noted that larger events are possible.

Wildfire	Wildfire data was provided by the North Carolina Division of Forest Resources and is reported annually by county from 2003-2012. The greatest number of fires to occur in Madison County in any year was 84 in 2007. The greatest number of acres to burn in the county in a single year occurred in 2007 when 793 acres were burned. Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout the county.

Priority Risk Index Results

In order to draw some meaningful planning conclusions on hazard risk for Madison County, the results of the hazard profiling process were used to generate countywide hazard classifications according to a "Priority Risk Index" (PRI). More information on the PRI and how it was calculated can be found in Section 5.18.2.

Table B.30 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Regional Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE B.30: SUMMARY OF PRI RESULTS FOR MADISON COUNTY

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Atmospheric Hazards						
Drought	Likely	Minor	Large	More than 24 hours	More than 1 week	**2.5**
Extreme Heat	Unlikely	Minor	Large	More than 24 hours	Less than 1 week	**1.8**
Hailstorm	Highly Likely	Minor	Moderate	Less than 6 hours	Less than 6 hours	**2.6**
Hurricane and Tropical Storm	Possible	Limited	Large	More than 24 hours	Less than 24 hours	**2.3**
Lightning	Highly Likely	Minor	Negligible	Less than 6 hours	Less than 6 hours	**2.2**
Thunderstorm / High Wind	Highly Likely	Critical	Moderate	6 to 12 hours	Less than 6 hours	**3.1**
Tornado	Possible	Critical	Small	Less than 6 hours	Less than 6 hours	**2.4**
Winter Storm and Freeze	Highly Likely	Critical	Large	More than 24 hours	Less than 1 week	**3.3**
Geologic Hazards						
Earthquake	Likely	Minor	Moderate	Less than 6 hours	Less than 6 hours	**2.3**
Landslide	Highly Likely	Critical	Small	Less than 6 hours	Less than 6 hours	**3.0**
Hydrologic Hazards						
Dam and Levee Failure	Unlikely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.3**
Erosion	Possible	Minor	Small	More than 24 hours	More than 1 week	**1.8**
Flood	Likely	Critical	Small	6 to 12 hours	Less than 1 week	**2.8**
Other Hazards						
Hazardous Materials Incident	Possible	Limited	Small	Less than 6 hours	Less than 24 hours	**2.2**
Wildfire	Likely	Minor	Small	Less than 6 hours	Less than 1 week	**2.4**

B.2.17 Final Determinations on Hazard Risk

The conclusions drawn from the hazard profiling process for Madison County, including the PRI results and input from the Regional Hazard Mitigation Planning Team, resulted in the classification of risk for each identified hazard according to three categories: High Risk, Moderate Risk, and Low Risk (**Table B.31**). For purposes of these classifications, risk is expressed in relative terms according to the estimated impact that a hazard will have on human life and property throughout all of Madison County. A more quantitative analysis to estimate potential dollar losses for each hazard has been performed separately, and is described in Section 6: *Vulnerability Assessment* and below in Section B.3. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

TABLE B.31: CONCLUSIONS ON HAZARD RISK FOR MADISON COUNTY

HIGH RISK	Winter Storm and Freeze Thunderstorm Wind / High Wind Landslide Flood Hailstorm
MODERATE RISK	Drought Tornado Wildfire Hurricane and Tropical Storm Earthquake Dam and Levee Failure
LOW RISK	Lightning Hazardous Material Incident Extreme Heat Erosion

B.3 MADISON COUNTY VULNERABILITY ASSESSMENT

This subsection identifies and quantifies the vulnerability of Madison County to the significant hazards previously identified. This includes identifying and characterizing an inventory of assets in the county and assessing the potential impact and expected amount of damages caused to these assets by each identified hazard event. More information on the methodology and data sources used to conduct this assessment can be found in Section 6: *Vulnerability Assessment*.

B.3.1 Asset Inventory

Table B.32 lists the number of parcels, total value of parcels, total number of parcels with improvements, and the total assessed value of improvements for Madison County and its participating jurisdictions (study area of vulnerability assessment).[20]

TABLE B.32: IMPROVED PROPERTY IN MADISON COUNTY

Location	Number of Parcels	Total Assessed Value of Parcels	Estimated Number of Buildings	Total Assessed Value of Improvements
Hot Springs	453	$64,476,128	271	$26,152,076
Marshall	579	$49,630,874	344	$30,013,557
Mars Hill	587	$78,982,239	431	$59,197,091
Unincorporated Area	19,206	$2,169,030,525	8,494	$881,828,178
MADISON COUNTY TOTAL	**20,825**	**$2,362,119,766**	**9,540**	**$997,190,902**

Table B.33 lists the fire stations, police stations, emergency operations centers (EOCs), medical care facilities, schools and other critical facilities located in Madison County. All data was collected from local government GIS departments. In addition, **Figure B.13** shows the locations of essential facilities in Madison County. **Table B.45**, near the end of this section, shows a complete list of the critical facilities by name, as well as the hazards that affect each facility. As noted previously, this list is not all-inclusive and only includes information provided by the county.

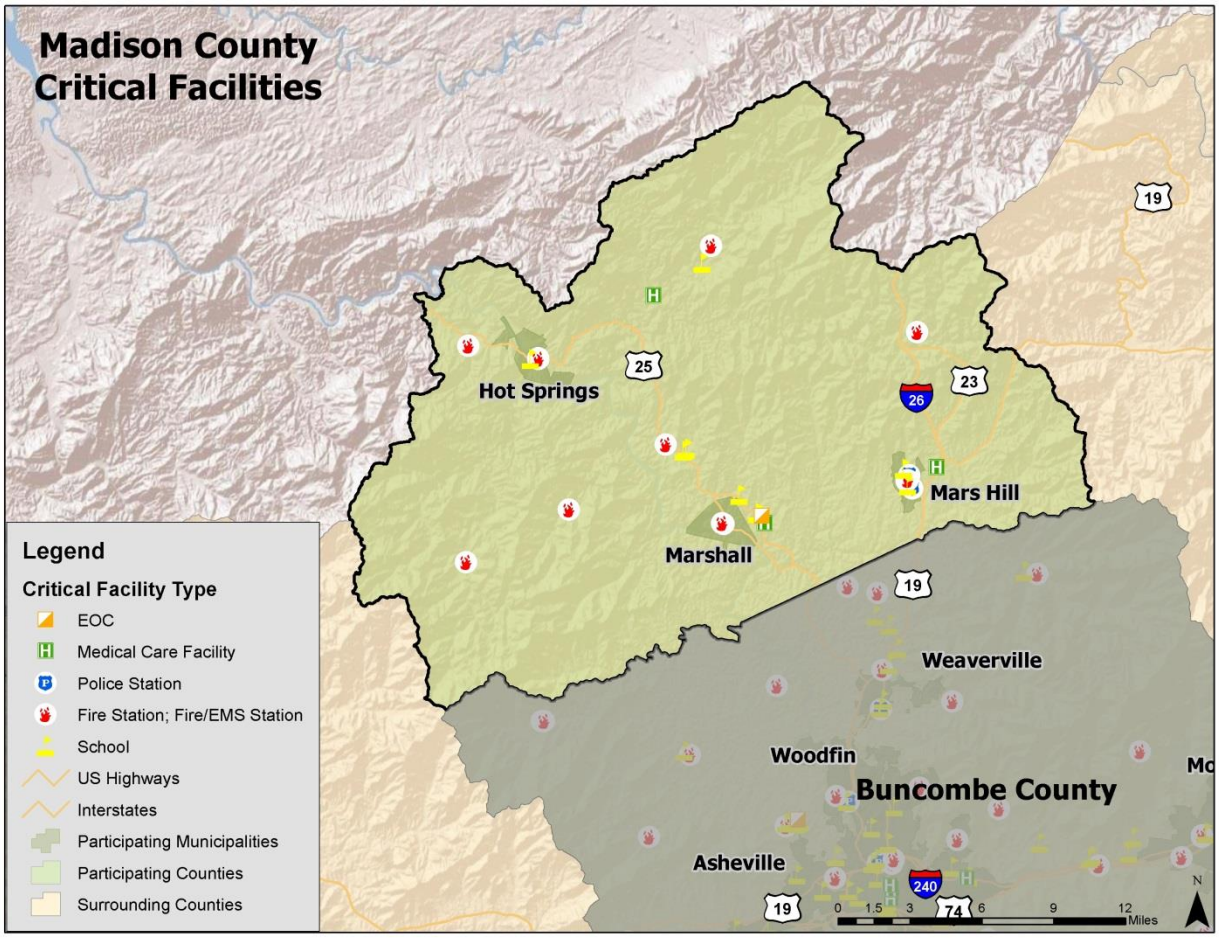
TABLE B.33: CRITICAL FACILITY INVENTORY IN MADISON COUNTY

Location	Fire Stations	Police Stations	Medical Care Facilities	EOC	Schools
Hot Springs	1	1	0	0	1
Marshall	1	1	0	0	0
Mars Hill	1	3	1	0	1
Unincorporated Area	8	0	3	1	6
MADISON COUNTY TOTAL	**11**	**5**	**4**	**1**	**8**

Source: Hazus-MH

[20] Total assessed values for improvements is based on tax assessor records as joined to digital parcel data. This data does not include dollar figures for tax-exempt improvements such as publicly-owned buildings and facilities. It should also be noted that, due to record keeping, some duplication is possible thus potentially resulting in an inflated value exposure for an area.

FIGURE B.13: CRITICAL FACILITY LOCATIONS IN MADISON COUNTY



Source: Hazus-MH 2.1

B.3.2 Social Vulnerability

In addition to identifying those assets potentially at risk to identified hazards, it is important to identify and assess those particular segments of the resident population in Madison County that are potentially at risk to these hazards.

Table B.34 lists the population by jurisdiction according to U.S. Census 2010 population estimates. Unfortunately, estimates were not available at the census block level, limited the results to county-wide estimates. The total population in Madison County according to Census data is 20,764 persons. Additional population estimates are presented above in Section B.1.

TABLE B.34: TOTAL POPULATION IN MADISON COUNTY

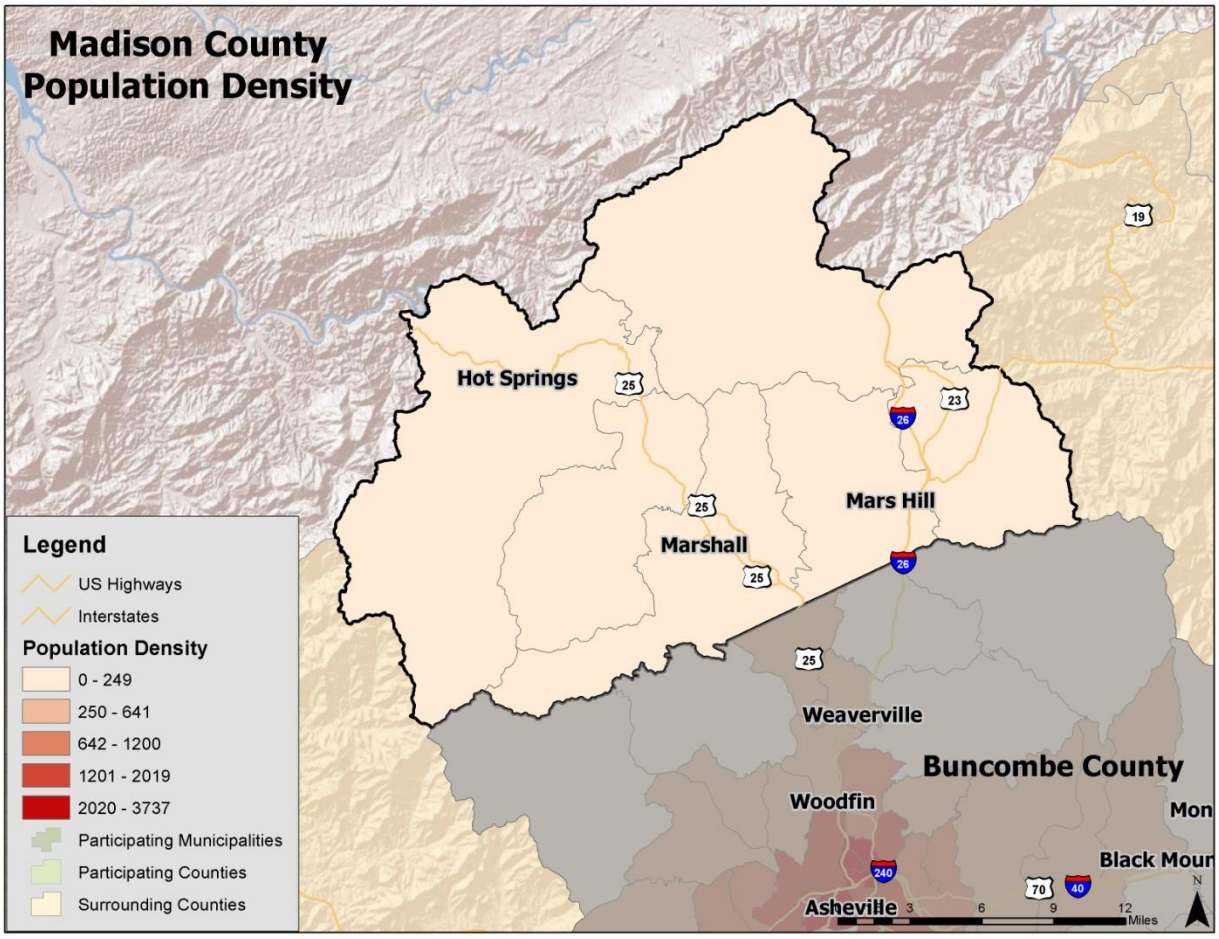
Jurisdiction	2010 Census Population
Madison County	**20,764**
Town of Hot Springs	560
Town of Mars Hill	1,869

Jurisdiction	2010 Census Population
Town of Marshall	872

Source: United States Census 2010

In addition, **Figure B.14** illustrates the population density by census tract as it was reported by the U.S. Census Bureau in 2010.[21]

FIGURE B.14: POPULATION DENSITY IN MADISON COUNTY



Source: United States Census Bureau, 2010

B.3.3 Vulnerability Assessment Results

As noted in Section 6: *Vulnerability Assessment*, only hazards with a specific geographic boundary, modeling tool, or sufficient historical data allow for further analysis. Those results, specific to Madison County, are presented here. All other hazards are assumed to impact the entire planning region (drought, extreme heat, hailstorm, lightning, thunderstorm wind, tornado, and winter storm and freeze) or, due to lack of data, analysis would not lead to credible results (erosion, dam and levee failure). The total county exposure, and thus risk, was presented in **Table B.32**.

[21] Population by census block was not available at the time this plan was completed.

The annualized loss estimate for all hazards is presented at the end of this section in **Table B.45.**

The hazards presented in this section include: hurricane and tropical storm winds, earthquake, landslide, flood, hazardous materials incident, and wildfire.

Hurricane and Tropical Storm

Historical evidence indicates that Madison County has a significant risk to the hurricane and tropical storm hazard. Several tracks have come near or traversed through the county, as shown and discussed in Section B.2.4.

Hurricanes and tropical storms can cause damage through numerous additional hazards such as flooding, erosion, tornadoes, and high winds and precipitation, thus it is difficult to estimate total potential losses from these cumulative effects. The current Hazus-MH hurricane model only analyzes hurricane winds and is not capable of modeling and estimating cumulative losses from all hazards associated with hurricanes; therefore only hurricane winds are analyzed in this section. It can be assumed that all existing and future buildings and populations are at risk to the hurricane and tropical storm hazard. Hazus-MH 2.1 was used to determine annualized losses for the county as shown below in **Table B.35.** Only losses to buildings are reported, in order to best match annualized losses reported for other hazards. Hazus-MH reports losses at the U.S. Census tract level, so determining participating jurisdiction losses was not possible.

TABLE B.35: ANNUALIZED LOSS ESTIMATIONS FOR HURRICANE WIND HAZARD

Location	Total Annualized Loss
Madison County	$13,000

Source: Hazus-MH 2.1

In addition, probable peak wind speeds were calculated in Hazus. These are shown below in **Table B.36.**

TABLE B.36: PROBABLE PEAK HURRICANE / TROPICAL STORM WIND SPEEDS (MPH)

Location	50-year event	100-year event	500-year event	1,000-year event
Hot Springs	48.0	57.9	76.2	82.3
Marshall	48.7	58.5	77.2	83.4
Mars Hill	49.1	59.0	78.2	84.9
Unincorporated Area	49.3	59.3	78.2	85.1
MAXIMUM WIND SPEED REPORTED	**49.3**	**59.3**	**78.2**	**85.1**

Source: Hazus-MH 2.1

Social Vulnerability

Given some susceptibility across the county, it is assumed that the total population is at risk to the hurricane and tropical storm hazard.

Critical Facilities

Given equal vulnerability across Madison County, all critical facilities are considered to be at risk. Some buildings may perform better than others in the face of such an event due to construction and age, among other factors. Determining individual building response is beyond the scope of this plan. However, this plan will consider mitigation actions for vulnerable structures, including critical facilities,

to reduce the impacts of the hurricane wind hazard. A list of specific critical facilities and their associated risk can be found in **Table B.45** at the end of this section.

In conclusion, a hurricane event has the potential to impact many existing and future buildings, critical facilities, and populations in Madison County. Hurricane events can cause substantial damage in their wake including fatalities, extensive debris clean-up, and extended power outages.

Earthquake

For the earthquake hazard vulnerability assessment, a probabilistic scenario was created to estimate the annualized loss for Madison County. The results of the analysis reported at the U.S. Census tract level do not make it feasible to estimate losses at the jurisdiction level. Since the scenario is annualized, no building counts are provided. Losses reported included losses due to building damage and do not include losses to contents, inventory, or business interruption. **Table B.37** summarizes the findings.

TABLE B.37: ANNUALIZED LOSS ESTIMATIONS FOR EARTHQUAKE HAZARD

Location	Total Annualized Loss
Madison County	$10,000

Source: Hazus-MH 2.1

Social Vulnerability

It can be assumed that all existing and future populations are at risk to the earthquake hazard.

Critical Facilities

The Hazus probabilistic analysis indicated that no critical facilities would sustain measurable damage in an earthquake event. However, all critical facilities should be considered at-risk to minor damage, should an event occur. A list of individual critical facilities and their risk can be found in **Table B.45**.

In conclusion, an earthquake has the potential to impact all existing and future buildings, facilities, and populations in Madison County. Minor earthquakes may rattle dishes and cause minimal damage while stronger earthquakes will result in structural damage as indicated in the Hazus scenario above. Impacts of earthquakes include debris clean-up, service disruption and, in severe cases, fatalities due to building collapse. Specific vulnerabilities for assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available. Furthermore, mitigation actions to address earthquake vulnerability will be considered.

Landslide

In order to complete the vulnerability assessment for landslides in Madison County, GIS analysis was used. The potential dollar value of exposed land and property total can be determined using the USGS Landslide Susceptibility Index (detailed in Section B.2.10), county level tax parcel data, and GIS analysis. **Table B.38** presents the potential at-risk property where available. All areas of Madison County are identified as moderate or high incidence areas by the USGS landslide data. All areas of the county are also of high landslide susceptibility. The incidence levels (high and moderate) were used to identify different areas of concern for the analysis below.

TABLE B.38: TOTAL POTENTIAL AT-RISK PARCELS FOR THE LANDSLIDE HAZARD

Location	Number of Parcels At Risk		Number of Improvements At Risk		Total Value of Improvements At Risk ($)	
Incidence Level	Moderate	High	Moderate	High	Moderate	High
Hot Springs	0	453	0	271	$0	$64,476,128
Marshall	0	579	0	344	$0	$49,630,874
Mars Hill	0	587	0	431	$0	$78,982,239
Unincorporated Area	1	19,205	0	8,494	$0	$2,169,030,525
MADISON COUNTY TOTAL	**1**	**20,824**	**0**	**9,540**	**$0**	**$997,190,902**

Source: United States Geological Survey

Social Vulnerability

Given high susceptibility across the entire county, it is assumed that the total population is at risk.

Critical Facilities

All critical facilities are located in a high susceptibility area. All critical facilities in Madison County are located in a high incidence area (high susceptibility). A list of specific critical facilities and their associated risk can be found in **Table B.45** at the end of this section.

In conclusion, a landslide has the potential to impact all existing and future buildings, facilities, and populations in Madison County, though some areas are at a higher risk than others due to a variety of factors. For example, steep slopes and modified slopes bear a greater risk than flat areas. Specific vulnerabilities for county assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available.

Flood

Historical evidence indicates that Madison County is susceptible to flood events. A total of 37 flood events have been reported by the National Climatic Data Center resulting in $20.5 million dollars in damages. On an annualized level, these damages amounted to $1.2 million for Madison County.

In order to assess flood risk, a GIS-based analysis was used to estimate exposure to flood events using Digital Flood Insurance Rate Map (DFIRM) data in combination with local tax assessor records for the county. The determination of assessed value at-risk (exposure) was calculated using GIS analysis by summing the total assessed building values for only those improved properties that were confirmed to be located within an identified floodplain. **Table B.39** presents the potential at-risk property. Both the number of parcels and the approximate value are presented.

TABLE B.39: ESTIMATED EXPOSURE OF PARCELS TO THE FLOOD HAZARD

	1.0-percent ACF			0.2-percent ACF		
Location	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings	Approx. Number of Parcels	Approx. Number Improved Buildings	Approx. Improved Value of Buildings
Hot Springs	123	60	$8,676,167	0	0	$0
Marshall	257	163	$16,119,395	0	0	$0

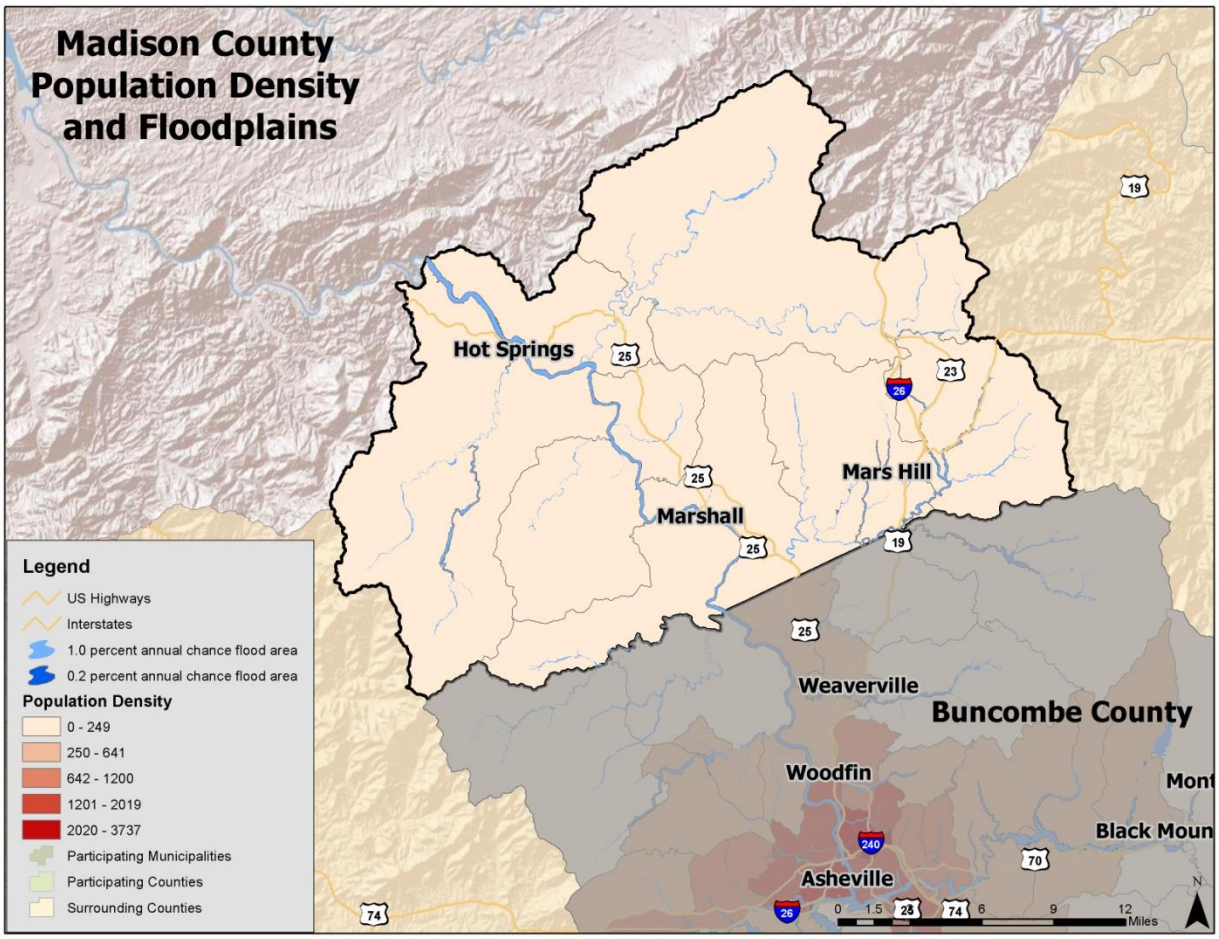
	1.0-percent ACF			0.2-percent ACF		
Location	**Approx. Number of Parcels**	**Approx. Number Improved Buildings**	**Approx. Improved Value of Buildings**	**Approx. Number of Parcels**	**Approx. Number Improved Buildings**	**Approx. Improved Value of Buildings**
Mars Hill	46	32	$4,174,548	0	0	$0
Unincorporated Area	2,501	1,181	$123,274,606	3	0	$0
MADISON COUNTY TOTAL	**2,927**	**1,436**	**$152,244,716**	**3**	**0**	**$0**

Source: Federal Emergency Management Agency DFIRM

Social Vulnerability

Since 2010 population was only available at the tract level, it was difficult to determine a reliable figure on population at-risk to flood due to tract level population data. **Figure B.15** is presented to gain a better understanding of at risk population.

FIGURE B.15 : POPULATION DENSITY NEAR FLOODPLAINS



Source: Federal Emergency Management Agency DFIRM, United States Census 2010

Critical Facilities

The critical facility analysis revealed that there are no critical facilities located in the Madison County 1.0-percent annual chance floodplain and 0.2-percent annual chance floodplain based on FEMA DFIRM boundaries and GIS analysis. A list of specific critical facilities and their associated risk can be found in **Table B.45** at the end of this section.

In conclusion, a flood has the potential to impact many existing and future buildings and populations in Madison County, though some areas are at a higher risk than others. All types of structures in a floodplain are at-risk, though elevated structures will have a reduced risk. As noted, the floodplains used in this analysis include the 100-year and 500-year FEMA regulated floodplain boundaries. It is certainly possible that more severe events could occur beyond these boundaries or urban (flash) flooding could impact additional structures. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates. Furthermore, areas subject to repetitive flooding should be analyzed for potential mitigation actions.

Hazardous Materials Incident

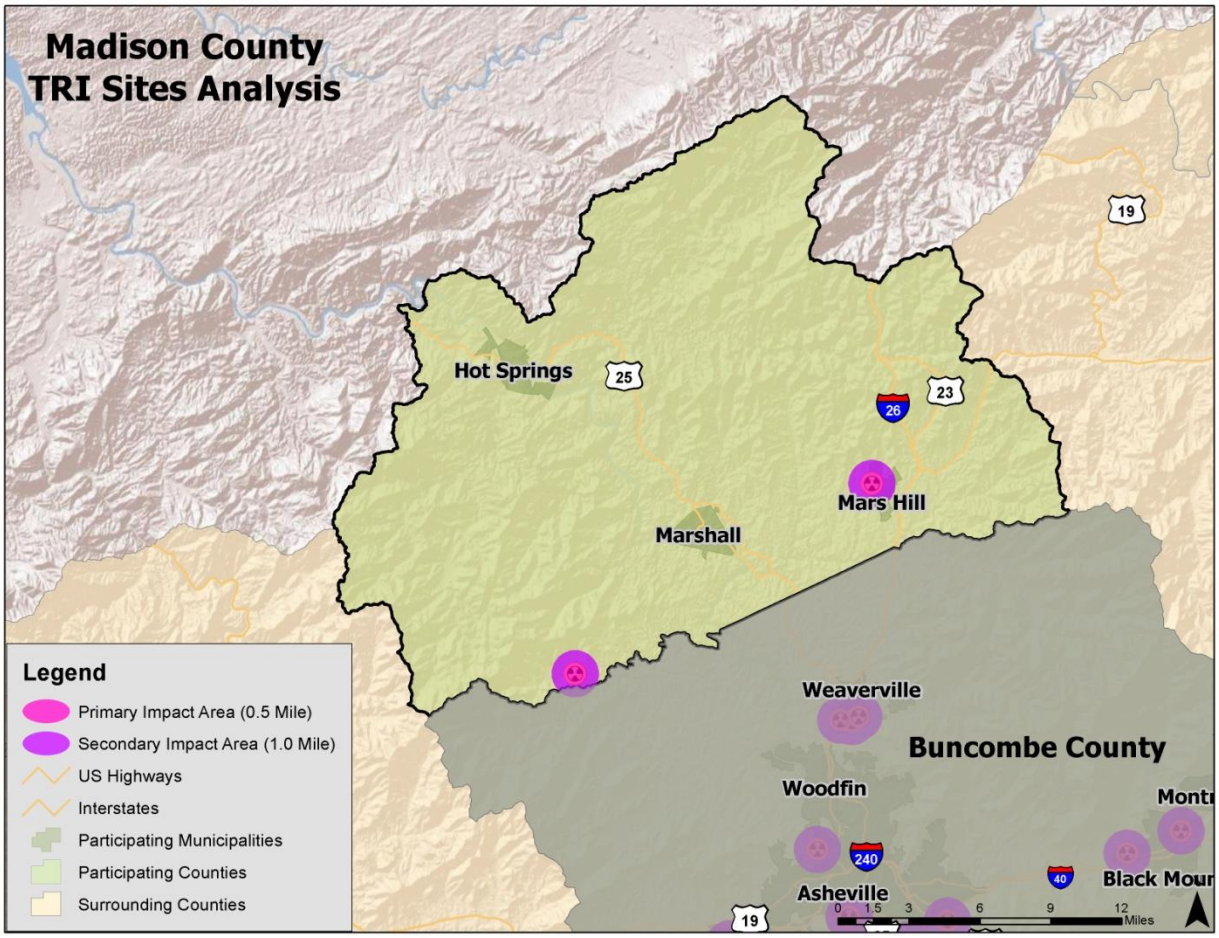
Although historical evidence and existing Toxic Release Inventory sites indicate that Madison County is susceptible to hazardous materials events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. It is assumed that while one major event could result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for Madison County.

Most hazardous materials incidents that occur are contained and suppressed before destroying any property or threatening lives. However, they can have a significant negative impact. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops. Certain chemicals may travel through the air or water, affecting a much larger area than the point of the incidence itself. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features, can substantially increase the damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

In order to conduct the vulnerability assessment for this hazard, GIS intersection analysis was used for fixed and mobile areas and parcels.[22] In both scenarios, two sizes of buffers—0.5 mile and 1.0 mile—were used. These areas are assumed to respect the different levels of effect: immediate (primary) and secondary. Primary and secondary impact sites were selected based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks against Buildings and engineering judgment. For the fixed site analysis, geo-referenced TRI listed toxic sites in Madison County, along with buffers, were used for analysis as shown in **Figure B.16.** For the mobile analysis, the major roads (Interstate highway, U.S. highway, and State highway) and railroads, where hazardous materials are primarily transported that could adversely impact people and buildings, were used for the GIS buffer analysis. **Figure B.17** shows the areas used for mobile toxic release buffer analysis. The results indicate the approximate number of parcels, improved value, as shown in **Table B.40** (fixed sites), **Table B.41** (mobile road sites) and **Table B.42** (mobile railroad sites).[23]

[22] This type of analysis will likely yield inflated results (generally higher than what is actually reported after an event).
[23] Note that parcels included in the 1.0-mile analysis are also included in the 0.5-mile analysis.

FIGURE B.16 : TRI SITES WITH BUFFERS IN MADISON COUNTY



Source: Environmental Protection Agency

TABLE B.40: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS (FIXED SITES)

	0.5-mile buffer			1.0-mile buffer		
Location	**Approx. Number of Parcels**	**Approx. Number Improved**	**Approx. Improved Value**	**Approx. Number of Parcels**	**Approx. Number Improved**	**Approx. Improved Value**
Hot Springs	0	0	$0	0	0	$0
Marshall	0	0	$0	0	0	$0
Mars Hill	101	69	$8,575,004	434	323	$44,352,109
Unincorporated Area	156	89	$13,591,736	476	273	$33,435,680
MADISON COUNTY TOTAL	**257**	**158**	**$22,166,740**	**910**	**596**	**$77,787,789**

FIGURE B.17 : MOBILE HAZMAT BUFFERS IN MADISON COUNTY

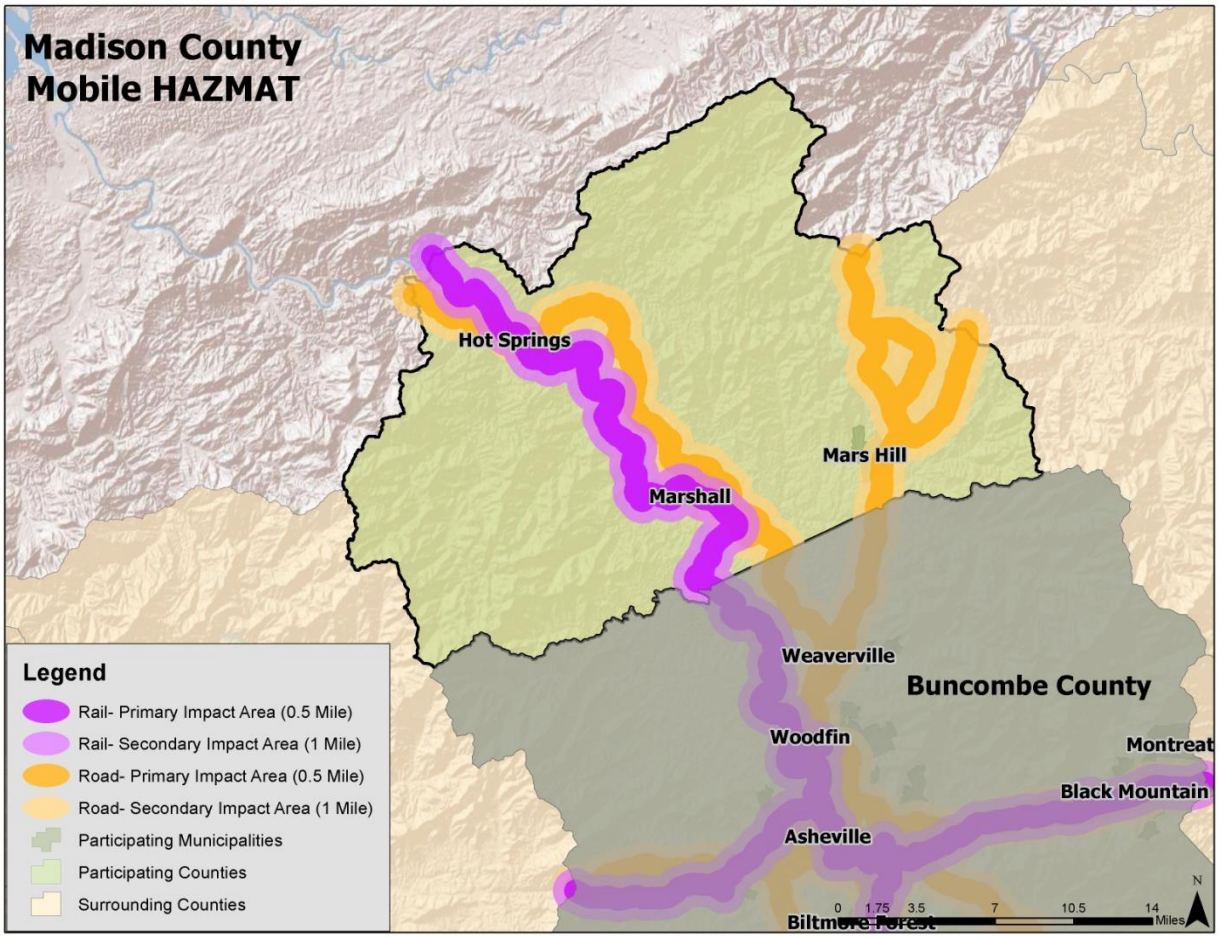


TABLE B.41: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - ROAD)

	0.5-mile buffer			1.0-mile buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Hot Springs	428	258	$25,662,549	453	271	$26,152,076
Marshall	551	330	$29,094,841	576	325	$29,911,968
Mars Hill	68	52	$10,590,755	442	342	$45,060,722
Unincorporated Area	4,094	1,939	$224,446,750	6,171	2,897	$318,550,141
MADISON COUNTY TOTAL	**5,141**	**2,579**	**$289,794,895**	**7,642**	**3,835**	**$419,674,907**

TABLE B.42: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS MATERIALS SPILL (MOBILE ANALYSIS - RAILROAD)

	0.5-mile buffer			1.0-mile buffer		
Location	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
Hot Springs	417	255	$25,224,582	453	271	$26,152,076
Marshall	490	286	$23,040,957	569	341	$29,253,538
Mars Hill	0	0	$0	0	0	$0
Unincorporated Area	1,076	446	$43,318,106	2,285	1,042	$96,340,507
MADISON COUNTY TOTAL	**1,983**	**987**	**$91,583,645**	**3,307**	**1,654**	**$151,746,121**

Social Vulnerability

Given high susceptibility across the entire county, it is assumed that the total population is at risk to hazardous materials incidents. It should be noted that areas of population concentration may be at an elevated risk due to a greater burden to evacuate population quickly.

Critical Facilities

Fixed Site Analysis:

The critical facility analysis for fixed TRI sites revealed that there are 7 Madison County facilities located in a HAZMAT risk zone. The primary impact zone includes one facility, a school. The remaining facilities are in the secondary, 1.0-mile zone. This includes 1 fire/EMS station, 3 police stations, 1 medical care facility, and 1 school. A list of specific critical facilities and their associated risk can be found in **Table B.45** at the end of this section.

Mobile Analysis:

The critical facility analysis for road and railroad transportation corridors in Madison County revealed that there are 21 critical facilities located in the primary and secondary mobile HAZMAT buffer areas for roads and 8 critical facilities located in the railroad HAZMAT buffer areas. The 1.0-mile road buffer area (worst case scenario modeled) includes the following critical facilities: 1 EOC, 6 fire/EMS stations, 5 police stations, 3 medical care facilities, and 6 schools. The 1.0-mile railroad buffer areas include the following critical facilities: 2 fire/EMS stations, 2 police stations, 1 medical care facility, and 2 schools. It should be noted that many of the facilities located in the buffer areas for road are also located in the buffer areas for railroad and/or the fixed site analysis. A list of specific critical facilities and their associated risk can be found in **Table B.45** at the end of this section.

In conclusion, a hazardous material incident has the potential to impact many existing and future buildings, critical facilities, and populations in Madison County. Those areas in a primary buffer are at the highest risk, though all areas carry some vulnerability due to variations in conditions that could alter the impact area such direction and speed of wind, volume of release, etc. Further, incidents from neighboring counties could also impact the county and participating jurisdictions.

Wildfire

Although historical evidence indicates that Madison County is susceptible to wildfire events, there are few reports of damage. Therefore, it is difficult to calculate a reliable annualized loss figure. Annualized loss is considered negligible though it should be noted that a single event could result in significant damages throughout the county.

To estimate exposure to wildfire, the approximate number of parcels and their associated improved value was determined using GIS analysis. For the critical facility analysis, areas of concern were intersected with critical facility locations. **Figure B.18**, **Figure B.19**, **Figure B.20**, and **Figure B.21** show the Level of Concern data. Initially provided as raster data, it was converted to a polygon to allow for analysis. The LOC data ranges from 1 to 100 with higher values being most severe (as noted previously, this is only a measure of relative risk). Twenty-five was the highest level recorded in the Buncombe Madison planning area. Therefore, areas with a value above 1 were chosen to be displayed as areas of risk. The county contains some large areas where the value falls into the at-risk category, making it somewhat more at-risk than many other regions of North Carolina. Since all of this land area is on the lower fourth of the overall LOC scale, there is likely somewhat less risk in the county than in other areas of the country.

Table B.43 shows the results of the analysis.

FIGURE B.18: WILDFIRE RISK AREAS IN MADISON COUNTY

Source: Southern Wildfire Risk Assessment Data

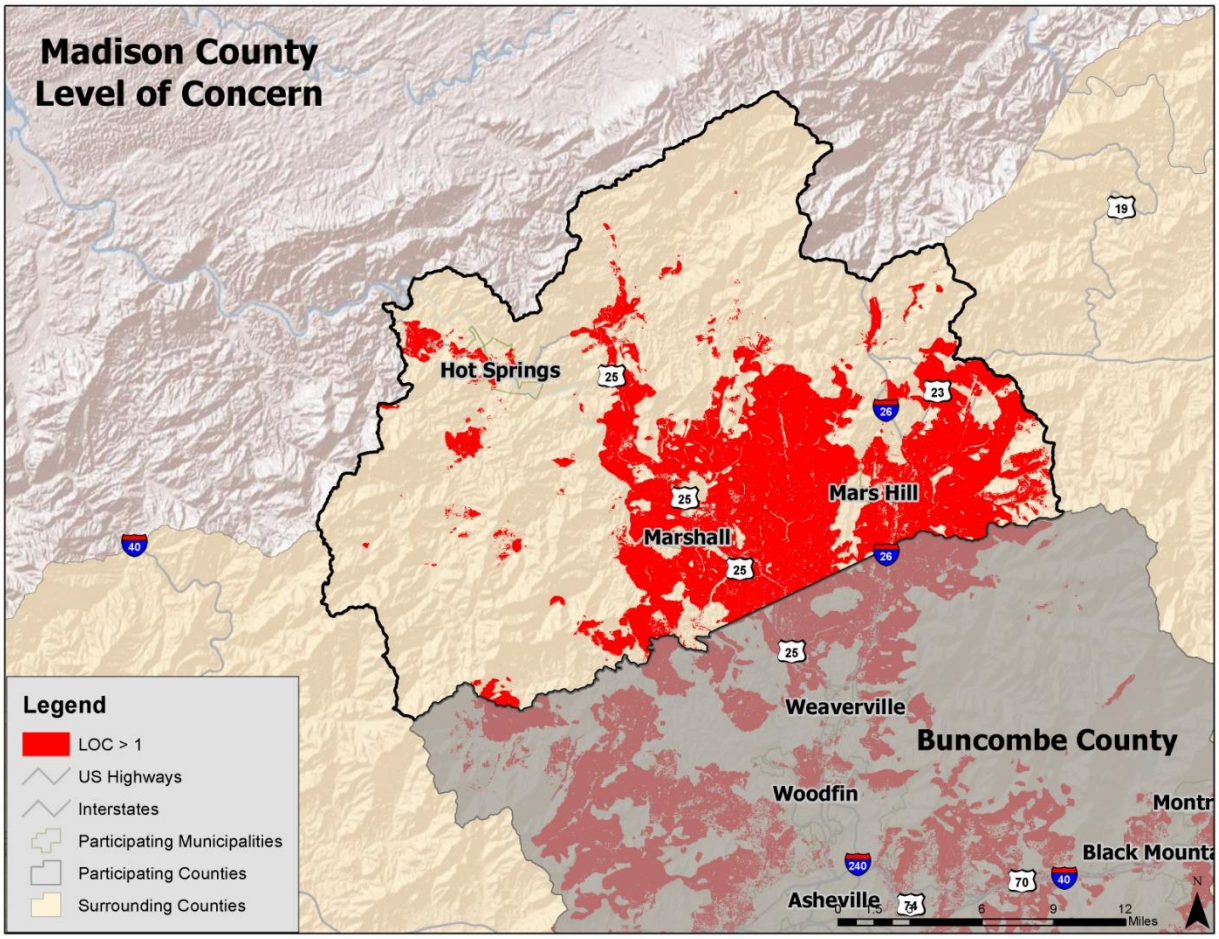
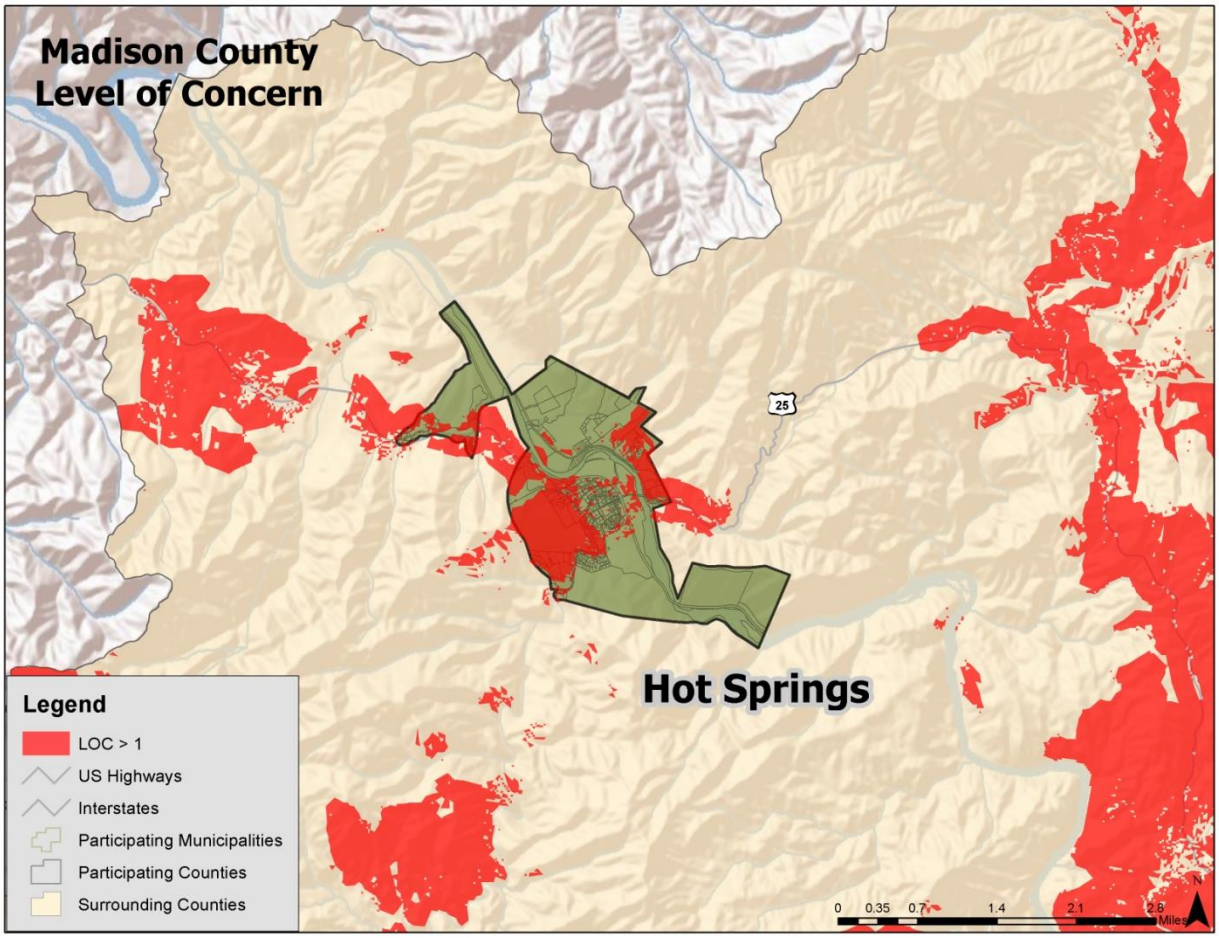
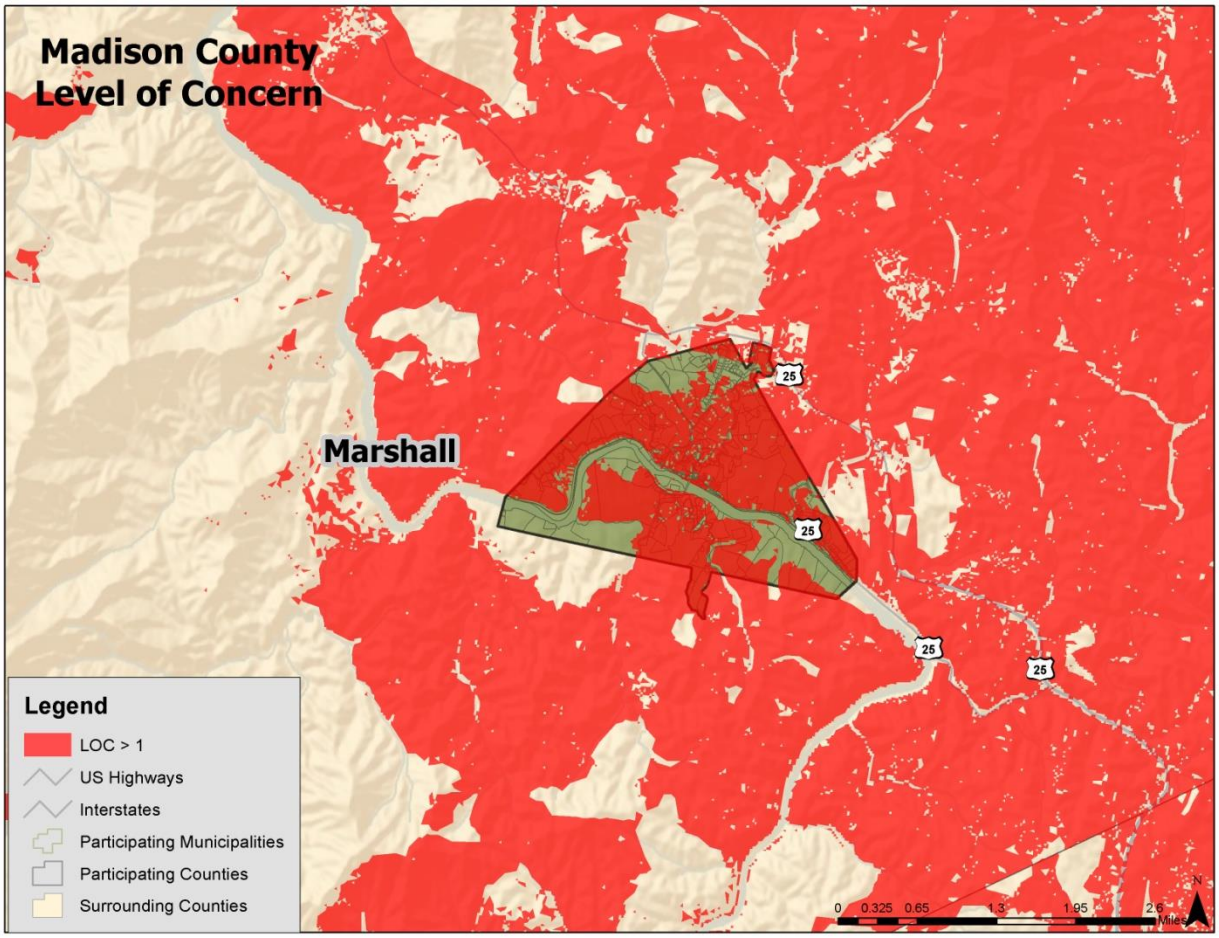


FIGURE B.19: WILDFIRE RISK AREAS IN HOT SPRINGS



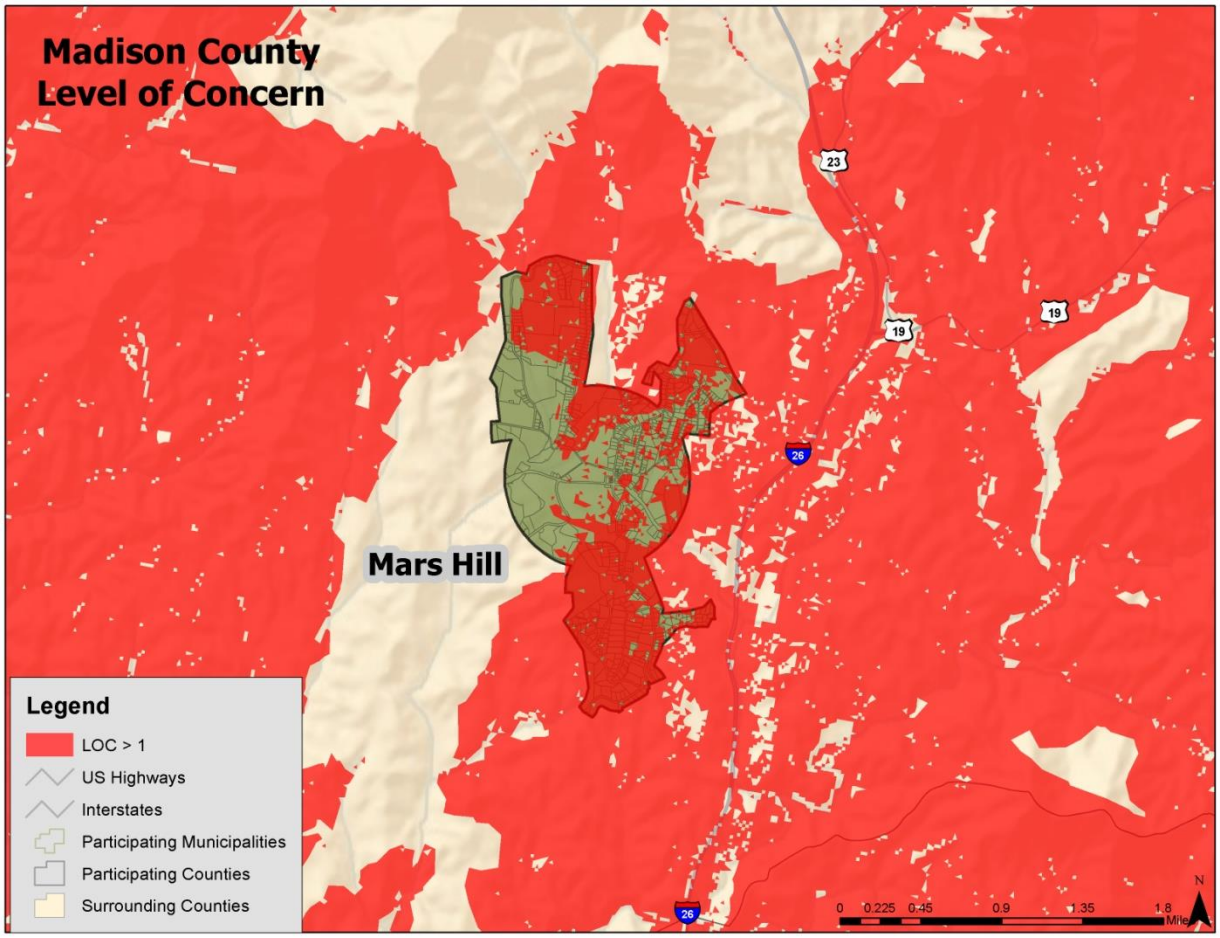
Source: Southern Wildfire Risk Assessment Data

FIGURE B.20: WILDFIRE RISK AREAS IN MARSHALL



Source: Southern Wildfire Risk Assessment Data

FIGURE B.21: WILDFIRE RISK AREAS IN MARS HILL



Source: Southern Wildfire Risk Assessment Data

TABLE B.43: EXPOSURE OF IMPROVED PROPERTY TO WILDFIRE AREAS OF CONCERN

	HIGH WILDFIRE RISK AREA		
Location	**Approx. Number of Parcels**	**Approx. Number of Buildings**	**Approx. Improved Value**
Hot Springs	264	163	$16,708,039
Marshall	523	307	$26,546,672
Mars Hill	489	360	$50,316,020
Unincorporated Area	10,664	5,229	$563,985,076
MADISON COUNTY TOTAL	**11,940**	**6,059**	**$657,555,807**

Looking at the jurisdiction level, unincorporated areas of the county face the highest level of concern areas. However, most incorporated areas of the county, especially Marshall and Mars Hill, are surrounded by areas where the level of concern is above 1.

Social Vulnerability
Although not all areas have equal vulnerability, there is some susceptibility across the entire county. It is assumed that the total population is at risk to the wildfire hazard. Determining the exact number of people in certain wildfire zones is difficult with existing data and could be misleading.

Critical Facilities
The critical facility analysis revealed that there are 2 schools, 3 fire/EMS stations, 1 police station, 1 EOC, and 2 medical care facilities located in the wildfire areas of concern in Madison County. It should also be noted, however, that several factors could impact the spread of a wildfire putting all facilities at risk. A list of specific critical facilities and their associated risk can be found in **Table B.45** at the end of this section.

In conclusion, a wildfire event has the potential to impact many existing and future buildings, critical facilities, and populations in Madison County.

Conclusions on Hazard Vulnerability
Table B.44 presents a summary of annualized loss for each hazard in Madison County. Due to the reporting of hazard damages primarily at the county level, it was difficult to determine an accurate annualized loss estimate for each municipality. Therefore, an annualized loss was determined through the damage reported through historical occurrences at the county level. These values should be used as an additional planning tool or measure risk for determining hazard mitigation strategies throughout the county.

TABLE B.44: ANNUALIZED LOSS FOR MADISON COUNTY

Event	Madison County
Atmospheric Hazards	
Drought	Negligible
Extreme Heat	Negligible
Hailstorm	$1,730
Hurricane & Tropical Storm	$13,000
Lightning	$23,658
Severe Thunderstorm / High Wind	$51,740
Tornado	$60,793
Winter Storm & Freeze	$319,567
Geologic Hazards	
Earthquake	$10,000
Landslide	Negligible
Hydrologic Hazards	
Dam Failure	Negligible
Erosion	Negligible
Flood	$1,160,697
Other Hazards	
HAZMAT Incident	Negligible

Event	Madison County
Wildfire	Negligible

*In this table, the term "Negligible" is used to indicate that no records of dollar losses for the particular hazard were recorded. This could be the case either because there were no events that caused dollar damage or because documentation of that particular type of event is not well kept.

As noted previously, all existing and future buildings and populations (including critical facilities) are vulnerable to atmospheric hazards including drought, extreme heat, hailstorm, hurricane and tropical storm, lightning, thunderstorm wind, tornado, and winter storm and freeze. Some buildings may be more vulnerable to these hazards based on locations, construction, and building type. **Table B.45** shows the critical facilities vulnerable to additional hazards analyzed in this section. The table lists those assets that are determined to be exposed to each of the identified hazards (marked with an "**X**").

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TABLE B.45: AT-RISK CRITICAL FACILITIES IN MADISON COUNTY

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
MADISON COUNTY																					
Madison County EOC	EOC	X	X	X	X	X	X	X	X	X	X						X	X		X	X
TOWN OF HOT SPRGS-POLICE DEPT	Police Station	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
HOT SPRINGS	Fire Station	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
Hot Springs Elementary School	School	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
MARS HILL MEDICAL CENTER	Medical Care Facility	X	X	X	X	X	X	X	X	X	X					X		X			
STATE HIGHWAY PATROL	Police Station	X	X	X	X	X	X	X	X	X	X					X	X	X			
JARRETT BLDG - CAMPUS POLICE	Police Station	X	X	X	X	X	X	X	X	X	X					X		X			
MARS HILL POLICE	Police Station	X	X	X	X	X	X	X	X	X	X					X		X			
MARS HILL	Fire Station	X	X	X	X	X	X	X	X	X	X					X		X			
Mars Hill College	School	X	X	X	X	X	X	X	X	X	X					X		X			X
MADISON COUNTY JAIL	Police Station	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X
MARSHALL	Fire Station	X	X	X	X	X	X	X	X	X	X						X	X	X	X	
ELDERBERRY HEALTH CARE	Medical Care Facility	X	X	X	X	X	X	X	X	X	X						X	X		X	

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
LAUREL MEDICAL CTR	Medical Care Facility	X	X	X	X	X	X	X	X	X	X										X
MADISON MANOR NURSING HOME	Medical Care Facility	X	X	X	X	X	X	X	X	X	X						X	X			X
BIG PINE	Fire Station	X	X	X	X	X	X	X	X	X	X										
COUNTRY	Fire Station	X	X	X	X	X	X	X	X	X	X						X	X			
EBBS CHAPEL	Fire Station	X	X	X	X	X	X	X	X	X	X							X			X
LAUREL	Fire Station	X	X	X	X	X	X	X	X	X	X										
SPRING CREEK	Fire Station	X	X	X	X	X	X	X	X	X	X										
WALNUT	Fire Station	X	X	X	X	X	X	X	X	X	X						X	X			X
JUPITER	Fire Station	X	X	X	X	X	X	X	X	X	X										
Leister	Fire Station	X	X	X	X	X	X	X	X	X	X										X
Brush Creek Elementary	School	X	X	X	X	X	X	X	X	X	X						X	X			
Laurel Elementary School	School	X	X	X	X	X	X	X	X	X	X										
Madison High School	School	X	X	X	X	X	X	X	X	X	X						X	X			
Madison Middle School	School	X	X	X	X	X	X	X	X	X	X						X	X			
Mars Hill Elementary School	School	X	X	X	X	X	X	X	X	X	X				X	X					

FACILITY NAME	FACILITY TYPE	ATMOSPHERIC								GEOLOGIC			HYDROLOGIC		OTHER						
		Drought	Extreme Heat	Hailstorm	Hurricane and Tropical Storm	Lightning	Thunderstorm	Tornado	Winter Storm and Freeze	Earthquake	Landslide – High Incidence	Landslide- Mod. Incidence	Flood – 100 yr	Flood – 500 yr	Fixed HAZMAT 0.5 mile	Fixed HAZMAT 1.0 mile	Mobile HZMT 0.5 mile (road)	Mobile HZMT 1.0 mile (road)	Mobile HZMT 0.5 mile (rail)	Mobile HZMT 1.0 mile (rail)	Wildfire
A-B Tech	School	X	X	X	X	X	X	X	X	X	X						X	X		X	X

B.4 MADISON COUNTY CAPABILITY ASSESSMENT

This subsection discusses the capability of Madison County to implement hazard mitigation activities. More information on the purpose and methodology used to conduct the assessment can be found in Section 7: *Capability Assessment*.

A.4.1 Planning and Regulatory Capability

Table A.46 provides a summary of the relevant local plans, ordinances, and programs already in place or under development for Madison County. A checkmark (✓) indicates that the given item is currently in place and being implemented. An asterisk (*) indicates that the given item is currently being developed for future implementation. Each of these local plans, ordinances, and programs should be considered available mechanisms for incorporating the requirements of the Buncombe Madison Regional Hazard Mitigation Plan.

TABLE A.46: RELEVANT PLANS, ORDINANCES, AND PROGRAMS

Planning Tool/Regulatory Tool	Hazard Mitigation Plan	Comprehensive Land Use Plan	Floodplain Management Plan	Open Space Management Plan (Parks & Rec/Greenway Plan	Stormwater Management Plan/Ordinance	Natural Resource Protection Plan	Flood Response Plan	Emergency Operations Plan	Continuity of Operations Plan	Evacuation Plan	Disaster Recovery Plan	Capital Improvements Plan	Economic Development Plan	Historic Preservation Plan	Flood Damage Prevention Ordinance	Zoning Ordinance	Subdivision Ordinance	Unified Development Ordinance	Post-Disaster Redevelopment Ordinance	Building Code	Fire Code	National Flood Insurance Program (NFIP)	NFIP Community Rating System
MADISON COUNTY	✓	✓						✓					✓		✓	✓	✓			✓	✓	✓	
Hot Springs	✓	✓						✓					✓		✓	✓				✓	✓	✓	
Marshall	✓	✓			✓			✓				✓	✓		✓	✓	✓	✓		✓	✓	✓	
Mars Hill	✓	✓						✓				✓	✓		✓	✓	✓			✓	✓	✓	

A more detailed discussion on the county's planning and regulatory capabilities follows.

Emergency Management

Hazard Mitigation Plan

Madison County has previously adopted a hazard mitigation plan. The Town of Hot Springs, the Town of Marshall, and the Town of Mars Hill were also included in this plan.

Emergency Operations Plan
Madison County maintains an emergency operations plan through its Emergency Management Department. Madison County's emergency operations plan addresses hazards which threaten the county and municipalities.

General Planning

Comprehensive Land Use Plan
Madison County, the Town of Hot Springs, the Town of Marshall, and the Town of Mars Hill have each adopted a comprehensive plan.

Capital Improvements Plan
Madison County does not have a capital improvements plan in place. However, the Town of Marshall and the Town of Mars Hill do have capital improvements programs.

Zoning Ordinance
Madison County and all of its municipalities have adopted zoning ordinances. The Town of Marshall includes zoning regulations as part of its local unified development ordinance. The other municipalities and county have adopted stand-alone zoning ordinances.

Subdivision Ordinance
Madison County and all of its municipalities have adopted subdivision regulations. Again, the Town of Marshall includes these regulations as part of its local unified development ordinance. The other municipalities and county have adopted stand-alone ordinances.

Building Codes, Permitting, and Inspections
North Carolina has a state compulsory building code which applies throughout the state. The building code is enforced throughout the county by the county building inspector.

Floodplain Management

Table A.47 provides NFIP policy and claim information for each participating jurisdiction in Madison County.

TABLE A.47: NFIP POLICY AND CLAIM INFORMATION

Jurisdiction	Date Joined NFIP	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Closed Claims	Total Payments to Date
MADISON COUNTY†	09/02/82	01/06/10	54	$14,328,800	11	$416,269
Hot Springs	07/05/82	01/06/10	7	$854,300	1	$2,361
Marshall	05/15/78	01/06/10	30	$6,865,300	36	$517,815
Mars Hill	08/19/87	01/06/10	1	$42,000	0	$0

†Includes unincorporated areas of county only
Source: NFIP Community Status information as of 10/3/13; NFIP claims and policy information as of 7/31/13

Flood Damage Prevention Ordinance
All communities participating in the NFIP are required to adopt a local flood damage prevention ordinance. Madison County and all of its municipalities participate in the NFIP and have adopted flood damage prevention regulations.

Stormwater Management Plan
Neither Madison County nor any of its municipalities have a stormwater management plan in place. However, the Town of Marshall has adopted stormwater regulations. These regulations are included in the town's unified development ordinance.

A.4.2 Administrative and Technical Capability

Table A.48 provides a summary of the capability assessment results for Madison County with regard to relevant staff and personnel resources. A checkmark (✓) indicates the presence of a staff member(s) in that jurisdiction with the specified knowledge or skill.

TABLE A.48: RELEVANT STAFF / PERSONNEL RESOURCES

Staff / Personnel Resource	Planners with knowledge of land development/land management practices	Engineers or professionals trained in construction practices related to buildings and/or infrastructure	Planners or engineers with an understanding of natural and/or human-caused hazards	Emergency Manager	Floodplain Manager	Land Surveyors	Scientists familiar with the hazards of the community	Staff with education or expertise to assess the community's vulnerability to hazards	Personnel skilled in GIS and/or Hazus	Resource development staff or grant writers
MADISON COUNTY		✓		✓	✓		✓	✓	✓	
Hot Springs		✓		✓	✓		✓	✓		
Marshall		✓		✓	✓		✓	✓		
Mars Hill		✓		✓	✓		✓	✓		

Credit for having a floodplain manager was given to those jurisdictions that have a flood damage prevention ordinance, and therefore an appointed floodplain administrator, regardless of whether the appointee was dedicated solely to floodplain management. Credit was given for having a scientist familiar with the hazards of the community if a jurisdiction has a Cooperative Extension Service or Soil and Water Conservation Department. Credit was also given for having staff with education or expertise to assess the community's vulnerability to hazards if a staff member from the jurisdiction was a participant on the existing hazard mitigation plan's planning committee.

A.4.3 Fiscal Capability

Table A.49 provides a summary of the results for Madison County with regard to relevant fiscal resources. A checkmark (✓) indicates that the given fiscal resource is locally available for hazard mitigation purposes (including match funds for state and federal mitigation grant funds) according to the previous county hazard mitigation plan.

TABLE A.49: RELEVANT FISCAL RESOURCES

Fiscal Tool / Resource	Capital Improvement Programming	Community Development Block Grants (CDBG)	Special Purpose Taxes (or taxing districts)	Gas/Electric Utility Fees	Water/Sewer Fees	Stormwater Utility Fees	Development Impact Fees	General Obligation, Revenue, and/or Special Tax Bonds	Partnering Arrangements or Intergovernmental Agreements	Other: HMGP, FMAP, other Federal and state funding sources, etc.
MADISON COUNTY	✓	✓	✓						✓	✓
Hot Springs	✓	✓	✓						✓	✓
Marshall	✓	✓	✓						✓	✓
Mars Hill	✓	✓	✓						✓	✓

A.4.4 Political Capability

The previous hazard mitigation plan indicates that in Madison County, as with many municipalities, major changes will likely be met with resistance. However, incremental changes stand a better chance of success over the long term. In terms of changes to hazard mitigation, there are numerous opportunities for Madison County, however, public education and progressive steps are essential for the success of any new initiatives. If the public is supportive of proposed changes, the elected officials who are responsible for adopting them are more likely to show their support. Building a disaster-resistant community depends primarily on involving the public and achieving participation. As required by FEMA for the local hazard mitigation plan, public participation is a must and to make it true, the political climate ought to be suitable.

A.4.5 Conclusions on Local Capability

Table A.50 shows the results of the capability assessment using the designed scoring methodology described in Section 7: *Capability Assessment*. The capability score is based solely on the information found in existing hazard mitigation plans and readily available on the jurisdictions' government

websites. According to the assessment, the average local capability score for the county and its municipalities is 28.5, which falls into the moderate capability ranking.

TABLE A.50: CAPABILITY ASSESSMENT RESULTS

Jurisdiction	Overall Capability Score	Overall Capability Rating
MADISON COUNTY	32	Moderate
Hot Springs	25	Moderate
Marshall	30	Moderate
Mars Hill	27	Moderate

A.5 MADISON COUNTY MITIGATION STRATEGY

This subsection provides the blueprint for Madison County to follow in order to become less vulnerable to its identified hazards. It is based on general consensus of the Regional Hazard Mitigation Planning Team and the findings and conclusions of the capability assessment and risk assessment. Additional Information can be found in Section 8: *Mitigation Strategy* and Section 9: *Mitigation Action Plan*.

A.5.1 Mitigation Goals

Madison County developed 11 mitigation goals in coordination with the other participating Buncombe Madison Region jurisdictions. The regional mitigation goals are presented in **Table A.51**.

TABLE A.51: BUNCOMBE MADISON REGIONAL MITIGATION GOALS

	Goal
Goal #1	Incorporate hazard mitigation into the planning process of each jurisdiction and continue to carry out hazard mitigation by seeking funding when available.
Goal #2	Evaluate, strengthen, and enforce ordinances.
Goal #3	Increase and enhance public education and awareness regarding disasters and hazard mitigation.
Goal #4	Address stormwater management and impervious surface issues.
Goal #5	Continue participation in the National Flood Insurance Program and investigate participation in the NFIP's Community Rating System.
Goal #6	Conduct future development (including infrastructure) in a way that protects human life and property through management of natural features such as floodplains and wetlands and avoids development in known hazard areas. This will also reduce the risk to emergency workers.
Goal #7	Ensure that population growth does not exceed the capacity of evacuation routes.
Goal #8	Protect existing structures through retrofitting or other means.

	Goal
Goal #9	Enhance the community's capability through the use of mutual aid agreements and sharing of resources at the county and regional level.
Goal #10	Ensure that community officials are well-educated and aware of existing resources, regulations, and procedures related to disasters.
Goal #11	Maintain and monitor the current plan and renew and revise as necessary.

A.5.2 Mitigation Action Plan

The mitigation actions proposed by Madison County, the Town of Hot Springs, the Town of Black Marshall, and the Town of Mars Hill are listed in the following individual Mitigation Action Plans.

Madison County Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Continue participation in the National Flood Insurance Program without suspension.	FL	High	Local	EM	2015, Annual review	The county is currently a participant in the NFIP and will continue to work to maintain compliance going forward.
P-2	Inventory of residential and commercial properties in the 100 year floodplain to mitigate the hazards of flooding– In addition to clearing debris in County creeks and the work now being considered by the US Army Corps of Engineers in the French Broad River in the vicinity of Marshall to reduce future flood impacts, it is recommended that an inventory of those public and private structures located in the floodplain be conducted and list of priority properties be identified for acquisition and relocation, or if appropriate, elevation of structures.	FL	Moderate	Local	EM	2015, Annual review	During this plan update, an inventory of properties in the 100 year floodplain was estimated. However, this list will need to be updated when future map updates occur and as mitigation actions are taken.
P-3	Inventory of dams in the County to mitigate the hazards of dam failure and flooding. – Conduct a full inventory of all publicly and privately maintained dams in the County. The information collected will identify problem areas and opportunities for rehabilitation or removal of decaying dams.	D/FL	Moderate	Local	EM	2015, Annual review	During this plan update, an inventory of dams was created. However, this list does not include all privately owned smaller dams and the list will need to be updated periodically so there is still some work to be completed on this action.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-4	Terrorism assessment and public health survey to mitigate the hazards of terrorism– By all accounts, the risk of a terrorist attack occurring in Madison County is small but it cannot be totally ignored. It is recommended that the County conduct a full assessment of its terrorist risk and of the capabilities of the public health system. Included in the appendices to this report is a community terrorism assessment. Public health system terrorism assessment tools are currently under development. The results of these two surveys should identify opportunities to reduce the impact of both a terrorist incident but also natural hazards such as floods, hurricanes, tornadoes, etc.	TR	Moderate	Local	EM	2018	The county will need to carry out a full assessment of its risk to a terrorist attack and the threats to the public health system.
P-5	Prepare a needs assessment for a second hazmat team to mitigate the hazards of hazmat.	HZ	Moderate	Local	EM	Completed	The county has developed a needs assessment and will look at investing in a second HazMat team. See ES-8
P-6	Link County, municipal and other computer systems and networks for use in mitigation and response efforts – It is recommended that County officials explore linking existing County computer systems to collect and process hazard data in order to provide information on hazard mitigation opportunities and to assist in disaster response and recovery efforts. There are numerous computer software products on the market or in development that could be used to integrate multiple data sources and assess the data collected.	All	Moderate	Local	IT/EM	2017	The county has looked into ways to integrate its computer systems and has done so in many ways to support productivity including having a countywide GIS layer of critical facilities. Although some of these initiatives have supported mitigation activities, additional integration is needed to fully support mitigation efforts.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-7	Establish a local funding source for mitigation projects – Consideration should be given to establishing a local funding source designed to provide incentives to developers to build disaster resistant homes and subdivisions. Funds from this account could also be used to provide loans and/or grants to homeowners and businesses for hazard mitigation projects. Funding mechanisms to be considered should include but not be limited to: sales tax increase, real estate tax, bond issue, utility charge and others.	All	Moderate	Local	EM	2019	The county has not established a local funding source to incentivize builders to develop disaster-resistant homes and businesses because it was not economically feasible. The county will look to establish this going forward.
P-8	Creative initiatives already under consideration to take advantage of tourist revenues should continue and other opportunities explored. Opportunities represented by the increase in market of second/vacation homes need to be explored.	All	Moderate	Local	County Board	2016	Thus far, the county has not looked into utilizing additional funding from tourist revenues to support mitigation initiatives to any great degree because those funds were needed for other projects/initiatives. The county will investigate whether this would be a viable option going forward.
P-9	Staffing for first responders – Staffing levels at some of the County fire installations. Priority should be given to finding ways to attract additional staff and resources.	All	Moderate	Local	EM	2019	The county has worked hard to ensure adequate staffing at its first responder facilities, but more staff is needed to have a sufficient coverage for all response needs.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
P-10	Ambulance Shortfall – Severe concerns were raised over the lack of ambulance capacity within the County. The distances within the County and potential for multiple incidents, in addition to the more routine medical emergencies requires the County to explore means to increase the number of ambulances available to serve the County, even in non-disaster circumstances.	All	Moderate	Local	EM	2019	The county has worked hard to ensure adequate ambulances, but this capacity remains an issue and additional funding will need to be pursued.
P-11	Application for emergency funds from the US Department of Transportation for impacts in I-26 corridor – County officials should approach the US Department of Transportation (DOT) to inquire if DOT emergency funds may be available to address flooding issues in the new I-26 corridor.	FL	Moderate	Federal	EM	2018	Many of the flooding issues in the new I-26 corridor remain and so the county will continue to pursue funding and efforts to try to address these issues. This type of funding has been discussed over the past 5 years, but there has been minimal advancement in terms of applying those funds to I-26.
Property Protection							
PP-1	Remove debris from streams across County.	FL	High	Grants	EM	2015, After events	The county has worked to remove debris from streams and ensure adequate flow of water. The county will continue to address any debris issues in streams and will seek funding to do so, especially in the wake of a disaster event.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-2	Update and enforce Land Use Ordinances and Building Codes to mitigate the hazards of structure fires, flooding, and landslides. Critical segments of this ordinance are the requirements for transportation ingress and egress to subdivisions and the grade of subdivision roadways. These requirements must be properly enforced to ensure that emergency vehicles will have adequate access to hazards in subdivisions and that floodplain restrictions are met.	WF/FL/LS	Moderate	Local	Planning and Zoning	2015, Annual review	The county has enforced its land use ordinances and building codes and will continue to update these codes as necessary to improve the county's resilience and mitigate the impacts of hazards.
PP-3	Clear fire fuel from forest floor in Wolf Laurel and other targeted areas in the County to mitigate the hazards of wildfire– The recent drought and the southern pine beetle epidemic has resulted in significant levels of additional fuel on the forest floor in several areas in the County. Removing this fuel should be a priority for fire prevention efforts in the County in the coming months.	WF	Moderate	Local	EM	2015, Annual process	The county has worked with staff at NC Forestry to clear fire fuel from the forest floor and reduce the potential impacts from wildfire. This will continue to be a priority going forward, especially in dry times when wildfires are more likely.
PP-4	Actively buyout targeted residential and commercial properties in the 100-year floodplain – Based on the priorities established as part of the countywide inventory, begin the acquisition, relocation or elevation of structures. This is a voluntary involvement project. It is further noted that the Town of Marshall is opposed to the demolition of any historical buildings in the Downtown area.	FL	Low	FEMA/Federal Grants	EM	2019	In recent years, the county has not acquired or elevated many homes due to a combination of factors including lack of funding and lack of interest, but it would like to look at implementing more voluntary buyouts and elevations in the future to reduce flood risk.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Emergency Services							
ES-1	Assess the need and seek funds to acquire warning systems – It is recommended that the County assess the need for various warning systems to address the hazards in the County. These systems would include a siren based system to alert residents to wildfire activities and threats, a series of stream gauges to alert residents and public officials to flood threats and conditions in the creeks in the County and in the French Broad River and a reverse 911 systems capability for use by County officials in alerting residents to threats and evacuation orders.	All	Moderate	Local	EM	2018	The county has installed some warning system capability, but in many ways it is not sufficient in terms of its total coverage due to some populations not being reached. The county would like to work to continue expanding its warning system capability.
ES-2	It is also recommended that the County sponsor Community Emergency Response Training (CERT) for individuals and business owners.	All	Moderate	Local	EM	2019	The county has not had as much success as it would like in developing a CERT team so it will continue to work to improve this resource in the future by training more individuals.
ES-3	Training for first responders – County police, fire, EMS and public health officers require additional training in responding to hazardous materials transportation incidents and biological and chemical incidents.	HM	Moderate	Local	EM	2019	Although first responders have been well trained in the county, there are always new strategies for improving this capability so additional training will be pursued.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-4	Improved operations and communications- It is recommended that County officials regularly exercise their response plan to natural and manmade disasters in order to maintain and refine coordination and communications among first responders. The County should hold at least one full exercise annually followed by a full debriefing of participants. Consideration should also be given to conducting 1-2 tabletop exercises annually including at least one tabletop exercise with a terrorism scenario.	All	Moderate	Local	EM	2015, Annual exercise	The county has held an annual exercise to practice and train for major disaster events. It will continue to hold an exercise at least annually going forward.
ES-5	Seek agreements with hospitals outside of the County on mass casualty requirements – County officials should approach hospitals located outside the County, including Tennessee, to establish mutual aid agreements concerning protocols if a mass casualty event occurs in the County. It is recommended that these new agreements build on existing agreements and expand to new facilities in order to achieve a reasonable capacity for mass casualties should an event occur in Madison County.	All	Moderate	Local	EM	2018	The county has worked to expand its capability in terms of hospitals and medical care with regard to mass casualty events. The county will continue to work on maintaining existing resources while expanding to new resources.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-6	Seek agreements with rail carriers in the County on notification requirements for HZM transported in and through the County – County officials should contact the Norfolk Southern railway concerning the shipment of hazardous materials on the rail line in the County and to determine roles and responsibilities of notification and response requirements for incidents involving a rail incident involving hazardous materials in the County.	HM	Moderate	Local	County Officials/EM	2016	The county has worked with rail carriers on notification requirements for materials passing through the county, but increased coordination is likely going to be necessary to maintain and improve the system of coordination and ensure safety.
ES-7	Acquire HZM equipment for fire, police and EMS – Each of the volunteer fire departments in the County consider the acquisition of additional hazardous materials response equipment a top priority. This equipment will provide needed protection to County first responders and improve their response capabilities. As a result, threat of injury and death to first responders and accident victims in hazardous materials incidents will be reduced which also result in reduced insurance costs and improved public safety.	All	Low	Federal and Private Grants	EM	2019	The county has provided adequate equipment and resources for responders, but this capability could be improved with additional resources.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
ES-8	Establish a second HazMat response team – Based on a needs assessment and the increased traffic in hazardous materials expected in the County in the future when the I-26 corridor is completed requires that the County consider establishing a second HazMat response team. Establishing this new team will require additional training for fire, police and EMS personnel, additional HazMat equipment for first responders and revisions to existing response protocols among volunteer fire departments. Consideration must also be given to where to locate this new team.	HM	Low	Federal and Private Grants	EM	2018	The county has not established a second HazMat team due to lack of funding, but it will look into funding for one in the future.
ES-9	Acquire fire equipment – Each of the volunteer fire departments in the County has fire equipment needs including fire vehicles, turnout gear, breathing apparatus and other equipment.	WF	Low	FEMA/Federal Grants	EM	2018	Although fire equipment has been provided, staff are always in need of the latest resources that can be acquired to respond to wildfire events.
Structural Projects							
SP-1	Construct County Emergency Operations Center (EOC) – The County should consider building an Emergency Operations Center (EOC) that would allow centralization of communications equipment, consolidation on command and control functions and a mitigation and preparedness planning and education center.	All	Low	FEMA/Federal Grants	EM	2019	The county has not established a specific building to act as an EOC, but it will continue to look into funding and constructing this facility.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Public Education and Awareness							
PEA-1	Citizen Program – Design and implement a public education campaign designed to inform County residents about hazard and terrorism mitigation efforts. This campaign would also outline County response capabilities and plans and identify the role individual citizens can play in a disaster incident.	All	Moderate	Local	EM	2019	The county is constantly reaching out to citizens to inform them of best practices in hazard mitigation and preparedness for emergency events. However, as new ways of communicating become available (such as social media), the county will expand its practices to attempt to reach as many citizens as possible. Information is provided via brochures and information on the county website regarding grant programs and preparedness efforts individual citizens can take to be ready when a hazard impacts the community.

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees TS = Thunderstorms EM = Madison County Emergency Management

Town of Hot Springs Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Continue participation in the National Flood Insurance Program without suspension.	FL	High	Local	Town Admin	2015, Annual review	The town is currently a participant in the NFIP and will continue to work to maintain compliance going forward.
Property Protection							
PP-1	Remove debris from streams across County.	FL	High	Grants	EM	Deleted	This action was deleted because it is more or less the same as Action PP-3.
PP-2	Flood proof commercial buildings on Main Street.	FL	High	PDM/HMGP Grants	EM	2019	The town has encouraged local business owners to flood proof their structures but this action is not complete as the town is looking into ways that it could help commercial property owners with this process.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-3	Clear creeks of debris to mitigate the hazards of flooding – Creek flooding is an issue in several areas in the County and one potential strategy for reducing creek flooding is removing debris directly from the creeks that reduces water flows in the creeks. This is not the only solution to creek flooding and will likely need to be repeated in the future. However, if done properly, clearing the debris can reduce flooding impacts in the future and provide additional protection to the County's natural resources. In order to reduce flooding problems in Madison County, debris will be regularly removed from the French Broad River in Hot Springs.	FL	High	Local	Public Works Dept.	2015, After events	The county/town have worked to remove debris from creeks and ensure adequate flow of water. The county/town will continue to address any debris issues in creeks and will seek funding to do so, especially in the wake of a disaster event.
Structural Projects							
SP-1	Construct County Emergency Operations Center (EOC) – The County should consider building an Emergency Operations Center (EOC) that would allow centralization of communications equipment, consolidation on command and control functions and a mitigation and preparedness planning and education center.	All	Low	FEMA/Federal Grants	EM	2019	New Action

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Public Education and Awareness Activities							
PEA-1	Citizen Program – Design and implement a public education campaign designed to inform County residents about hazard and terrorism mitigation efforts. This campaign would also outline County response capabilities and plans and identify the role individual citizens can play in a disaster incident.	All	Moderate	Local	EM	2019	New Action

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees TS = Thunderstorms EM = Madison County Emergency Management Town = Town of Hot Springs

Town of Marshall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Continue participation in the National Flood Insurance Program without suspension.	FL	High	Local	EM	2015, Annual review	The town is currently a participant in the NFIP and will continue to work to maintain compliance going forward.
Property Protection							
PP-1	Remove debris from streams across County.	FL	High	Grants	EM	Deleted	This action was deleted because it is more or less the same as Action PP-3.
PP-2	Flood proof commercial buildings on Main Street.	FL	High	PDM/HMGP Grants	EM	2019	The town has encouraged local business owners to flood proof their structures but this action is not complete as the town is looking into ways that it could help commercial property owners with this process.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
PP-3	Clear creeks of debris to mitigate the hazards of flooding – Creek flooding is an issue in several areas in the County and one potential strategy for reducing creek flooding is removing debris directly from the creeks that reduces water flows in the creeks. This is not the only solution to creek flooding and will likely need to be repeated in the future. However, if done properly, clearing the debris can reduce flooding impacts in the future and provide additional protection to the County's natural resources. In order to reduce flooding problems in Madison County, debris will be regularly removed from the French Broad River in Marshall.	FL	High	Local	Public Works Dept.	2015, After events	The county/town has worked to remove debris from creeks and ensure adequate flow of water. The county/town will continue to address any debris issues in creeks and will seek funding to do so, especially in the wake of a disaster event.
Structural Projects							
SP-1	Construct County Emergency Operations Center (EOC) – The County should consider building an Emergency Operations Center (EOC) that would allow centralization of communications equipment, consolidation on command and control functions and a mitigation and preparedness planning and education center.	All	Low	FEMA/Federal Grants	EM	2019	New Action

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Public Education and Awareness Activities							
PEA-1	Citizen Program – Design and implement a public education campaign designed to inform County residents about hazard and terrorism mitigation efforts. This campaign would also outline County response capabilities and plans and identify the role individual citizens can play in a disaster incident.	All	Moderate	Local	EM	2019	New Action

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees EM = Madison County Emergency Management Town = Town of Marshall

Town of Mars Hill Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Prevention							
P-1	Continue participation in the National Flood Insurance Program without suspension.	FL	High	Local	Town Admin	2015, Annual review	The town is currently a participant in the NFIP and will continue to work to maintain compliance going forward.
P-2	Staffing for first responders – Staffing levels at some of the County fire installations, such as Mars Hill are considered inadequate. Priority should be given to finding ways to attract additional staff and resources.	All	Moderate	Local	EM	2019	The county has worked hard to ensure adequate staffing at its first responder facilities, but more staff is needed to have a sufficient coverage for all response needs.
Property Protection							
PP-1	Remove debris from streams across County.	FL	High	Grants	EM	Deleted	This action was deleted because it is more or less the same as Action PP-2.
PP-2	Clear creeks of debris to mitigate the hazards of flooding – Creek flooding is an issue in several areas in the County and one potential strategy for reducing creek flooding is removing debris directly from the creeks that reduces water flows in the creeks. This is not the only solution to creek flooding and will likely need to be repeated in the future. However, if done properly, clearing the debris can reduce flooding impacts in the future and provide additional protection to the County's natural resources. In order to reduce flooding problems in Madison County, debris will be regularly removed from the Ivy River in Mars Hill.	FL	High	Local	Public Works Dept.	2015, After events	The county/town have worked to remove debris from creeks and ensure adequate flow of water. The county/town will continue to address any debris issues in creeks and will seek funding to do so, especially in the wake of a disaster event.

Action #	Description	Hazard(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date	2014 Action Implementation Status
Structural Projects							
SP-1	Construct County Emergency Operations Center (EOC) – The County should consider building an Emergency Operations Center (EOC) that would allow centralization of communications equipment, consolidation on command and control functions and a mitigation and preparedness planning and education center.	All	Low	FEMA/Federal Grants	EM	2019	New Action
Public Education and Awareness Activities							
PEA-1	Citizen Program – Design and implement a public education campaign designed to inform County residents about hazard and terrorism mitigation efforts. This campaign would also outline County response capabilities and plans and identify the role individual citizens can play in a disaster incident.	All	Moderate	Local	EM	2019	New Action

FL = Flood DR = Drought ES = Expansive Soils HU = Hurricane T = Tornado WF= Wildfire S/I = Snow/Ice ET = Extreme Temperatures EQ = Earthquake
LS = Landslide L = Lightning ER = Erosion HM = HAZMAT D = Dams/Levees TS = Thunderstorms EM = Madison County Emergency Management Town = Town of Mars Hill

Appendix A
Plan Adoption

This appendix includes the local adoption resolutions for each of the participating jurisdictions.

RESOLUTION TO ADOPT THE
BUNCOMBE MADISON REGIONAL HAZARD MITIGATION PLAN

WHEREAS, (JURISDICTION NAME) is vulnerable to an array of natural hazards that can cause loss of life and damages to public and private property; and

WHEREAS, the (JURISDICTION NAME) desires to seek ways to mitigate situations that may aggravate such circumstances; and

WHEREAS, the development and implementation of a hazard mitigation plan can result in actions that reduce the long-term risk to life and property from natural hazards; and

WHEREAS, it is the intent of the (LOCAL GOVERNNING BODY) to protect its citizens and property from the effects of natural hazards by preparing and maintaining a local hazard mitigation plan; and

WHEREAS, it is also the intent of the (LOCAL GOVERNING BODY) to fulfill its obligation under North Carolina General Statutes, Chapter 166A: North Carolina Emergency Management Act and Section 322: Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act to remain eligible to receive state and federal assistance in the event of a declared disaster affecting the (JURISDICTION NAME); and

WHEREAS, (JURISDICTION NAME), in coordination with Buncombe and Madison Counties and the participating municipalities within those Counties has prepared a multi-jurisdictional hazard mitigation plan with input from the appropriate local and state officials;

WHEREAS, the North Carolina Division of Emergency Management and the Federal Emergency Management Agency have reviewed the Buncombe Madison Regional Hazard Mitigation Plan for legislative compliance and has approved the plan pending the completion of local adoption procedures;

NOW, THEREFORE, BE IT RESOLVED that the (GOVERNING BODY) of (JURISDICTION NAME) hereby:

1. Adopts the Buncombe Madison Regional Hazard Mitigation Plan; and

2. Agrees to take such other official action as may be reasonably necessary to carry out the proposed actions of the Plan.

Adopted on _____, 2015.

_____
, Chair
LOCAL GOVERNING BODY

ATTEST:

_____
, Clerk

Appendix B
Planning Tools

This appendix includes the following:

1. Blank Public Participation Survey
2. GIS Data Inventory Sheet
3. Scoring Criteria for Capability Assessment
4. Blank Mitigation Action Worksheet

PUBLIC PARTICIPATION SURVEY
FOR HAZARD MITIGATION PLANNING

We need your help!

The Counties of Buncombe and Madison are currently engaged in a planning process to become less vulnerable to natural disasters, and your participation is important to us!

The Counties, along with participating local jurisdictions and other participating partners, are now working to prepare a multi-jurisdictional *Hazard Mitigation Plan*. The purpose of this Plan is to identify and assess our community's natural hazard risks and determine how to best minimize or manage those risks. Upon completion, the Plan will represent a comprehensive multi-jurisdictional *Hazard Mitigation Plan* for the two-county region.

This survey questionnaire provides an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that should help lessen the impact of future hazard events.

Please help us by completing this survey by February 28, 2014 and returning it to:

Sara Reynolds, Atkins
1616 E Millbrook Road, Suite 310
Raleigh, NC 27609

Surveys can also be faxed to: (919) 876-6848 or emailed to sara.reynolds@atkinsglobal.com

If you have any questions regarding this survey or would like to learn about more ways you can participate in the development of the *Buncombe Madison Regional Hazard Mitigation Plan*, please contact Atkins, planning consultant for the project. You may reach Nathan Slaughter (Atkins) at 919-431-5251 or by email at nathan.slaughter@atkinsglobal.com.

1. Where do you live?

- ❑ Unincorporated Buncombe County
- ❑ Unincorporated Madison County
- ❑ Asheville
- ❑ Biltmore Forest
- ❑ Black Mountain
- ❑ Hot Springs
- ❑ Marshall
- ❑ Mars Hill
- ❑ Montreat
- ❑ Weaverville
- ❑ Woodfin
- ❑ Other

2. **Have you ever experienced or been impacted by a disaster?**

   - ❑ Yes
   - ❑ No

   a. **If "Yes," please explain:**

3. **How concerned are you about the possibility of our community being impacted by a disaster?**

   - ❑ Extremely concerned
   - ❑ Somewhat concerned
   - ❑ Not concerned

4. **Please select the <u>one</u> hazard you think is the *highest threat* to your neighborhood:**

   - ❑ Dam / Levee Failure
   - ❑ Drought
   - ❑ Extreme Heat
   - ❑ Earthquake
   - ❑ Erosion
   - ❑ Flood
   - ❑ Hailstorm
   - ❑ Hazardous Materials Incident
   - ❑ Hurricane / Tropical Storm
   - ❑ Land Subsidence / Sink Hole
   - ❑ Landslide
   - ❑ Lightning
   - ❑ Severe Winter Storm / Freeze
   - ❑ Severe Thunderstorm / High Wind
   - ❑ Tornado
   - ❑ Wildfire

5. **Please select the <u>one</u> hazard you think is the *second highest threat* to your neighborhood:**

   - ❑ Dam / Levee Failure
   - ❑ Drought
   - ❑ Extreme Heat
   - ❑ Earthquake
   - ❑ Erosion
   - ❑ Flood
   - ❑ Hailstorm
   - ❑ Hazardous Materials Incident
   - ❑ Hurricane / Tropical Storm
   - ❑ Land Subsidence / Sink Hole
   - ❑ Landslide
   - ❑ Lightning
   - ❑ Severe Winter Storm / Freeze
   - ❑ Severe Thunderstorm / High Wind
   - ❑ Tornado
   - ❑ Wildfire

6. **Is there another hazard not listed above that you think is a wide-scale threat to your neighborhood?**

   - ❑ Yes (please explain): _____
   - ❑ No

7. **Is your home located in a floodplain?**

- ❑ Yes
- ❑ No
- ❑ I don't know

8. **Do you have flood insurance?**

- ❑ Yes
- ❑ No
- ❑ I don't know

   a. **If "No," why not?**

   - ❑ Not located in floodplain
   - ❑ Too expensive
   - ❑ Not necessary because it never floods
   - ❑ Not necessary because I'm elevated or otherwise protected
   - ❑ Never really considered it
   - ❑ Other (please explain): _____

9. **Have you taken any actions to make your home or neighborhood more resistant to hazards?**

- ❑ Yes
- ❑ No

   a. **If "Yes," please explain:**

10. **Are you interested in making your home or neighborhood more resistant to hazards?**

- ❑ Yes
- ❑ No

11. **Do you know what office to contact regarding reducing your risks to hazards in your area?**

- ❑ Yes
- ❑ No

12. What is the most effective way for you to receive information about how to make your home and neighborhood more resistant to hazards?

- ❑ Newspaper
- ❑ Television
- ❑ Radio
- ❑ Internet
- ❑ Mail
- ❑ Public workshops/meetings
- ❑ School meetings
- ❑ Other (please explain): _____

13. In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future hazard damages in your neighborhood?

14. Are there any other issues regarding the reduction of risk and loss associated with hazards or disasters in the community that you think are important?

15. **A number of community-wide activities can reduce our risk from hazards. In general, these activities fall into one of the following six broad categories. Please tell us how important you think each one is for your community to consider pursuing.**

Category	Very Important	Somewhat Important	Not Important
1. Prevention Administrative or regulatory actions that influence the way land is developed and buildings are built. Examples include planning and zoning, building codes, open space preservation, and floodplain regulations.	❑	❑	❑
2. Property Protection Actions that involve the modification of existing buildings to protect them from a hazard or removal from the hazard area. Examples include acquisition, relocation, elevation, structural retrofits, and storm shutters.	❑	❑	❑
3. Natural Resource Protection Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. Examples include: floodplain protection, habitat preservation, slope stabilization, riparian buffers, and forest management.	❑	❑	❑
4. Structural Projects Actions intended to lessen the impact of a hazard by modifying the natural progression of the hazard. Examples include dams, levees, detention/retention basins, channel modification, retaining walls, and storm sewers.	❑	❑	❑
5. Emergency Services Actions that protect people and property during and immediately after a hazard event. Examples include warning systems, evacuation planning, emergency response training, and protection of critical emergency facilities or systems.	❑	❑	❑
6. Public Education and Awareness Actions to inform citizens about hazards and the techniques they can use to protect themselves and their property. Examples include outreach projects, school education programs, library materials, and demonstration events.	❑	❑	❑

THANK YOU FOR YOUR PARTICIPATION!

This survey may be submitted anonymously; however, if you provide us with your name and contact information below we will have the ability to follow up with you to learn more about your ideas or concerns (optional):

Name: _____

Address: _____

_____

Phone: _____ **E-Mail:** _____

GIS Data Request Sheet
Buncombe Madison Regional Hazard Mitigation Plan

Data requested	Available?	Received?	Potential Sources
Tax Parcel Data			Tax Assessor
including replacement value			
Building Footprints			Tax Assessor/GIS office
Critical Facilities (in GIS or list form with addresses)			Tax Assessor/GIS office
examples include:			
government buildings			
hospitals			
senior care			
police/fire/EMS/EOC			
locally significant buildings			
schools			
Local hazard studies			public works, natural resources, planning
examples include:			
Flood Studies (HEC-RAS, Risk MAP)			
Local Hazard History Articles			
Areas of Concern Studies			

If you have any questions, please contact:

Nathan Slaughter
nathan.slaughter@atkinsglobal.com
919-431-5251

Points System for Capability Ranking

0-19 points = Limited overall capability **20-39 points = Moderate overall capability** **40-68 points = High overall capability**

I. Planning and Regulatory Capability
(Up to 43 points)

Yes = 3 points
Under Development = 1 point
Included under County plan/code/ordinance/program = 1 point
No = 0 points

- Hazard Mitigation Plan
- Comprehensive Land Use Plan
- Floodplain Management Plan
- National Flood Insurance Program
- NFIP Community Rating System

Yes = 2 points
Under Development = 1 point
Included under County plan/code/ordinance/program = 1 point
No = 0 points

- Open Space Management Plan / Parks & Recreation Plan
- Stormwater Management Plan
- Natural Resource Protection Plan
- Flood Response Plan
- Emergency Operations Plan
- Continuity of Operations Plan
- Evacuation Plan
- Disaster Recovery Plan
- Flood Damage Prevention Ordinance
- Post-disaster Redevelopment / Reconstruction Ordinance

Yes = 1 point
No = 0 points

- Capital Improvements Plan
- Economic Development Plan
- Historic Preservation Plan
- Zoning Ordinance
- Subdivision Ordinance
- Unified Development Ordinance
- Building Code
- Fire Code

II. Administrative and Technical Capability
(Up to 15 points)

Yes = 2 points
Service provided by County = 1 point
No = 0 points

- Planners with knowledge of land development and land management practices
- Engineers or professionals trained in construction practices related to buildings and/or infrastructure
- Planners or engineers with an understanding of natural and/or human-caused hazards
- Emergency manager
- Floodplain manager

Yes = 1 point
No = 0 points

- Land surveyors
- Scientist familiar with the hazards of the community
- Staff with education or expertise to assess the community's vulnerability to hazards
- Personnel skilled in Geographical Information Systems (GIS) and/or Hazus
- Resource development staff or grant writers

III. Fiscal Capability
(Up to 10 points)

Yes = 1 point
No = 0 points

- Capital Improvement Programming
- Community Development Block Grants (CDBG)
- Special Purpose Taxes (or tax districts)
- Gas / Electric Utility Fees
- Water / Sewer Fees
- Stormwater Utility Fees
- Development Impact Fees
- General Obligation / Revenue / Special Tax Bonds
- Partnering arrangements or intergovernmental agreements
- Other

MITIGATION ACTION WORKSHEETS

Mitigation Action Worksheets are used to identify potential hazard mitigation actions that participating jurisdictions in Buncombe and Madison Counties will consider to reduce the negative effects of identified hazards. The worksheets provide a simple yet effective method of organizing potential actions in a user-friendly manner that can easily be incorporated into the Region's Hazard Mitigation Plan.

The worksheets are to be used as part of a strategic planning process and are designed to be:

a.) completed electronically (worksheets and instructions will be e-mailed to members of the Hazard Mitigation Planning Team following the Mitigation Strategy Workshop);
b.) reviewed with your department/organization for further consideration; and
c.) returned according to the contact information provided below.

Please return all completed worksheets no later than April 21, 2014 to:

Nathan Slaughter, Project Manager Atkins
Electronic copies may be e-mailed to: nathan.slaughter@atkinsglobal.com
Hard copies may be faxed to: 919-876-6848 (Attn: Nathan Slaughter)

INSTRUCTIONS

Each mitigation action should be considered to be a separate local project, policy or program and each individual action should be entered into a separate worksheet. By identifying the implementation requirements for each action, the worksheets will help lay the framework for engaging in distinct actions that will help reduce the community's overall vulnerability and risk. Detailed explanations on how to complete the worksheet are provided below.

Proposed Action: Identify a specific action that, if accomplished, will reduce vulnerability and risk in the impact area. Actions may be in the form of local policies (i.e., regulatory or incentive-based measures), programs or structural mitigation projects and should be consistent with any pre-identified mitigation goals and objectives.

Site and Location: Provide details with regard to the physical location or geographic extent of the proposed action, such as the location of a specific structure to be mitigated, whether a program will be citywide, countywide or regional, etc.

History of Damages: Provide a brief history of any known damages as it relates to the proposed action and the hazard(s) being addressed. For example, the proposed elevation of a repetitive loss property should include an overview of the number of times the structure has flooded, total dollar amount of damages if available, etc.

Hazard(s) Addressed: List the hazard(s) the proposed action is designed to mitigate against.

Category: Indicate the most appropriate category for the proposed action as discussed during the Mitigation Strategy Workshop (Prevention; Property Protection; Natural Resource Protection; Structural Projects; Emergency Services; Public Education and Awareness).

Priority: Indicate whether the action is a "high" priority, "moderate" priority or "low" priority based generally on the following criteria:

1. Effect on overall risk to life and property
2. Ease of implementation / technical feasibility
3. Project costs versus benefits
4. Political and community support
5. Funding availability

Estimated Cost: If applicable, indicate what the total cost will be to accomplish this action. This amount will be an estimate until actual final dollar amounts can be determined. Some actions (such as ordinance revisions) may only cost "local staff time" and should be noted so.

Potential Funding Sources: If applicable, indicate how the cost to complete the action will be funded. For example, funds may be provided from existing operating budgets or general funds, a previously established contingency fund, a cost-sharing federal or state grant program, etc.

Lead Agency/Department Responsible: Identify the local agency, department or organization that is best suited to implement the proposed action.

Implementation Schedule: Indicate when the action will begin and when the action is expected to be completed. Remember that some actions will require only a minimal amount of time, while others may require a long-term or continuous effort.

Comments: This space is provided for any additional information or details that may not be captured under the previous headings.

	MITIGATION ACTION
Proposed Action:	
BACKGROUND INFORMATION	
Site and Location:	
History of Damages:	

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	
Category:	
Priority (High, Moderate, Low):	
Estimated Cost:	
Potential Funding Sources:	
Lead Agency/Department Responsible:	
Implementation Schedule:	

COMMENTS

Appendix C
Local Mitigation Plan Review Tool

Appendix D
Planning Process Documentation

This appendix includes:

1. Meeting Agendas
2. Meeting Minutes
3. Meeting Sign-In Sheets
4. Public Survey Summary Results

AGENDA

Buncombe Madison Regional Hazard Mitigation Plan
Hazard Mitigation Planning Team Kickoff Meeting

November 7, 2013
10:00 PM – Noon

1) **Introductions**

2) **Overview of Mitigation/Icebreaker Exercise**

3) **Project Overview**
   a) Key Objectives
   b) Project Tasks
   c) Project Schedule
   d) Project Staffing

4) **Data Collection**
   a) GIS Data Inventory
   b) Capability Assessment Survey
   c) Public Participation Survey
   d) Existing Mitigation Actions

5) **Roles & Responsibilities**
   a) Atkins
   b) County Leads
   c) Participating Jurisdictions

6) **Next Steps**
   a) Data collection efforts
   b) Begin public outreach
   c) Discuss next Hazard Mitigation Planning Team meeting

7) **Questions, Issues, or Concerns**

ATKINS

AGENDA

Buncombe Madison Regional Hazard Mitigation Plan
Hazard Mitigation Planning Team Mitigation Strategy Meeting
April 7, 2014
Noon – 3:00 PM

1) **Introductions**

2) **Recap – What We're Doing Today**

3) **Risk Assessment Findings**
   a) Hazard History and Profiles
   b) Conclusions on Risk: PRI

4) **Capability Assessment Findings**
   a) Indicators
   b) Results

5) **Mitigation Strategy**
   a) Current Goals/Actions
   b) New Actions
   c) Discussion

6) **Next Steps**
   a) Mitigation Actions
   b) Continue public outreach

7) **Questions, Issues, or Concerns**

ATKINS

Meeting Minutes
Buncombe Madison Regional Hazard Mitigation Plan
Project Kickoff Meeting
November 7, 2013

Nathan Slaughter. Project Manager from the project consulting team, Atkins started the meeting by welcoming the representatives from the Counties, participating municipal jurisdictions and other stakeholders. Mr. Slaughter led the kickoff meeting and began by providing an overview of the items to be discussed at the meeting and briefly reviewed each of the handouts that were distributed in the meeting packets (agenda, project description, and presentation slides). He then asked each of the meeting attendees to introduce themselves. Following introductions, he provided a brief overview of mitigation and discussed the Disaster Mitigation Act of 2000 and NC Senate Bill 300.

He discussed the key objectives of the planning process and gave a list of the participating jurisdictions for the regional plan and asked if there were any changes that needed to be made to the list. Mr. Slaughter then explained the six different categories of mitigation techniques (emergency services; prevention; natural resource protection; structural projects; public education and awareness; and property protection) and gave examples of each. This explanation culminated in an Ice Breaker Exercise for the attendees.

Mr. Slaughter instructed attendees on how to complete the exercise. Attendees were given an equal amount of fictitious FEMA money and asked to spend it in the various mitigation categories. Money could be thought of grant money that communities received towards mitigation. Attendees were asked to target their money towards areas of mitigation that are of greatest concern for their community. Ideally, the exercise helps pinpoint areas of mitigation that the community may want to focus on when developing mitigation grants. The Ice Breaker Exercise results were to be reviewed and presented at the conclusion of the meeting.

Mr. Ryan Wiedenman, Planner for Atkins, then explained the mitigation planning process and specific tasks to be accomplished for this project, including the planning process, risk assessment, capability assessment, mitigation strategy and action plan, and plan maintenance procedures.

The project schedule was presented along with the project staffing chart, which demonstrates the number of experienced individuals that will be working on this project. Mr. Wiedenman then reviewed the roles and responsibilities of Atkins, the counties, and the participating jurisdictions. The presentation concluded with a discussion of the next steps to be taken in the project development, which included determining the members of the Hazard Mitigation Planning Team that should be present for the next meeting, addressing issues of regulation compliance, and fulfilling data collection needs.

The meeting was adjourned.

Meeting Minutes
Buncombe Madison Regional Hazard Mitigation Plan
Mitigation Strategy Meeting
April 7, 2014

Mr. Slaughter initiated the meeting with a review of the meeting handouts, which included an agenda, presentation slides, proposed goals for the regional plan, mitigation actions from each county's existing plan, and mitigation action worksheets for collecting information for any new mitigation actions. Mr. Slaughter gave a quick recap about mitigation and the Disaster Mitigation Act of 2000. He then reviewed the project schedule and stated that a draft of the Hazard Mitigation Plan would be presented to the Regional Hazard Mitigation Council later in 2014.

Mr. Slaughter then gave the results of the icebreaker exercise from the first Regional Hazard Mitigation Council meeting, where attendees were given "money" to spend on various hazard mitigation techniques. The results were as follows:

- Emergency Services $120
- Prevention $110
- Structural Projects $77
- Property Protection $72
- Natural Resource Protection $57
- Public Education and Awareness $43

Ryan Wiedenman with Atkins then presented the findings of the risk assessment. He reviewed the Presidential Disaster Declarations that have impacted the region. He then explained the process for preparing Hazard Profiles and discussed how each hazard falls into one of four basic categories: Atmospheric, Hydrologic, Geologic, and Other. He indicated that each hazard must be evaluated and formally ruled out if it is not applicable to the study area, even where it seems obvious (such as in the case of volcano).

Mr. Wiedenman reviewed the Hazard Profiles and the following bullets summarize the information presented:

- DROUGHT. There have been seven years (out of the past fourteen, 2000-2013) where drought conditions have been reported as severe, extreme or exceptional in the Buncombe Madison Region and future occurrences are likely.

- EXTREME HEAT. There have been no recorded extreme heat events reported by NCDC since 1950; however, significant the greatest extent of reported heat in the region was 105 degrees which indicates that extreme heat can be a hazard of concern for the region although future occurrences are relatively unlikely.

- HAILSTORM. There have been 222 recorded events since 1962. Future occurrences are highly likely.

- LIGHTNING. There have been 18 recorded lightning events since 1993, causing seven injuries, two deaths and approximately $775,000 million in reported property damages. Future occurrences are highly likely.

- TORNADOES. There have been 10 recorded tornado events reported in the region since 1976. $5.9 million in property damages. 0 deaths and 5 injuries have been reported. Future occurrences are possible.

- HURRICANES AND TROPICAL STORMS. NOAA data shows that 24 storm tracks have come within 75 miles of the Buncombe Madison Region since 1896. Future occurrences are possible.

- SEVERE THUNDERSTORM WINDS. There have been 279 severe thunderstorm events reported since 1959 with $5.9 million in reported property damages. 3 deaths and 17 injuries have been reported. Future occurrences are highly likely.

- WINTER STORM. There have been 351 recorded winter events in the Buncombe Madison Region since 1993 resulting in $12.9 million in reported property damages. Future occurrences are highly likely.

- EARTHQUAKES. There have been 87 recorded earthquake events in the Buncombe Madison Region since 1911. The strongest had a recorded magnitude of VI MMI. Future occurrences are likely.

- LANDSLIDE. There have been 213 recorded landslide events in the Buncombe Madison Region. Future occurrences are highly likely.

- DAM FAILURE. There are 112 dams in the Buncombe Madison Region, 59 of which are classified as high hazard dams. There has been one reported significant failure (Bear Wallow Dam). Future occurrences are unlikely.

- EROSION. Erosion was included in the previous County level plans but impacts are minimal. Future occurrences are possible.

- FLOOD. There have been 62 flood events recorded in the Buncombe Madison Region since 1993, resulting in 3 deaths and 2 injuries. There have been 421 NFIP losses since 1978 and approximately $18.1 million in claims. 31 repetitive loss properties in the region account for 78 of the recorded losses (18%). Future occurrences are likely.

- HAZARDOUS MATERIALS INCIDENTS. There have been 21 reported hazardous materials events reported in the region. No serious events reported. Future occurrences are possible. Hazmat incidents seem under reported as well. Atkins agreed to investigate.

- WILDFIRE. There is an average of 455 fires per year reported in the Buncombe Madison Region. Future occurrences are likely but major events are not common.

In concluding the review of Hazard Profiles, Mr. Wiedenman stated if anyone had additional information for the hazard profiles, or disagreed with any of the data presented, they should call or email him with their concerns.

The results of the hazard identification process were used to generate a Priority Risk Index (PRI), which categorizes and prioritizes potential hazards as high, moderate or low risk based on probability, impact, spatial extent, warning time, and duration. The highest PRI was assigned to Winter Storm and Freeze, Thunderstorm/High Wind followed by Landslide, Flood and Hailstorm.

Mr. Slaughter presented the Capability Assessment Findings. Atkins has developed a scoring system that was used to rank the participating jurisdictions in terms of capability in four major areas (Planning and Regulatory; Administrative and Technical; Fiscal; Political). Important capability indicators include National Flood Insurance Program (NFIP) participation, Building Code Effective Grading Schedule (BCEGS) score, Community Rating System (CRS) participation, and the Local Capability Assessment Survey conducted by Atkins.

Mr. Slaughter reviewed the Relevant Plans and Ordinances, Relevant Staff/Personnel Resources, and Relevant Fiscal Resources. All of these categories were used to rate the overall capability of the participating counties and jurisdictions. Most jurisdictions are in the moderate range for Planning and Regulatory Capability and in the limited to moderate range for Fiscal Capability. There is variation between the jurisdictions for Administrative and Technical Capability, mainly with respect to availability of planners and grant writers. Based upon the scoring methodology developed by Atkins, it was determined that most of the participating jurisdictions have at least moderate capability to implement hazard mitigation programs and activities.

Mr. Slaughter also discussed the results of the public participation survey that was posted on several of the participating counties' and municipal websites. As of the meeting date, 176 responses had been received. Based on preliminary survey results, respondents felt that severe winter storms posed the greatest threat to their neighborhood, followed by severe thunderstorms, floods and landslides. 84 percent of the respondents were interested in making their homes more resistant to hazards. However, 75 percent don't know who to contact regarding reducing their risks to hazards.

Mr. Slaughter gave an overview of Mitigation Strategy Development and presented the proposed goals for the regional plan based on a review of the goals in the three existing county plans. The Regional Hazard Mitigation Council accepted the proposed goals for the regional plan. Mr. Wiedenman then provided an overview and examples of suggested mitigation actions specifically tailored for Buncombe and Madison Counties. Mr. Slaughter then asked each county, and the municipalities to provide a status update for their existing mitigation actions (completed, deleted, or deferred) by April 21, 2014. Mr. Slaughter also discussed the Mitigation Action Worksheets to be completed for any new mitigation actions and requested that all worksheets be returned by April 21, 2014.

Mr. Slaughter thanked the group for taking the time to attend and the meeting was adjourned.

Buncombe Madison Regional Hazard Mitigation Plan
Hazard Mitigation Planning Team Kickoff Meeting

November 7, 2013
10:00 AM - Noon

Name	Agency	City	Phone Number	E-mail Address
Eddie Fox	Town of Mars Hill	Mars Hill	828 691 5709	efox@townofmarshill.org
Jerry Vehaun	Buncombe County EM	Asheville	828 250 6601	jerry.vehaun@buncombecounty.org
Abby Moore	Asheville Fire Ret-6	Asheville	828-251-4009	amoore@ashevillenc.gov
Cleve Fox	USFS	Mars Hill	828-208-7707	cfox@fs.fed.us
Nelson Smith	Biltmore Forest		828-274-0824	
Steve Freeman	Town of Montreat	Montreat	828 776 1345	publicworks@townofmontreat.org
Jason Young	Town of Woodfin	Woodfin	828.253.4887 ext 1007	jasonyoung@woodfin-nc.gov
Steve Jones	Town of Black Mtn.	Black Mtn	828-419-9331	steve.jones@townofblackmountain.org

Buncombe Madison Regional Hazard Mitigation Plan
Hazard Mitigation Planning Team Kickoff Meeting

November 7, 2013

10:00 AM - Noon

Name	Agency	City	Phone Number	E-mail Address
Ron NAlley	Town of Montreat	Montreat	(828) 779-6124	townAdmin@townofmontreat.org
Brandon Cervantes	USFS	Buncombe & Madison County.	828-285-5539.	Bucervantes@usfs.fs.
Joe Meadows	Asheville FD	Asheville NC	828.232.4511	Jmeadows@ashevillenc.gov
Lewis Garrison	Asheville FD	Asheville, NC	828 768-0135	Lgarrison@ashevillenc.gov
Cynthia Orlandow	Bun Co Planning	Asheville NC	828 250 4836	Cynthia.bardhelm@buncombecounty.org
Angie Ledford	Buncombe Co. EM	Buncombe County	(828) 707-4726	angela.ledford@buncombecounty.org

Buncombe Madison Regional Hazard Mitigation Plan
Hazard Mitigation Planning Team Kickoff Meeting

November 7, 2013

10:00 AM - Noon

Name	Agency	City	Phone Number	E-mail Address
Martha Ramsey	Town of Marshall	Marshall	828 649 3031	marthalouiseramsey@gmail.com
Stephen Staude	Madison EMS	Marshall	828 - 649 - 3815	Jedsws@msj.org
Chris Deyton	NCDOT	Madison County Marshall	649-2222	cdeyton@ncdot.gov
Jayson Harwood	Weaverville Fire	Weaverville	828-645-3500	jharwood@weavervillefd.org
Edward Roberts	Laurel Fire Dept.	Marshall	828-656-2023	lroberts3186@yahoo.com
Terry Malone	Weaverville FD	Weaverville	484-7031	tmalone@weavervillefd.org
Allen Stines	MadCounty Amt. Radio	Marshall	828 712 6554	bpufd1102@intergate.com
Chad Bandy	NCDOT	Asheville	298-2741	cebandy@ncdot.gov

Buncombe Madison Regional Hazard Mitigation Plan
Hazard Mitigation Planning Team Kickoff Meeting

November 7, 2013

10:00 AM - Noon

Name	Agency	City	Phone Number	E-mail Address
Jeff Willis	Madison EM	Marshall	828-649-9608	jwillis@madisoncountyne.gov
SHANNON TUCH	PLANNING & DEV. SRVCS, CITY OF ASHEVILLE	ASHEVILLE	259-5817	stuch@ashevillenc.gov
Ted Williams	Weaverville FD	Weaverville	828-645-3500	twilliams@weavervillefd.org

Buncombe Madison Regional Hazard Mitigation Plan
Hazard Mitigation Planning Team Kickoff Meeting

April 7, 2014

Noon - 3:00 PM

Name	Agency	City	Phone Number	E-mail Address
Martha Ramsey	Town of Marshall	Marshall, NC	828-649-3031	marthalouiseramsey@gmail.com
Angela [illegible]	Buncombe EM	Buncombe County	(828) 707-4726	angela.[illegible]@buncombecounty.org
Jayson Harwood	Weaverville FD	Weaverville, NC	828-545-2925	jharwood@weavervillefd.org
Alex Moore	Asheville FD	Asheville	828-251-4009	amoore@ashevillenc.gov
Joe Meadows	Asheville Fire	Asheville	828 232 4511	Jmeadows@ashevillenc.gov
Cynthia Fox Barcklow	Buncombe Planning	Buncombe Co	250 4536	cynthia.barcklow@buncombecounty.org
Ron Nalley	Town of Montreat	Montreat	669-8002	RNALLEY@townofmontreat.org
Steve Freemon	Town of Montreat	Montreat	669-8002	sfreemon@townofmontreat.org

Buncombe Madison Regional Hazard Mitigation Plan
Hazard Mitigation Planning Team Kickoff Meeting

April 7, 2014

Noon - 3:00 PM

Name	Agency	City	Phone Number	E-mail Address
Josh Harrold	Town of Black Mountain	Black Mountain	828-419-9300	josh.harrold@townofblackmountain.org
Shannon Tuch	COA	COA	259-5817	stuche@ashevillenc.gov
McKay Coates	COA	COA	259-5966	mcoates@ashevillenc.gov
Chris Dayton	NCDOT		649-2772	cdayton@ncdot.gov
Lewis Garrison	Asheville FD	Asheville	828-768-0135	Lgarrison@ashevillenc.gov

Photo Source: NCDOT

Buncombe Madison
Regional Hazard Mitigation Plan

Public Participation Survey Results

ATKINS

Public Participation Survey

- Provides an opportunity for the public to share opinions and participate in the planning process
- Link to survey posted on County websites
- 176 completed surveys received

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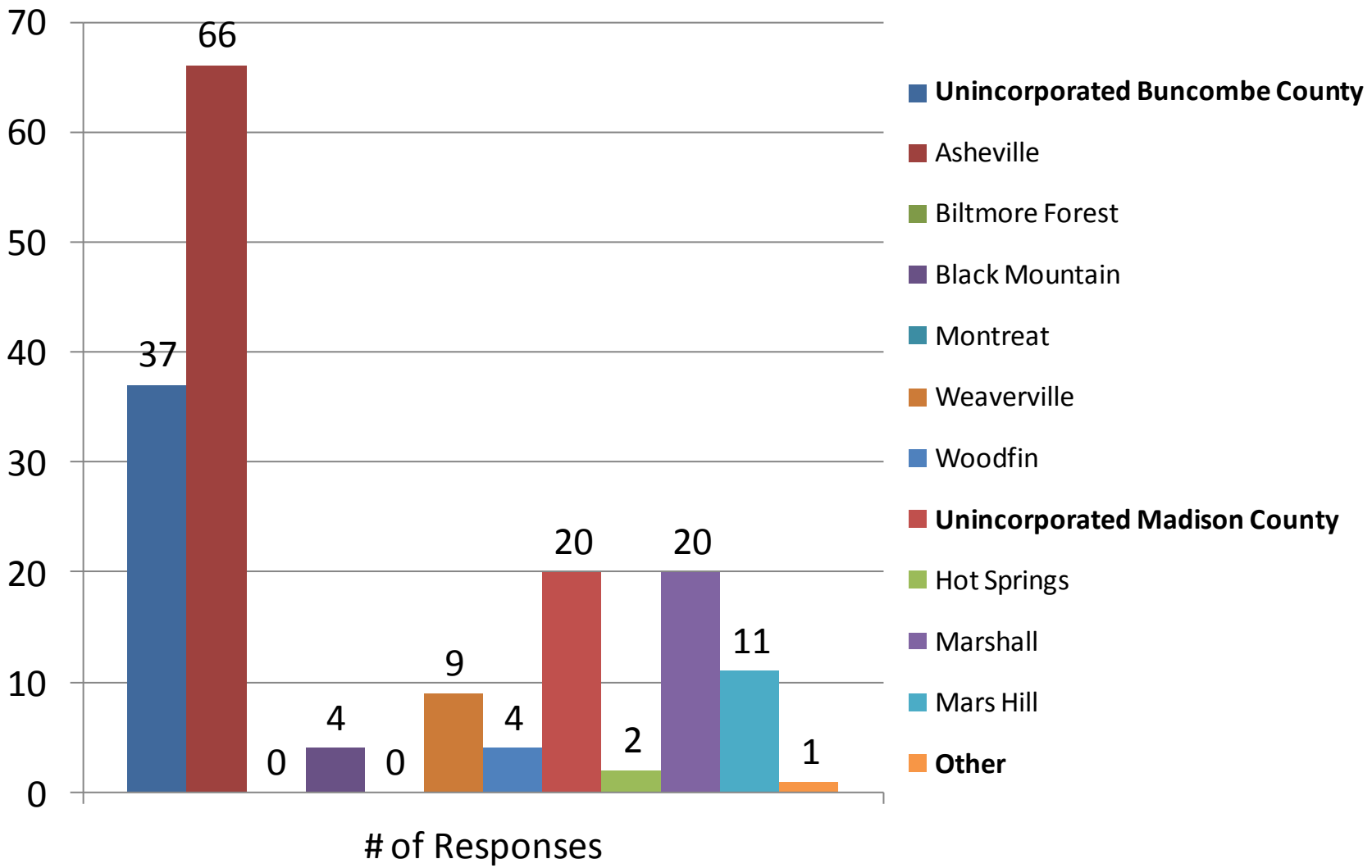
Public Participation Survey Highlights

- 84% of respondents are interested in making their homes more resistant to hazards
- 43% have already taken action to make their homes more hazard resistant
- 75% do not who to contact regarding risk reduction

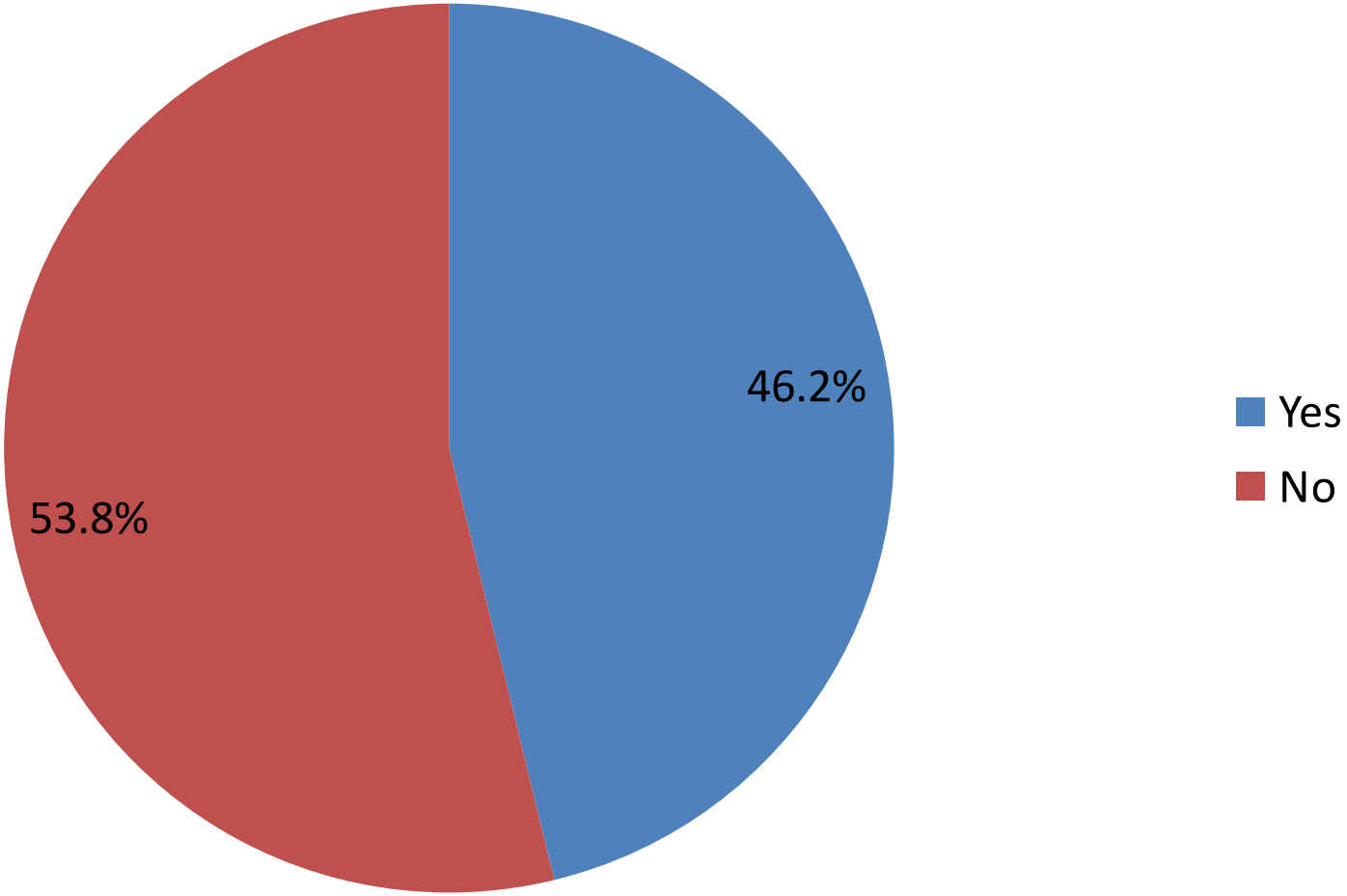
ATKINS

1. Where do you live?



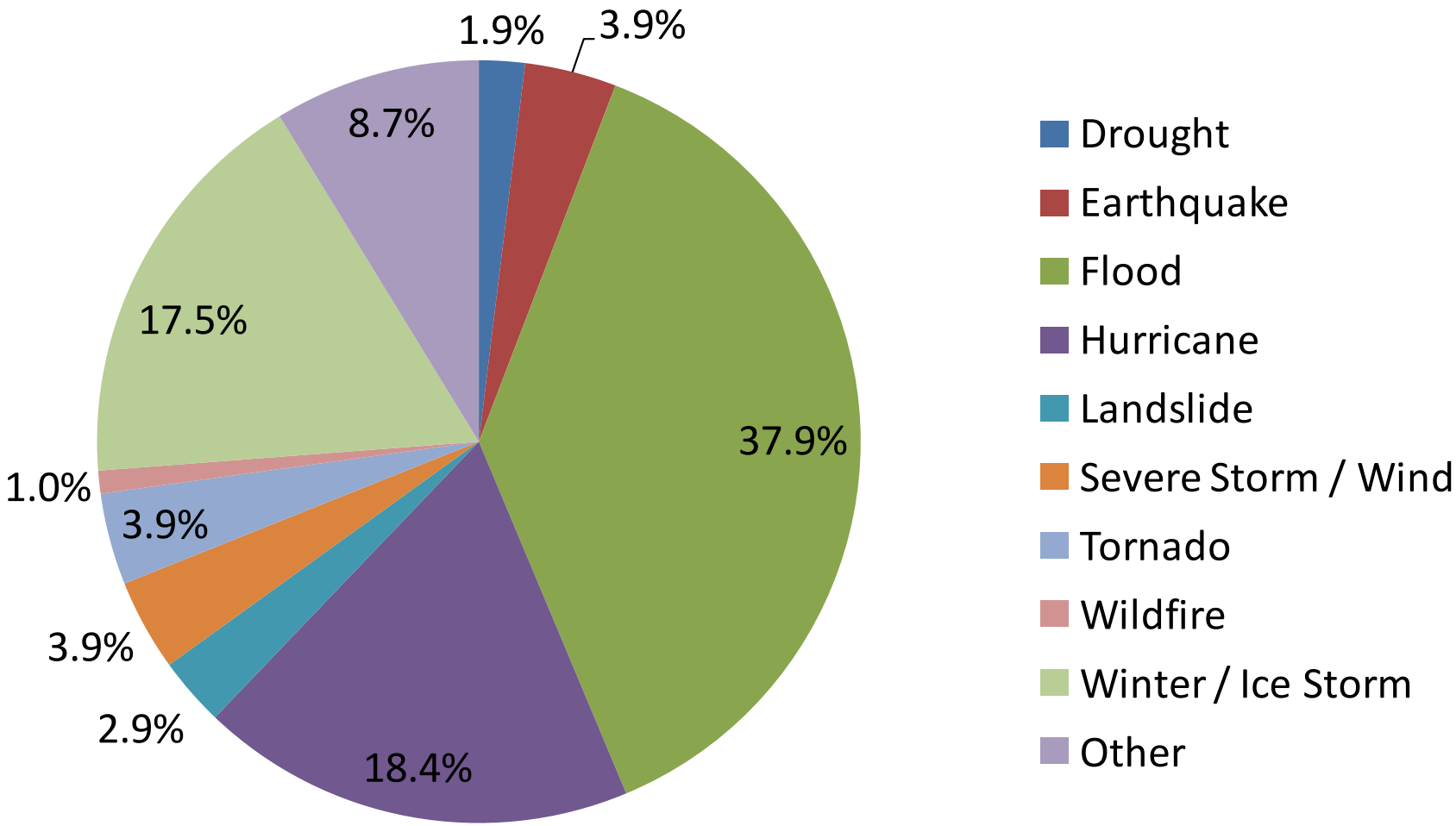
ATKINS

2. Have you experienced a disaster?



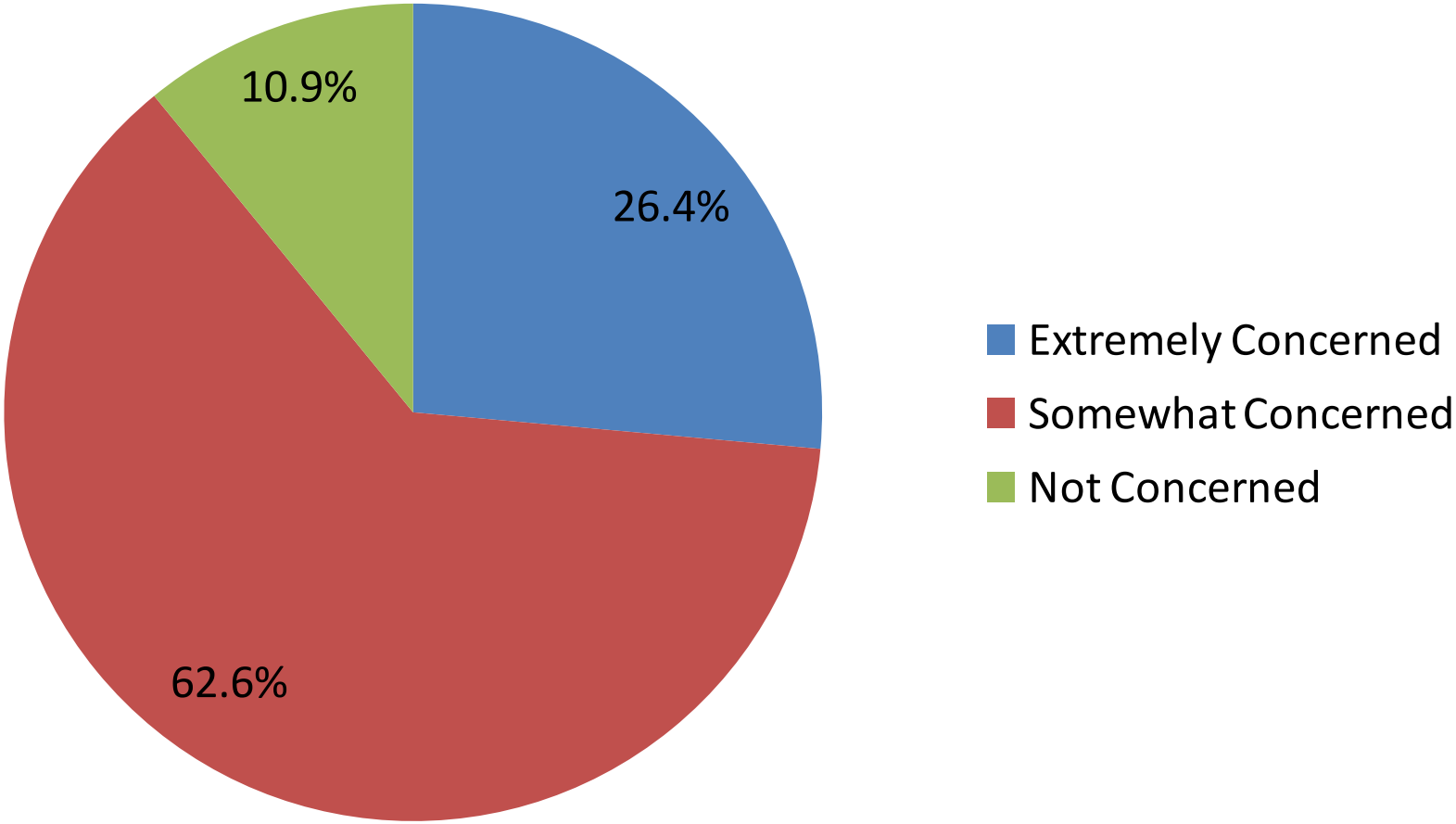
ATKINS

2. Examples of disasters experienced



ATKINS

3. How concerned about possibility of disaster?



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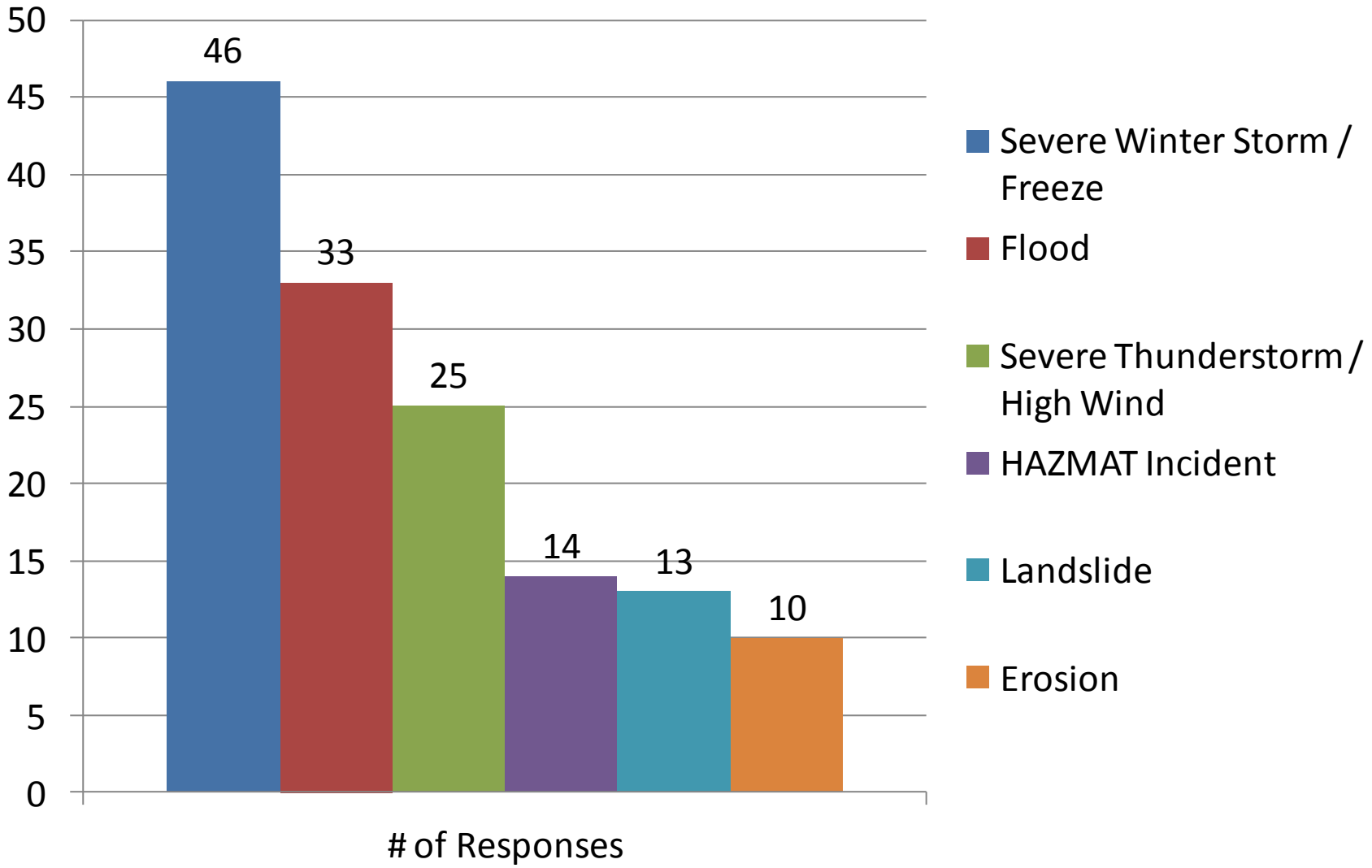
4. Highest hazard threat?



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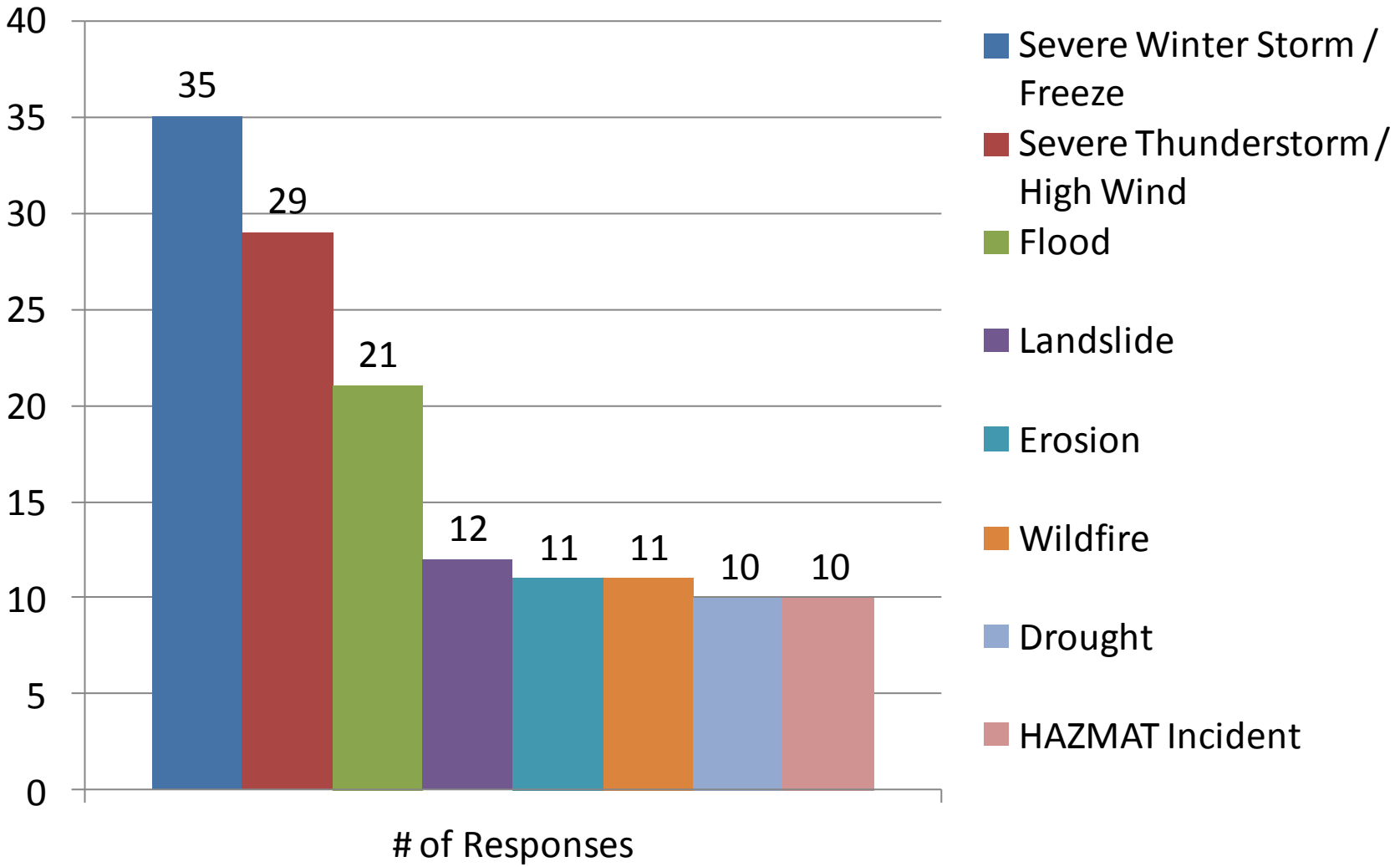
5. Second highest hazard threat?



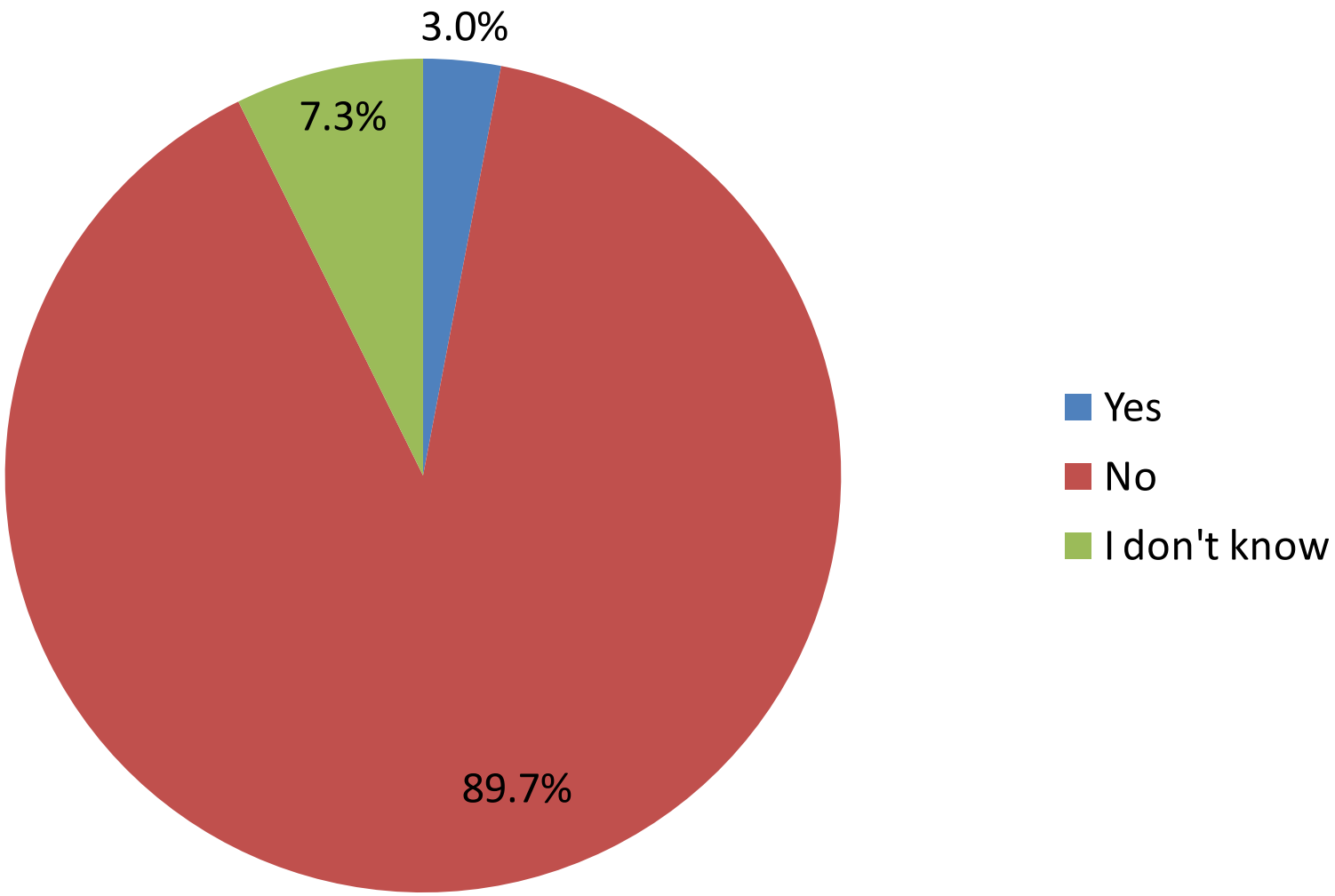
ATKINS

6. Other hazards not listed?

- Climate change / global warming
- Disease outbreak
- Acid rain
- Bioterrorism / terrorism
- Nuclear accident
- Food scarcity / fuel shortage /economic collapse
- Manmade hazards
- Over development
- Water contamination

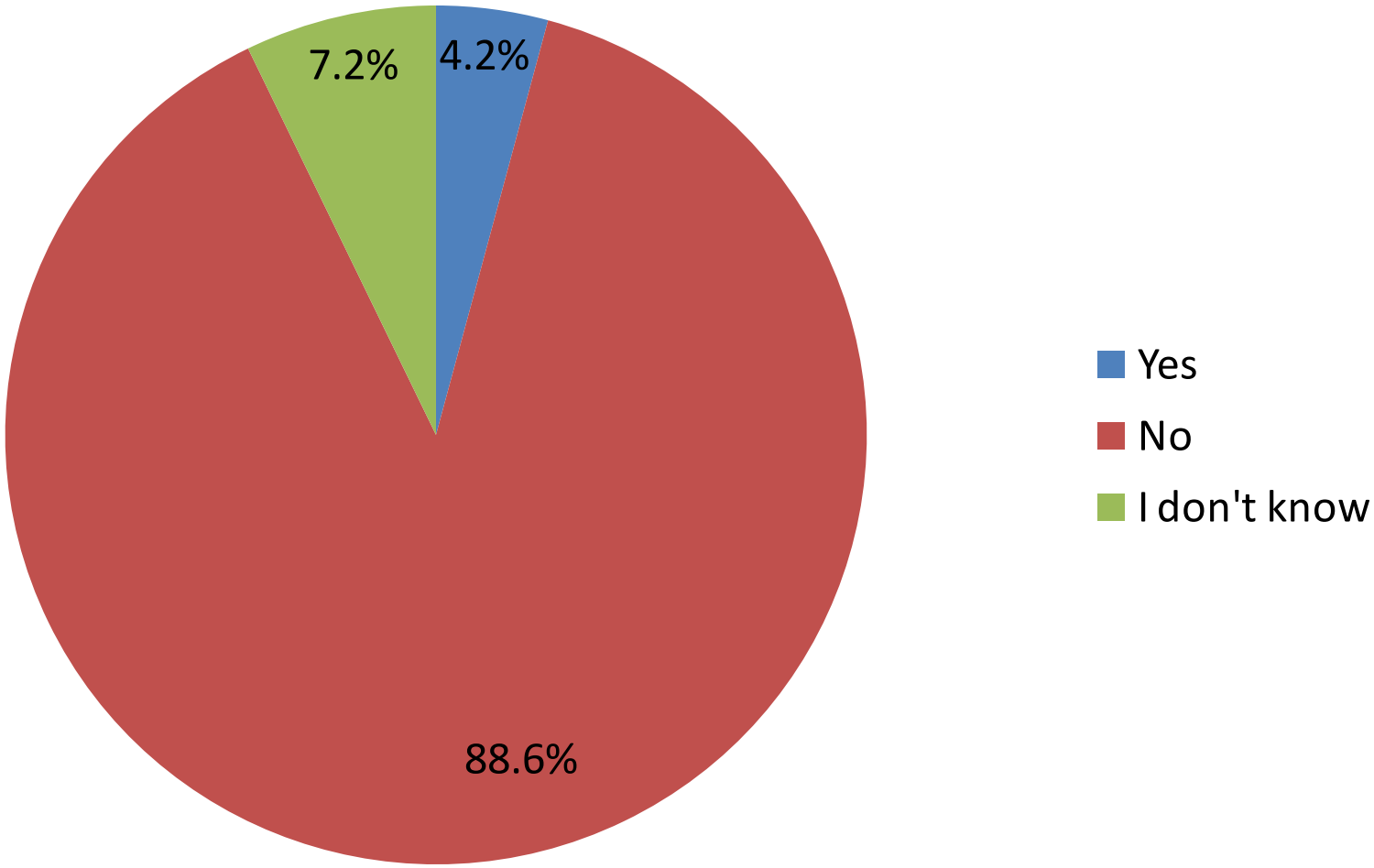
ATKINS

7. Is your home in a floodplain?



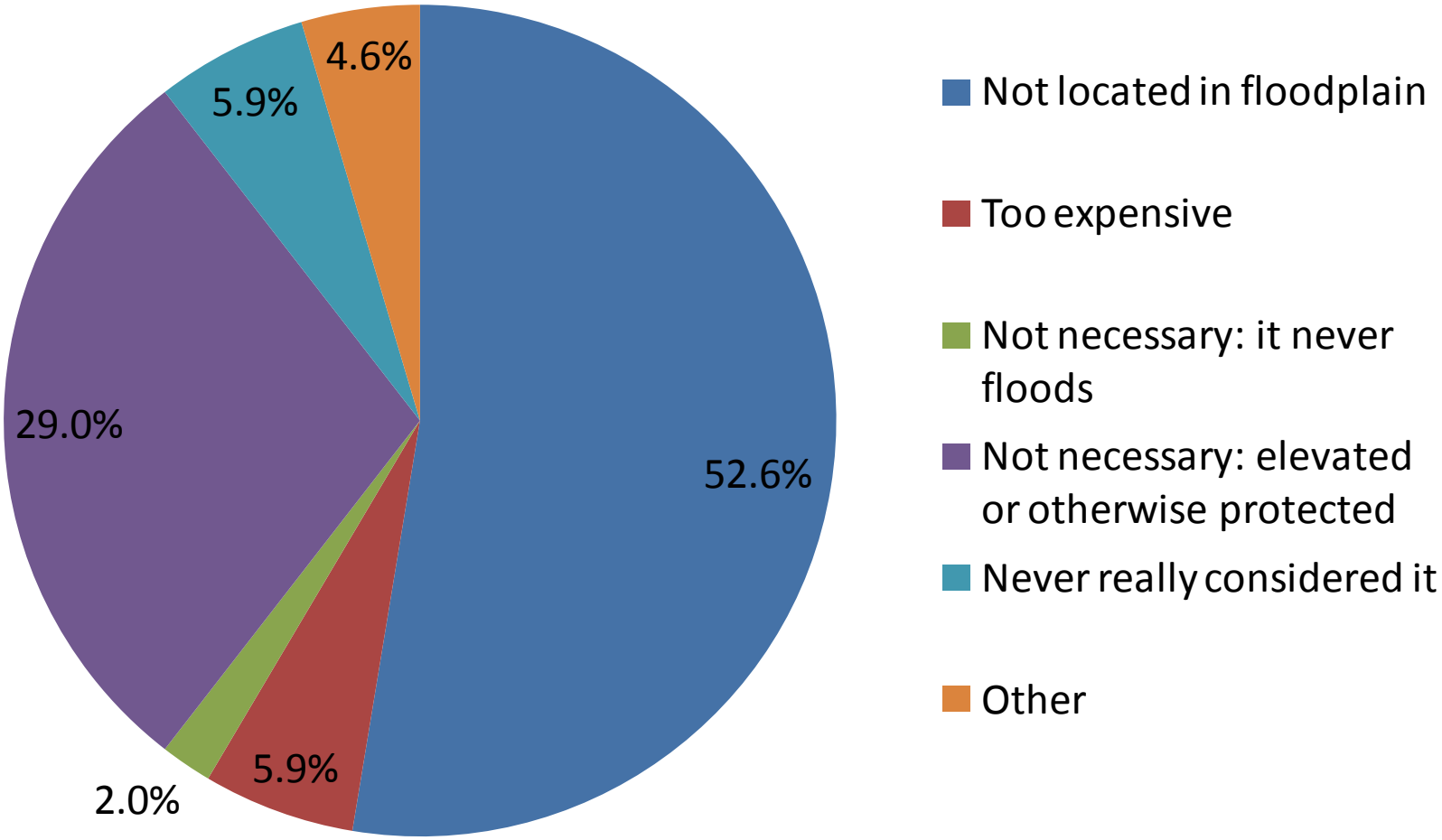
ATKINS

8. Do you have flood insurance?



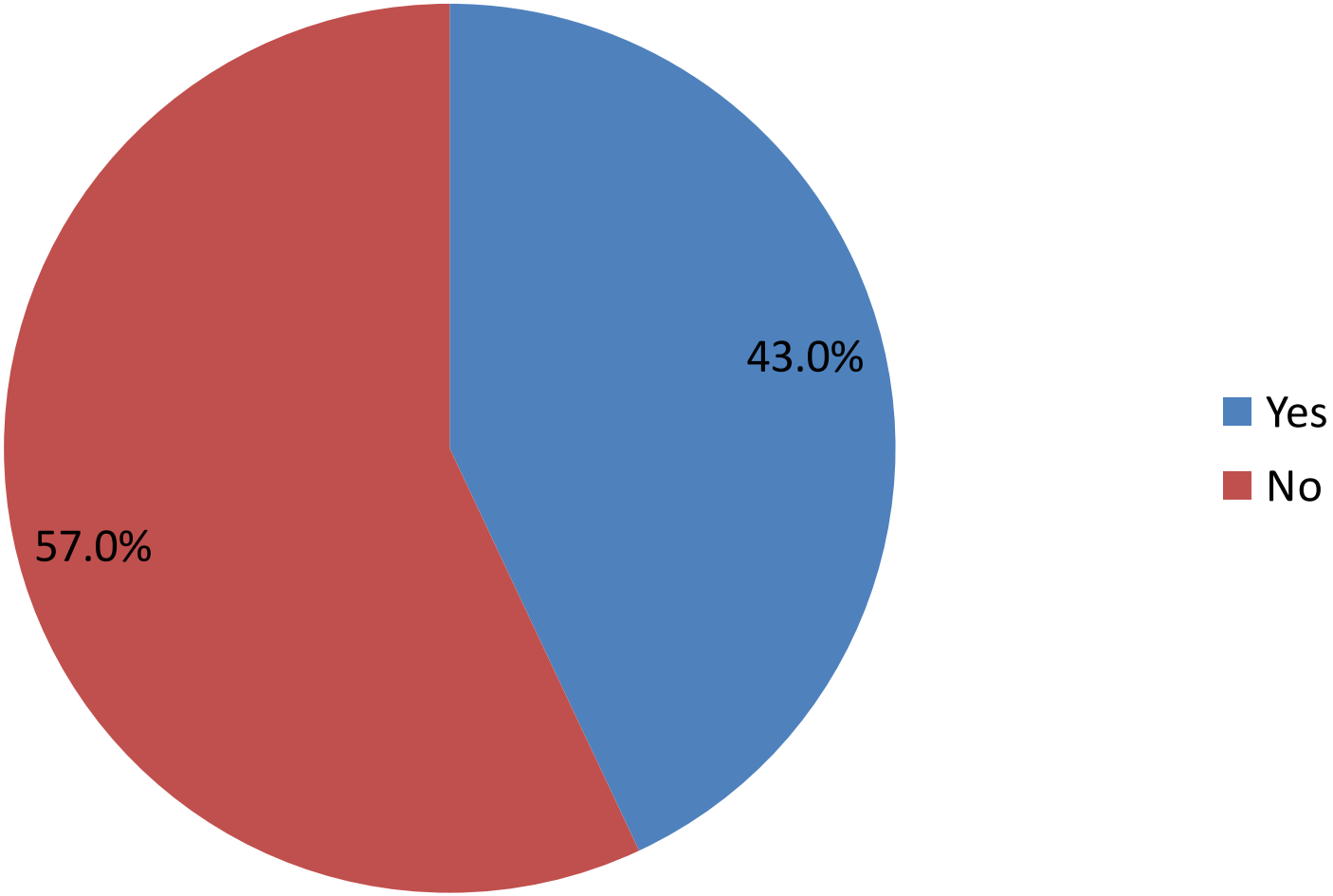
ATKINS

8. Why no flood insurance?



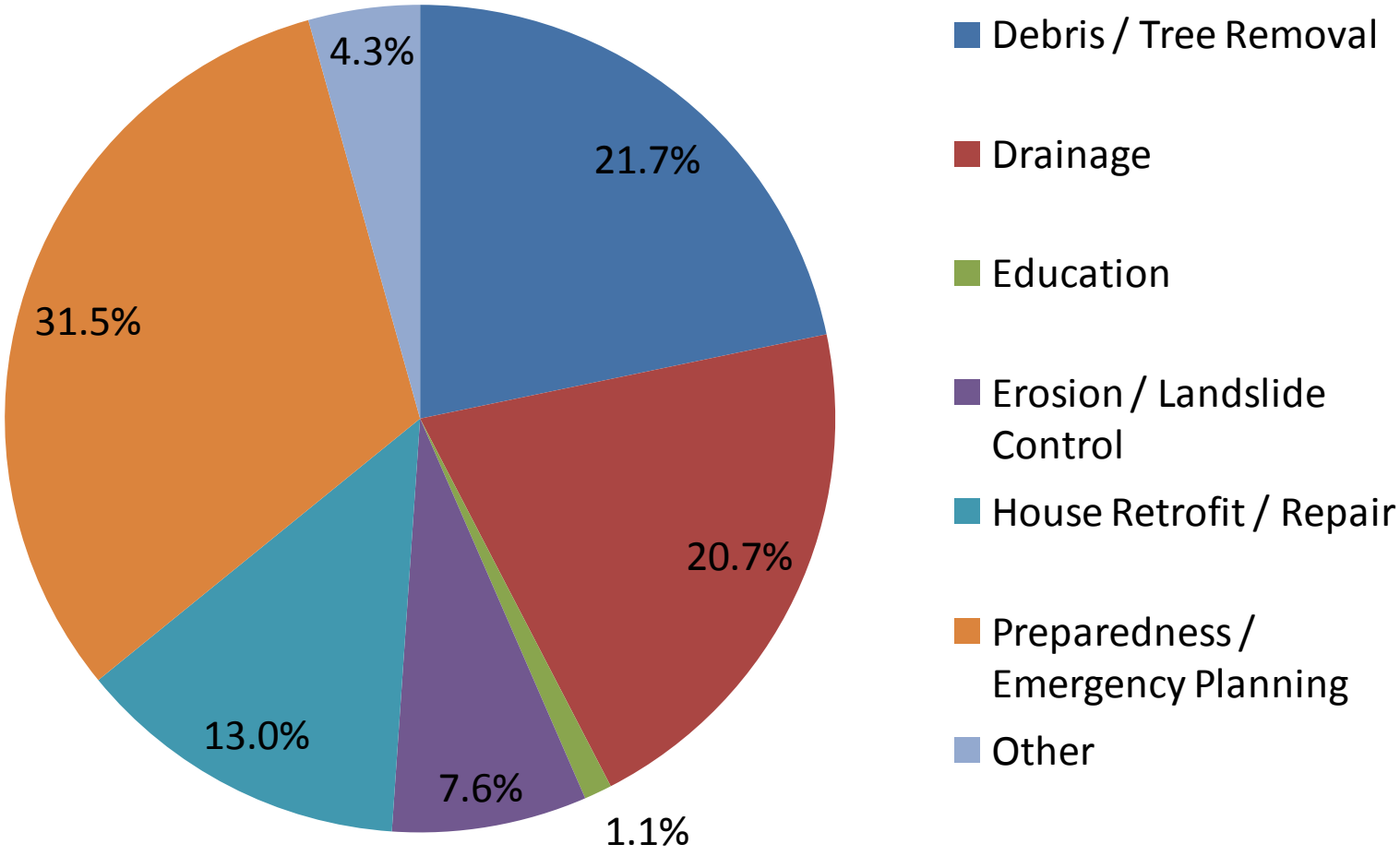
ATKINS

9. Taken action to be more hazard resistant?



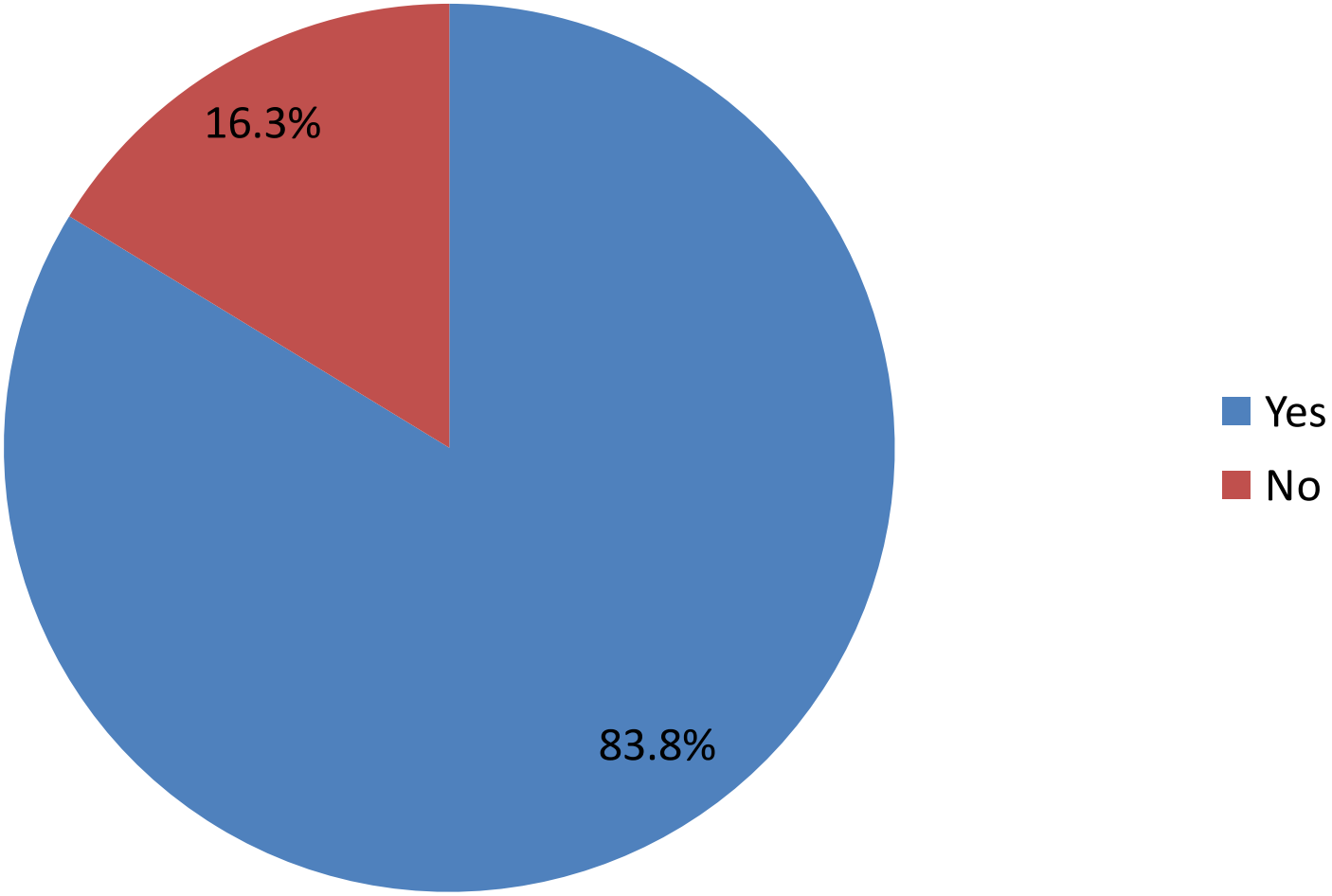
ATKINS

9. Examples of actions taken



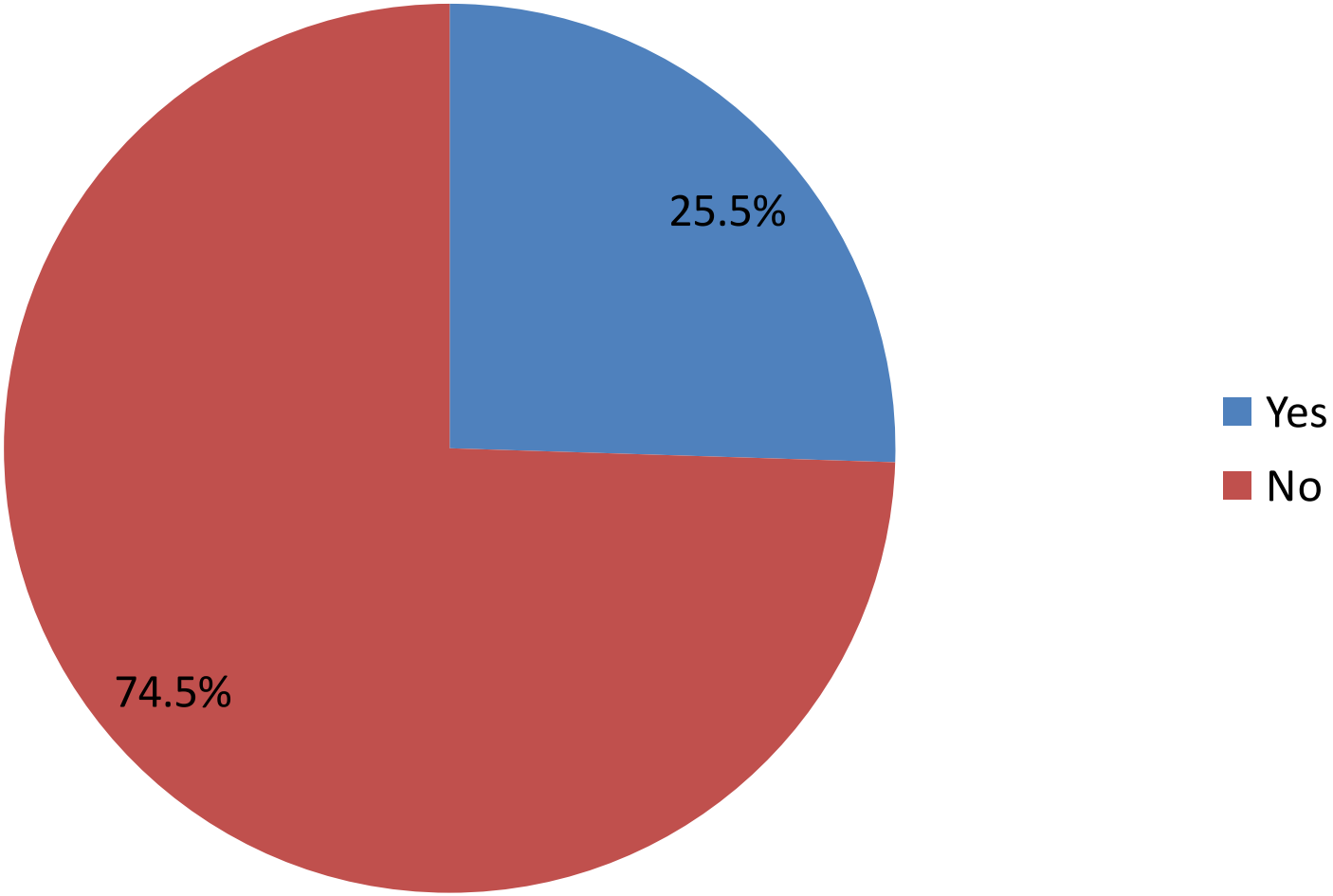
ATKINS

10. Interested in being more hazard resistant?



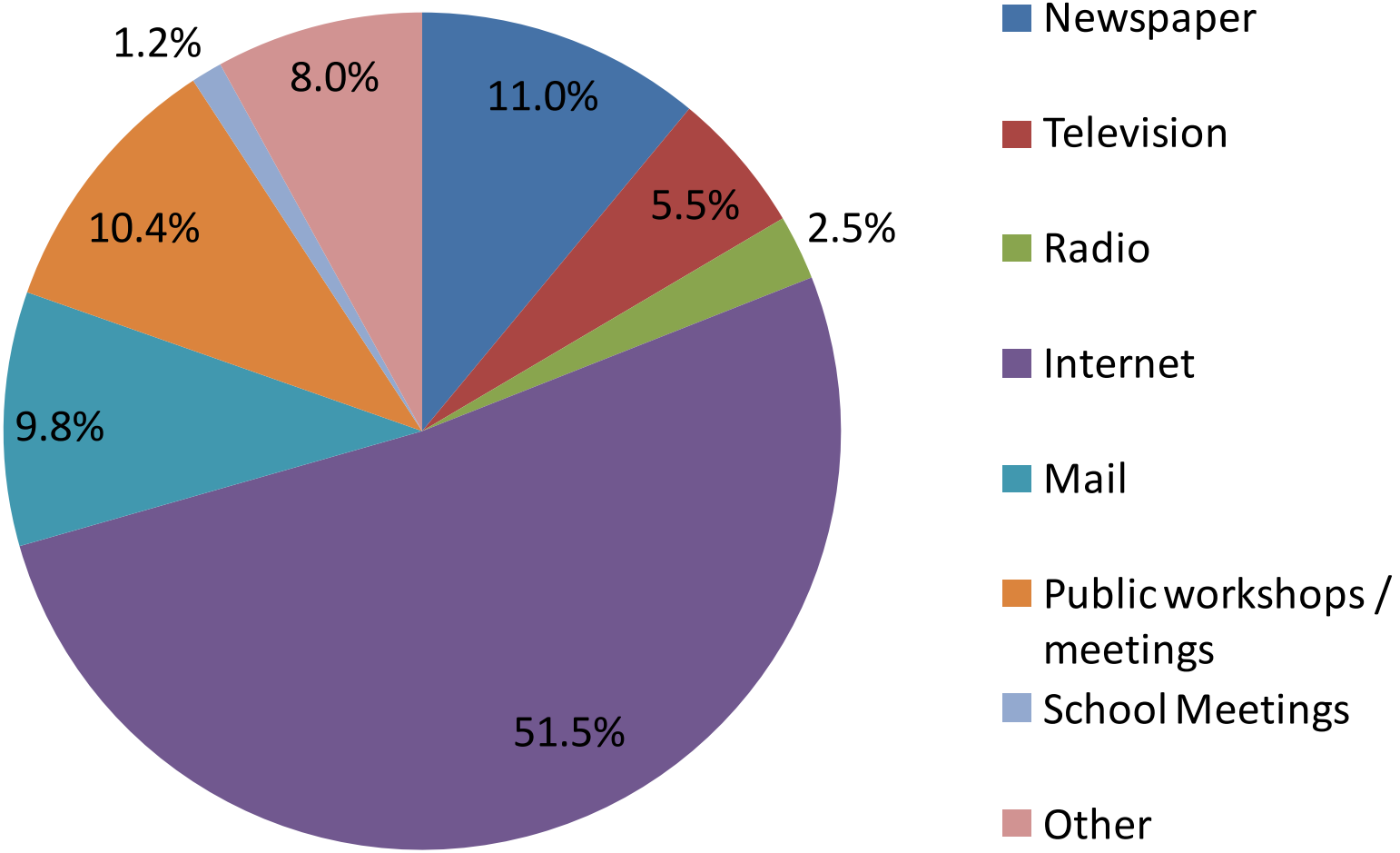
ATKINS

11. Know who to contact for reducing risks?



ATKINS

12. Most effective way to receive information?



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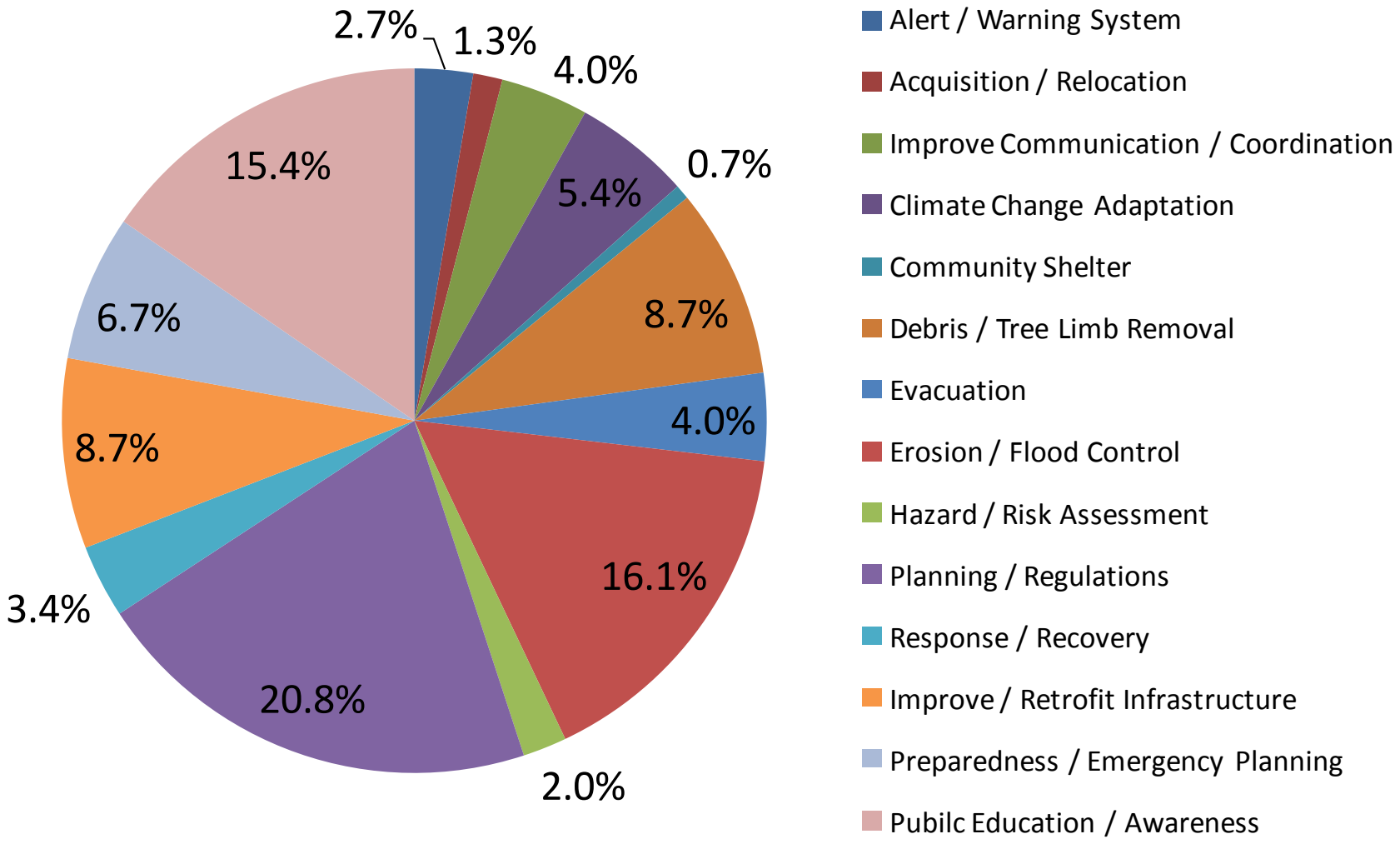
12. Other ways to receive information

- Email
- Twitter / Facebook / social media
- Cell phone / text message
- Neighborhood association meeting

ATKINS

13. Steps local gov't could take to reduce risk



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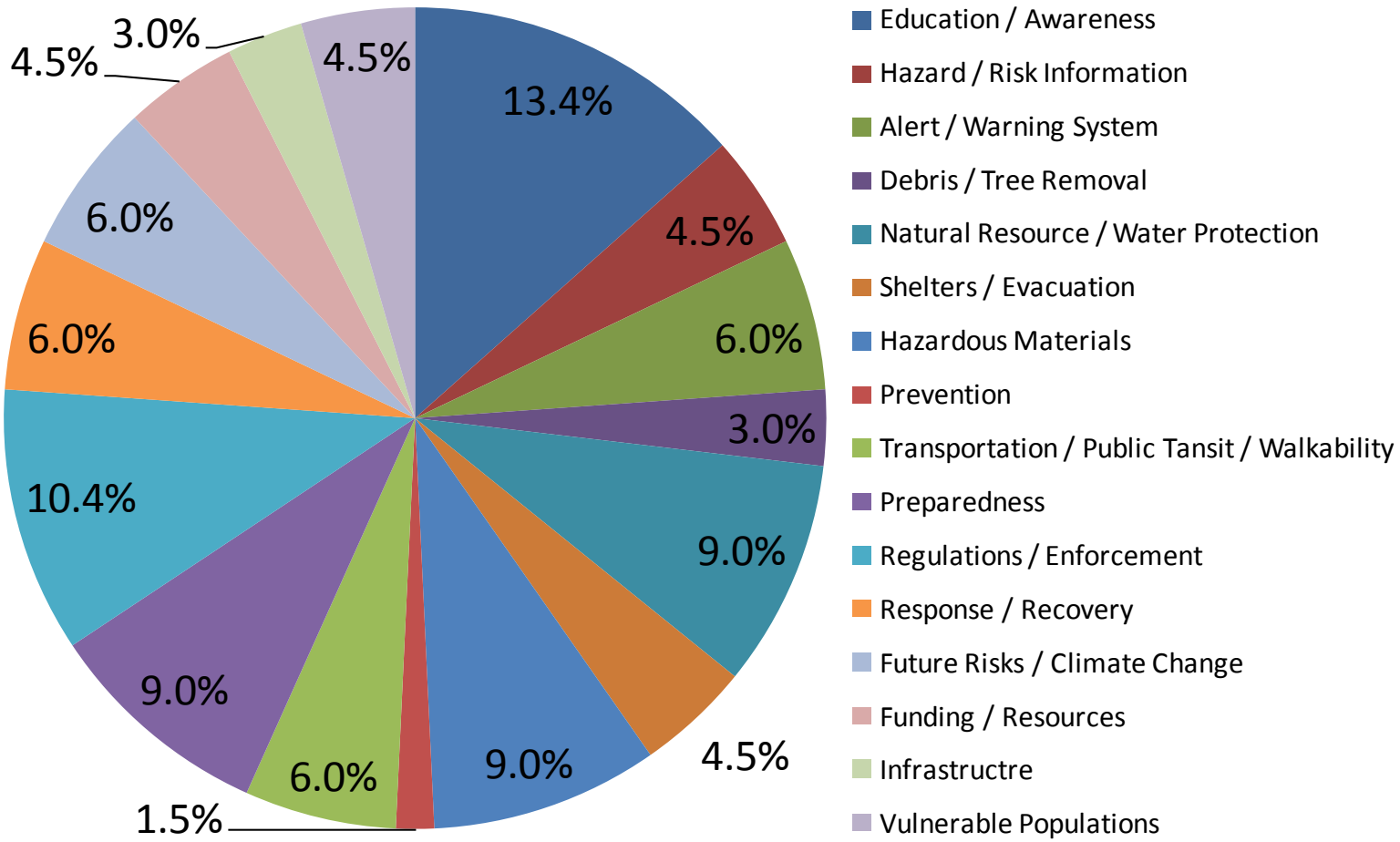
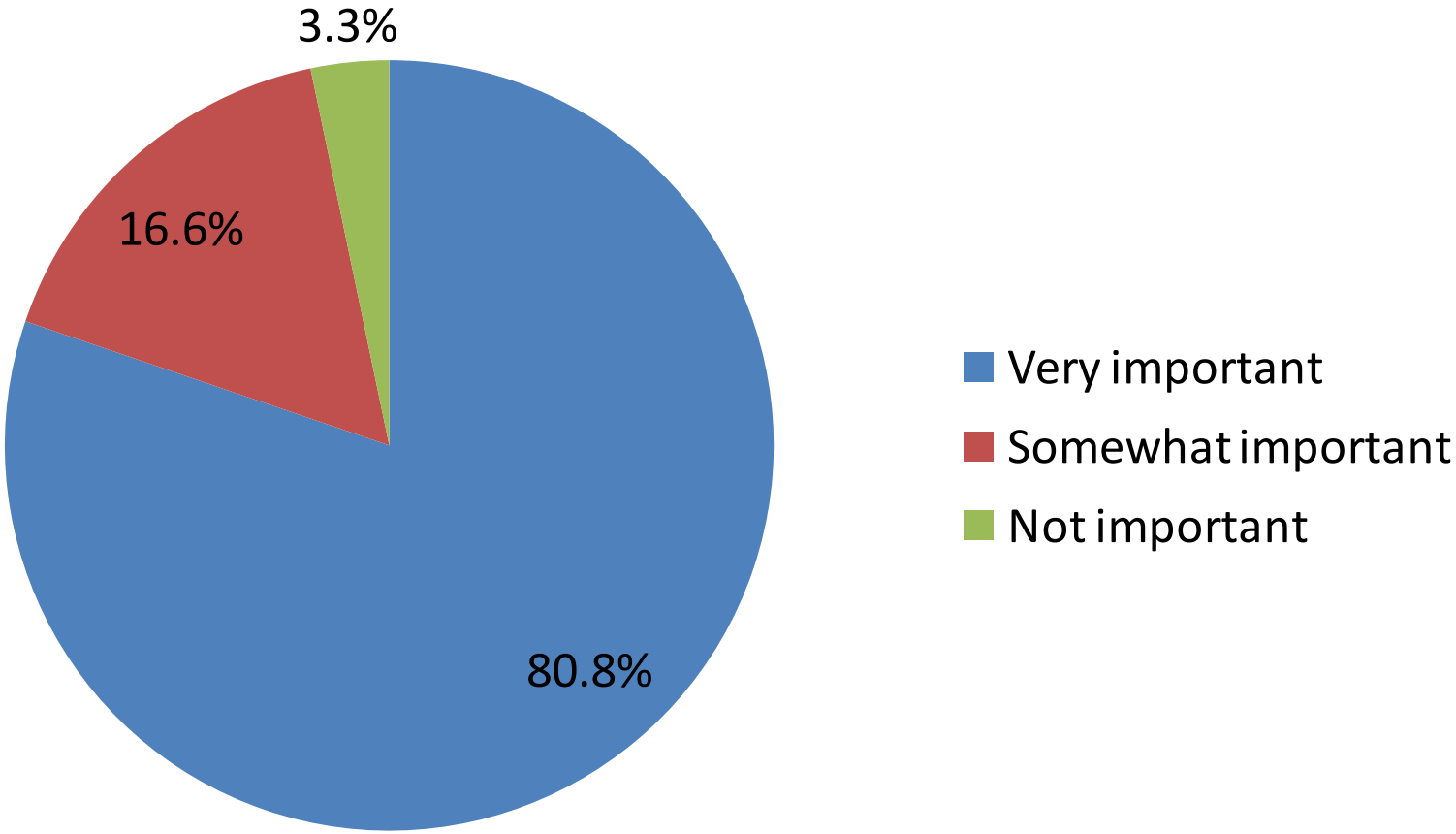
14. Other issues regarding risk and loss



ATKINS

15. Mitigation Actions: Prevention



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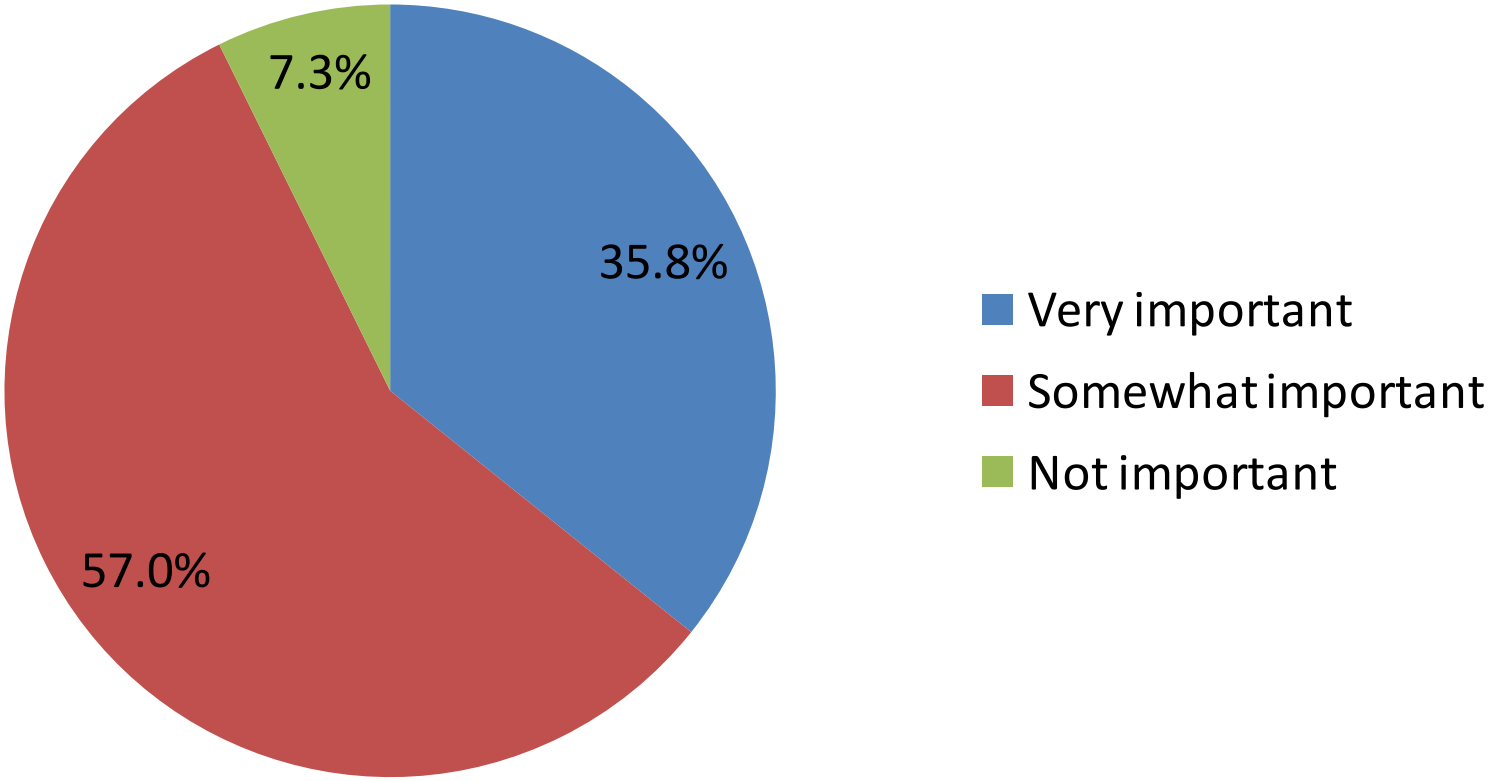
15. Mitigation Actions: Property Protection



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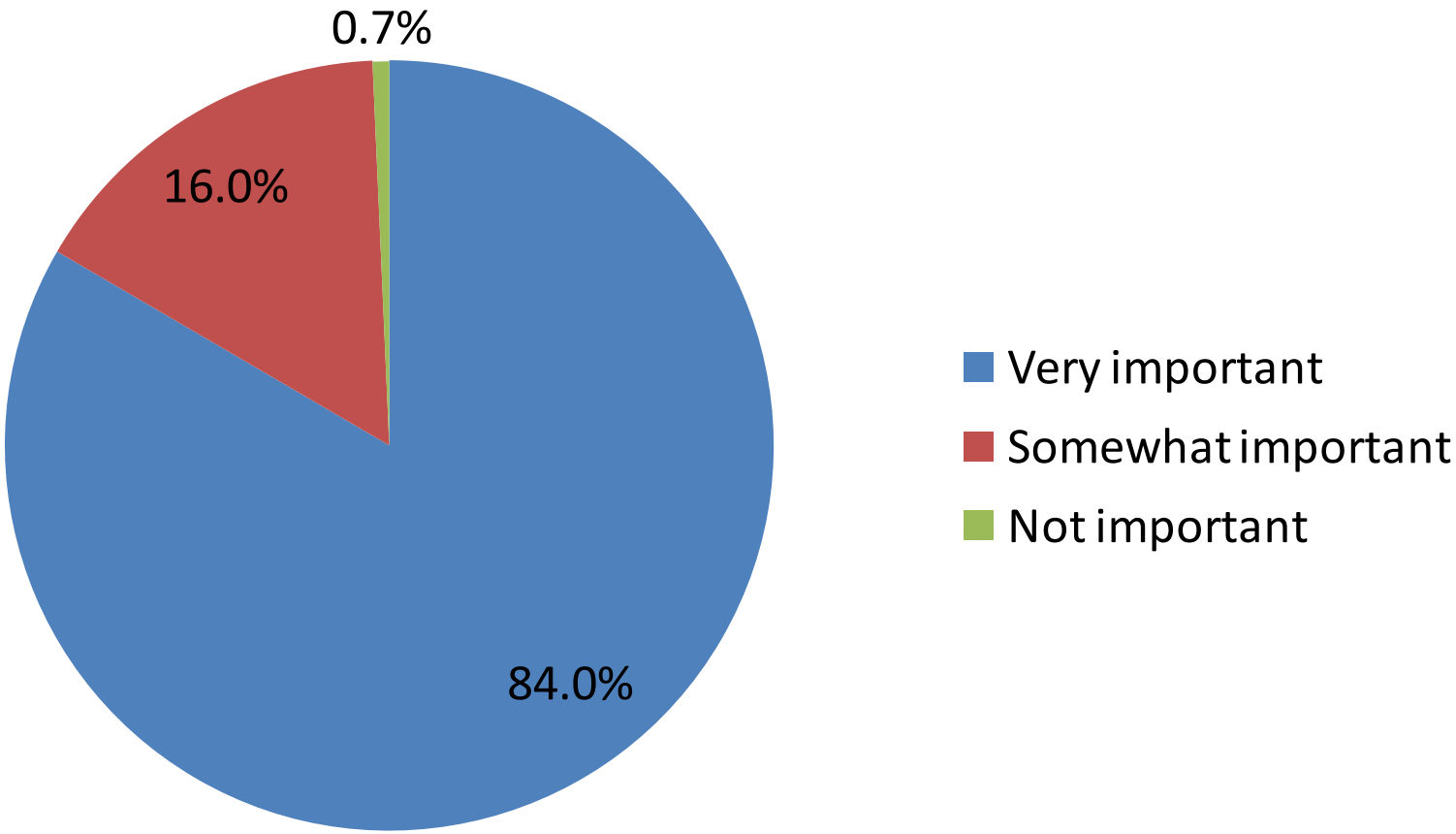
15. Mitigation Actions: Natural Resource Protection



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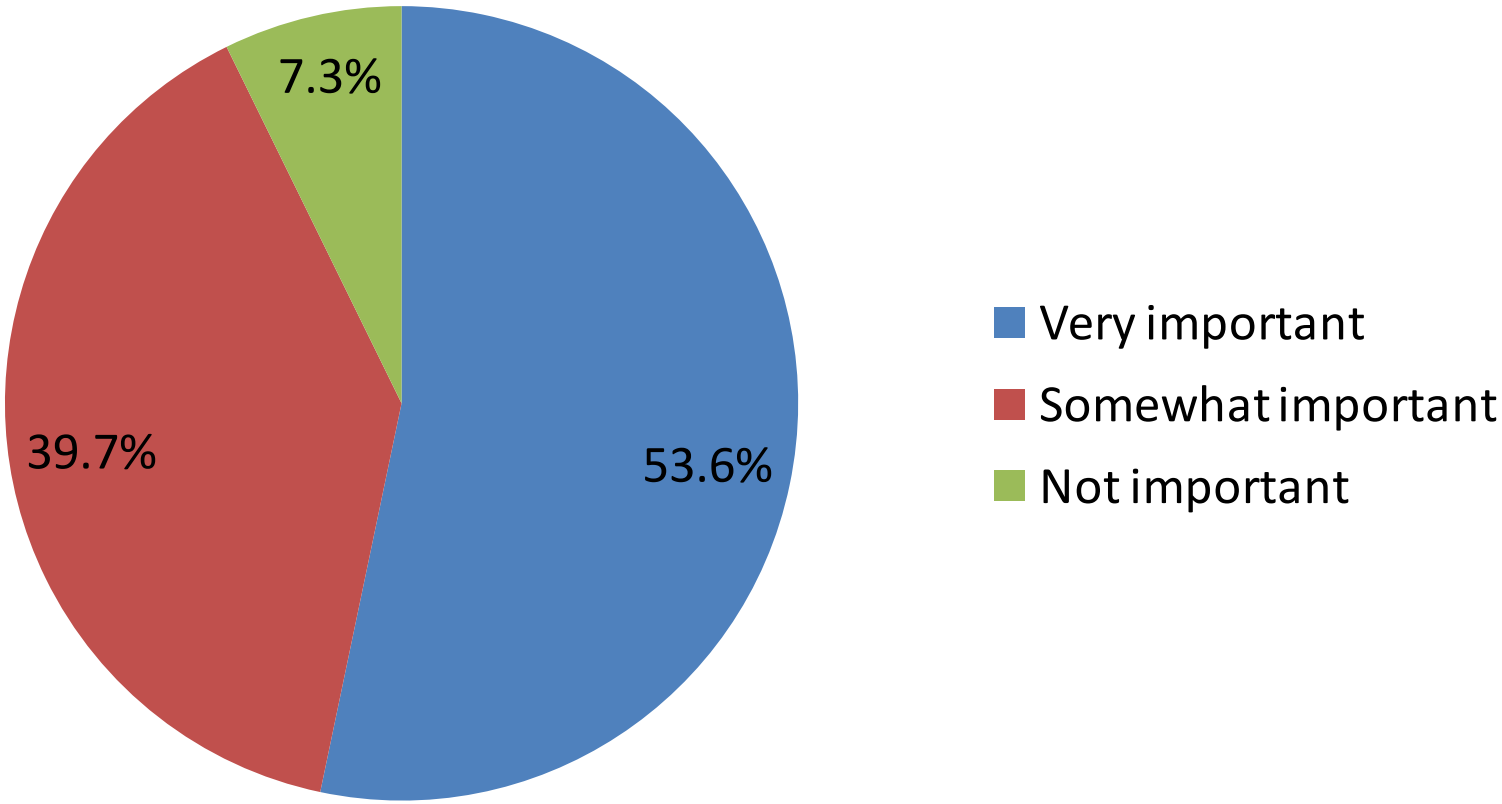
15. Mitigation Actions: Structural Projects



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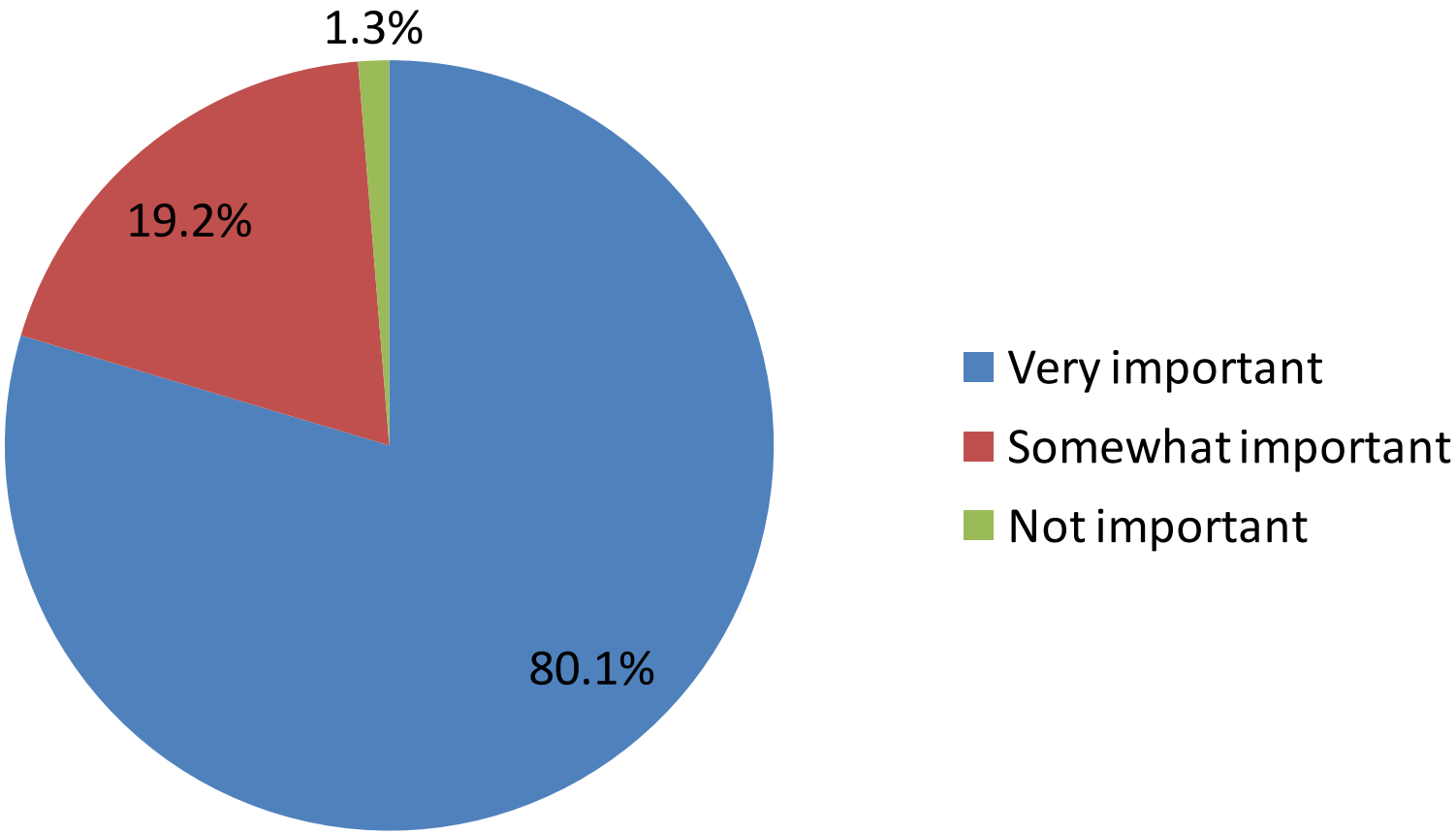
15. Mitigation Actions: Emergency Services



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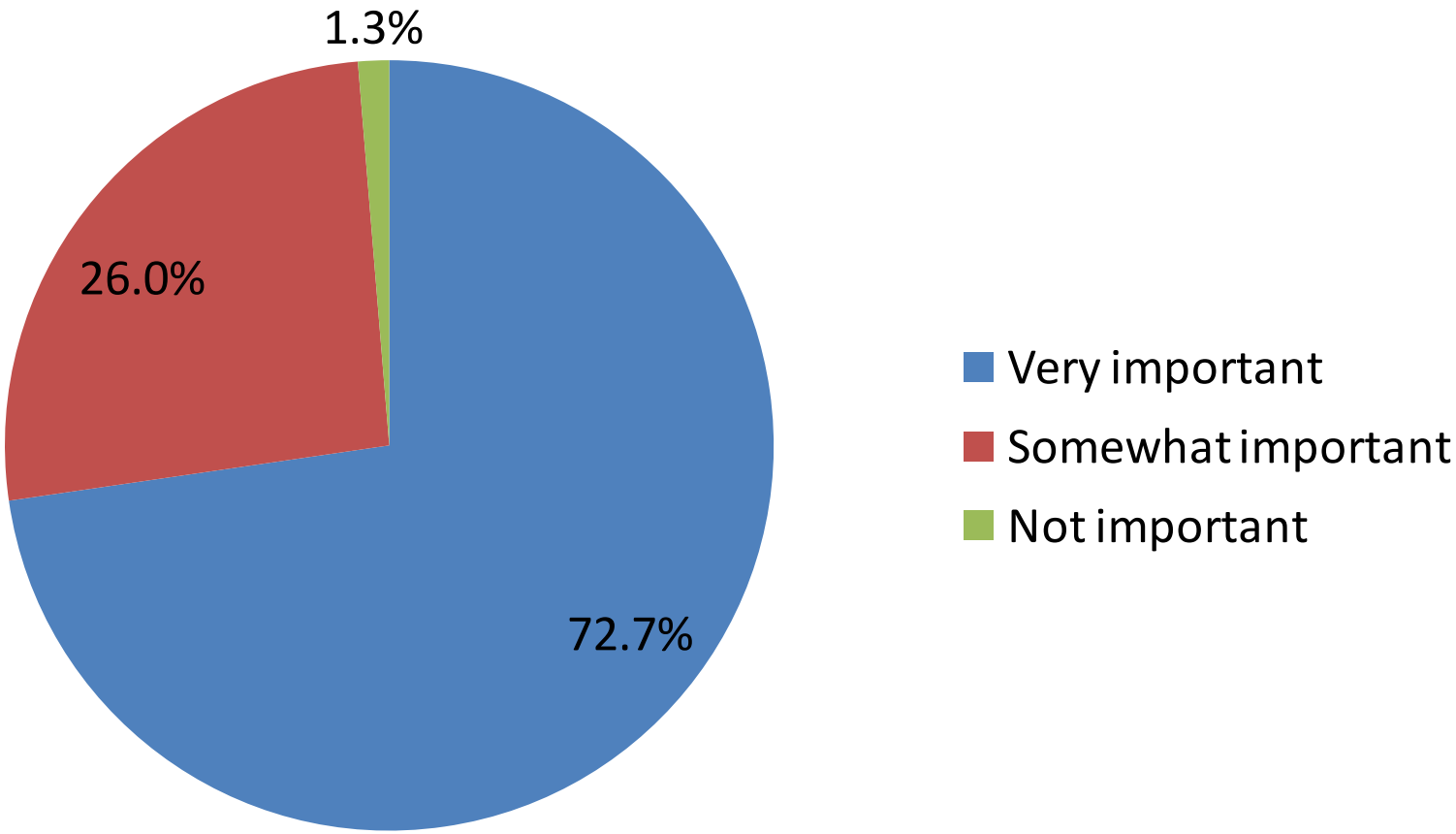
15. Mitigation Actions: Public Education & Awareness



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15. Mitigation Actions: Summary

- Highest importance
  - Natural Resource Protection
  - Prevention
  - Emergency Services
- Moderate importance
  - Public Education & Awareness
- Lowest importance
  - Structural Projects
  - Property Protection

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Photo Source: NCDOT

Buncombe Madison
Regional Hazard Mitigation Plan

Public Participation Survey Results

ATKINS

Appendix E
Community Rating System

This section of the Plan provides a summary of mitigation measures that were considered by the participating jurisdictions in the Buncombe Madison Regional Hazard Mitigation Plan to reduce their risk to the flood hazard specifically, thereby achieving the requirements set forth in Section 510 of the Community Rating System (specifically Step 7). These flood mitigation measures are based on suggested activities that have been shown to significantly reduce flood risk and have been analyzed by each of the respective communities that participate in the Buncombe Madison Regional Hazard Mitigation Plan. The measures are broken down into one of the following six categories of activities that fall within the sphere of prevention activities:

PREVENTION ACTIVITIES

- Floodplain Management
- Comprehensive or Land Use Planning
- Zoning
- Subdivision Regulations
- Stormwater Management
- Building Codes

E.1 INTRODUCTION

This appendix to the Hazard Mitigation Plan was developed in order to enhance each jurisdiction's overall resilience to the flood hazard by documenting the steps that have been taken, and those that need to be taken to help improve each jurisdiction's regulatory environment through preventative actions. In order to maximize points that can be awarded to reduce flood insurance rates through the Community Rating System, communities must thoroughly evaluate preventative mitigation measures.

These measures are often considered the most exemplary type of mitigation actions that can be implemented because their purpose is to prevent issues related to flooding from occurring at all. For instance, if a community were to prohibit any construction within the floodplain, this would prevent any structures that might have been built in that area from being flooded because they won't be located in a high risk area.

Preventative measures are often associated with planning and regulatory activities such as zoning and building codes. The six main categories of prevention activities are outlined above and each of these types of activities are assessed in greater detail below. For each community that participated in this plan, an evaluation of several measures for each category was carried out to determine the community's willingness to implement preventative measures and outline a plan for reducing flood risk.

Within this evaluation, current standards and regulations are identified along with an explanation of local implementation of the specific standard or regulation. In addition, recommendations for future implementation have been discussed and any changes that were considered but discounted as not feasible have been identified along with an explanation concerning why that determination was made.

E.1.1 Floodplain Management

Floodplain Management is a broad category that generally overlaps many of the other prevention-related categories identified herein. However, while other categories of prevention activities such as zoning often exist for purposes beyond mitigation and risk reduction, floodplain management is the primary activity designed to reduce flood risk. Each of the jurisdictions that participated in the hazard mitigation planning process considered several activities that attempt to reduce flood risk through better management of identified floodplain areas.

As described in **Table E.1**, in some cases, it was determined that local governments were already implementing risk reducing activities and merely needed to formalize their commitment to continue to enact these measures. In general, communities were either already implementing floodplain management activities or were working towards implementing these activities in the near future. However, some activities that were considered for implementation could not be incorporated into the local government's implementation structure. In cases where activities were considered, but could not be moved forward, the activity has been identified and an explanation of why it would not be feasible has been included.

TABLE E.1: FLOODPLAIN MANAGEMENT ACTIVITIES

Preventative Activities				
Floodplain Management Regulations— There are a number of regulations that a local government can put into place that can be considered under the category of floodplain management regulations. For example, a jurisdiction could adopt a flood damage prevention ordinance, develop a floodplain management plan, or participate in the National Flood Insurance Program. Each of these activities may help reduce the impact of flooding by providing regulatory guidance aimed at the specific areas within the jurisdiction that are most vulnerable to flooding. Floodplain management regulations are an appropriate activity that the participating jurisdictions can use to reduce future flood losses since many communities have some type of floodplain management regulation in place.				
Jurisdiction	**Current Standards/ Regulations**	**Local Implementation**	**Recommendations for Future Implementation**	**Changes Considered but Discounted as Not Feasible**
City of Asheville	UDO, Chapter 7, Article XII: Flood Protection.	The City of Asheville's Flood Protection Ordinance requires a number of items be submitted with new applications for new development or redevelopment. Among other items, these include a boundary of the special flood hazard area be delineated on the plot plan and that the elevation of the proposed development be included.	• The city should continue to implement its higher freeboard requirements for properties located in the floodplain • The city should continue to implement its "no-rise" in base flood elevation clause.	• The city considered prohibiting any fill in floodplain areas, but it was determined to not be technically, politically, or economically feasible.

E.1.2 Comprehensive or Land Use Planning

Comprehensive or Land Use Planning is one of the most impactful means of reducing flood risk because it can provide an overall plan for the community in terms of where development takes place. As a result, comprehensive/land use planning can help direct people and property out of known flood prone areas

and reduce the threat of future flood losses. Each of the jurisdictions that participated in the CRS portion of the Hazard Mitigation Planning process considered several activities that attempt to reduce flood risk through better either a comprehensive or land use plan.

As described in **Table E.2**, in some cases, it was determined that local governments were already implementing risk reducing activities and merely needed to formalize their commitment to continue to enact these measures. In general, communities were either already implementing comprehensive or land use planning activities or were working towards implementing these activities in the near future. However, some activities that were considered for implementation could not be incorporated into the local government's implementation structure. In cases where activities were considered, but could not be moved forward, the activity has been identified and an explanation of why it would not be feasible has been included.

TABLE E.2: COMPREHENSIVE/LAND USE PLANNING ACTIVITIES

Preventative Activities				
Comprehensive/Land Use Plan— A comprehensive or land use plan establishes the overall vision for what a community wants to be and serves as a guide for future governmental decision making. Typically a comprehensive plan contains sections on demographic conditions, land use, transportation elements, and community facilities. Given the broad nature of the plan and its regulatory standing in many communities, the integration of hazard mitigation measures into the comprehensive plan can enhance the likelihood of achieving risk reduction goals, objectives, and actions. For example, the comprehensive plan can help reduce future flood risk by including a policy to prohibit new development within the 100-year floodplain or by including a goal to maximize open space in the floodplain. Comprehensive planning is an appropriate activity that the participating jurisdictions can use to reduce future flood losses since most communities already have a comprehensive plan in place.				
Jurisdiction	**Current Standards/ Regulations**	**Local Implementation**	**Recommendations for Future Implementation**	**Changes Considered but Discounted as Not Feasible**
City of Asheville	Asheville City Development Plan 2025	The Asheville City Development Plan 2025 includes several policies which are related to reducing flood risk through watershed protection. Specific policies include encouraging the protection of riparian zones and reducing impervious surface area, both of which can serve to reduce stormwater runoff, thereby reducing flood risk.	• The city is willing to consider possibly increasing the amount of its land area classified as open space.	• The city considered classifying all areas delineated as floodplain as open space but it was determined to be not socially, legally, technically, politically, or economically feasible. • The city considered preventing infrastructure expansion in areas exposed to flood hazards, but it was determined to not be legally, technically, politically, or economically feasible.

E.1.3 Zoning

Zoning is often considered an arm of land use planning and is generally designed to regulate certain functions or characteristics of development that are allowed in an area of the jurisdiction. Much like land use planning, zoning can help direct development outside of high risk areas and also regulate the density of development that is allowed in those areas. Each of the jurisdictions that participated in the

CRS portion of the Hazard Mitigation Planning process considered several activities that attempt to reduce flood risk through some form of zoning.

As described in **Table E.3**, in some cases, it was determined that local governments were already implementing risk reducing activities and merely needed to formalize their commitment to continue to enact these measures. In general, communities were either already implementing zoning activities or were working towards implementing these activities in the near future. However, some activities that were considered for implementation could not be incorporated into the local government's implementation structure. In cases where activities were considered, but could not be moved forward, the activity has been identified and an explanation of why it would not be feasible has been included.

TABLE E.3: ZONING ACTIVITIES

Preventative Activities				
Zoning— Zoning represents the primary means by which land use is controlled by local governments. As part of a community's police power, zoning is used to protect the public health, safety, and welfare of those in a given jurisdiction that maintains zoning authority. A zoning ordinance is the mechanism through which zoning is typically implemented. Since zoning regulations enable municipal governments to limit the type and density of development, a zoning ordinance can serve as a powerful tool when applied in identified hazard areas. For example, zoning can help reduce future flood risk by prohibiting or limiting future construction in the 100-year floodplain or by limiting the density of development in the floodplain. Zoning is an appropriate activity that the participating jurisdictions can use to reduce future flood losses since most communities have some degree of zoning in place.				
Jurisdiction	**Current Standards/ Regulations**	**Local Implementation**	**Recommendations for Future Implementation**	**Changes Considered but Discounted as Not Feasible**
City of Asheville	UDO, Chapter 7, Article VIII: General Use Districts. The city maintains several zoning districts, which include potential hazards from fire, flooding, and diseases as one of the evaluation criteria for zoning.	The City of Asheville's Unified Development Ordinance evaluates zoning district classifications based on the potential a given area has to flood. A specific example of how this criterion was put into action involves the River District. The zoning ordinance identifies the River District and explains that a goal of this district is to minimize stormwater runoff, soil erosion, river bank destabilization, grading, and flood damage to development located in this district.	• The city is willing to possibly consider requiring a higher ration than is currently in place of permeable to impermeable surface area in new commercial construction.	• The city considered prohibiting or limiting future construction in the floodplain, but it was determined to not be socially, legally, technically, politically, or economically feasible • The city considered limiting the density of development in the floodplain, but it was determined to not be socially, politically, or economically feasible.

E.1.4 Subdivision Regulations

Subdivision ordinances are typically enacted on a much smaller scale than any of the previously discussed types of prevention activities. Often, subdivision regulations address specific neighborhoods and the types of activities that might be carried out there. Many subdivision ordinances govern standards that must be put in to place when a new development is being designed, but subdivision ordinances also often provide incentives for the inclusion of best practices in flood management into development. Each of the jurisdictions that participated in the CRS portion of the Hazard Mitigation

Planning process considered several activities that attempt to reduce flood risk through subdivision ordinances.

As described in **Table E.4**, in some cases, it was determined that local governments were already implementing risk reducing activities and merely needed to formalize their commitment to continue to enact these measures. In general, communities were either already implementing subdivision ordinance activities or were working towards implementing these activities in the near future. However, some activities that were considered for implementation could not be incorporated into the local government's implementation structure. In cases where activities were considered, but could not be moved forward, the activity has been identified and an explanation of why it would not be feasible has been included.

TABLE E.4: SUBDIVISION ORDINANCE ACTIVITIES

Preventative Activities				
Subdivision Ordinance— A subdivision ordinance is intended to regulate the development of residential, commercial, industrial, or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development. Subdivision design that accounts for natural hazards can dramatically reduce the exposure of future development. For example, a subdivision ordinance can help reduce future flood risk by including risk reducing actions on a lot level such as tree planting requirements or encouraging the use of rain barrels. These ordinances are an appropriate activity that the participating jurisdictions can use to reduce future flood losses since each community already has a form of subdivision ordinance in place.				
Jurisdiction	**Current Standards/ Regulations**	**Local Implementation**	**Recommendations for Future Implementation**	**Changes Considered but Discounted as Not Feasible**
City of Asheville	UDO, Chapter 7, Article XV Subdivisions. The city has established subdivision regulations to promote orderly growth and development of the community.	The City of Asheville Subdivision Ordinance includes requirements that encourage the adequate design of stormwater systems within new subdivisions and that utilities and drainage be designed to minimize flood damage. These requirements recognize the importance of reducing the impacts to new development by ensuring it is protected from flooding.	• The city is willing to consider possibly incentivizing the use of rain barrels or rain gardens. • The city should continue to require more trees be preserved and planted in landscape designs to reduce stormwater runoff. • The city should continue to require a drainage study with new development.	• The city has considered a number of options regarding subdivision ordinances as is evident in previous columns. It is at least considering implementation of all options that were considered.

E.1.5 Stormwater Management

Somewhat distinct from many of the other categories of prevention activities, stormwater management encompasses activities that deal with water runoff during storm events that is managed and directed by the local government entity. Stormwater management issues have become an especially prominent discussion point in the arena of flood risk reduction for local governments because of this responsibility. Each of the jurisdictions that participated in the Hazard Mitigation Planning process considered several activities that attempt to reduce flood risk through stormwater management.

As described in **Table E.5**, in some cases, it was determined that local governments were already implementing risk reducing activities and merely needed to formalize their commitment to continue to enact these measures. In general, communities were either already implementing stormwater management activities or were working towards implementing these activities in the near future. However, some activities that were considered for implementation could not be incorporated into the local government's implementation structure. In cases where activities were considered, but could not be moved forward, the activity has been identified and an explanation of why it would not be feasible has been included.

TABLE E.5: STORMWATER MANAGEMENT ACTIVITIES

Preventative Activities				
Stormwater Management— A stormwater management plan is designed to address flooding associated with stormwater runoff. The stormwater management plan is typically focused on design and construction measures that are intended to reduce the impact of more frequently occurring minor urban flooding. For example, stormwater management regulations or plans can help reduce future flood risk by requiring restrictions on development in upland areas to reduce stormwater run-off or adopting Phase II stormwater regulations. Stormwater management plans are an appropriate activity that the participating jurisdictions can use to reduce future flood losses since most communities are working to develop or already have a form of stormwater management in place.				
Jurisdiction	**Current Standards/ Regulations**	**Local Implementation**	**Recommendations for Future Implementation**	**Changes Considered but Discounted as Not Feasible**
City of Asheville	UDO, Chapter 7, Article XII Stormwater, Soil Erosion and Sedimentation Control, Illicit Discharge and Connection. The city has established stormwater regulations to comply with federal and state law regarding stormwater discharge and control the potential adverse effects of increased stormwater runoff associated with future and existing development.	The City of Asheville Stormwater Management ordinance recognizes that stormwater runoff can have an adverse impact on the health, safety, and general welfare of its citizens. Therefore, as one of its primary tenets, it requires that new development and redevelopment maintain the pre-development hydrologic response as nearly as practicable to reduce flooding and erosion.	• The city should continue to set compensatory water storage requirements for new construction. • The city should continue to regulate development in upland areas in order to reduce stormwater runoff. • The city should continue to link flood hazard mitigation objectives with EPA Stormwater Phase II initiatives.	• The city has considered a number of options regarding stormwater management as is evident in previous columns. It is at least considering implementation of all options that were considered.

E.1.6 Building Codes

Building Codes are can help in the reduction of risk to flooding events in a number of ways. For instance, stronger building codes can help to ensure that structures are built to a standard which will allow them to resist the hydrostatic and hydrodynamic forces of flood waters. Building codes are often implemented at the local level, but in many cases, states set the actual provisions of the building code through minimum standards that communities must adopt. Each of the jurisdictions that participated in

the Hazard Mitigation Planning process considered several activities that attempt to reduce flood risk through better management of identified floodplain areas.

As described in **Table E.6**, in some cases, it was determined that local governments were already implementing risk reducing activities and merely needed to formalize their commitment to continue to enact these measures. In general, communities were either already implementing building code activities or were working towards implementing these activities in the near future. However, some activities that were considered for implementation could not be incorporated into the local government's implementation structure. In cases where activities were considered, but could not be moved forward, the activity has been identified and an explanation of why it would not be feasible has been included.

TABLE E.6: BUILDING CODE ACTIVITIES

Preventative Activities				
Building Code—Building codes regulate construction standards. In many communities, permits and inspections are required for new construction. Decisions regarding the adoption of building codes (that account for hazard risk), the type of permitting process required both before and after a disaster, and the enforcement of inspection protocols all affect the level of hazard risk faced by a community. An example of how building codes can reduce flood risk is by implementing a code that requires that new buildings constructed in the floodplain are built with materials that are resistant to the anticipated velocity of floodwaters.				
Jurisdiction	**Current Standards/ Regulations**	**Local Implementation**	**Recommendations for Future Implementation**	**Changes Considered but Discounted as Not Feasible**
City of Asheville	Adopted 2012 North Carolina State Building Code	Appendix G of the NC State Building Code outlines regulations for flood resistant construction. Among other regulations, the code states that all permit applications for construction or substantial improvement to structures in the floodplain must by designed and constructed with methods, practices, and materials that minimize flood damage.	• The city should continue adopting future updates to the North Carolina State Building Code and enforcing it throughout the jurisdiction. • The city should continue to enforce higher building codes such as the International Building Code or International Residential Code • The city should continue to implement ASCE 24-05 which specifies minimum requirement and expected performance for the design and construction of buildings and structures in flood hazard areas to make them more resistant to flood loads and flood damage	• The city considered a number of options regarding building codes as is evident in previous columns. It is at least considering implementation of all options that were considered.

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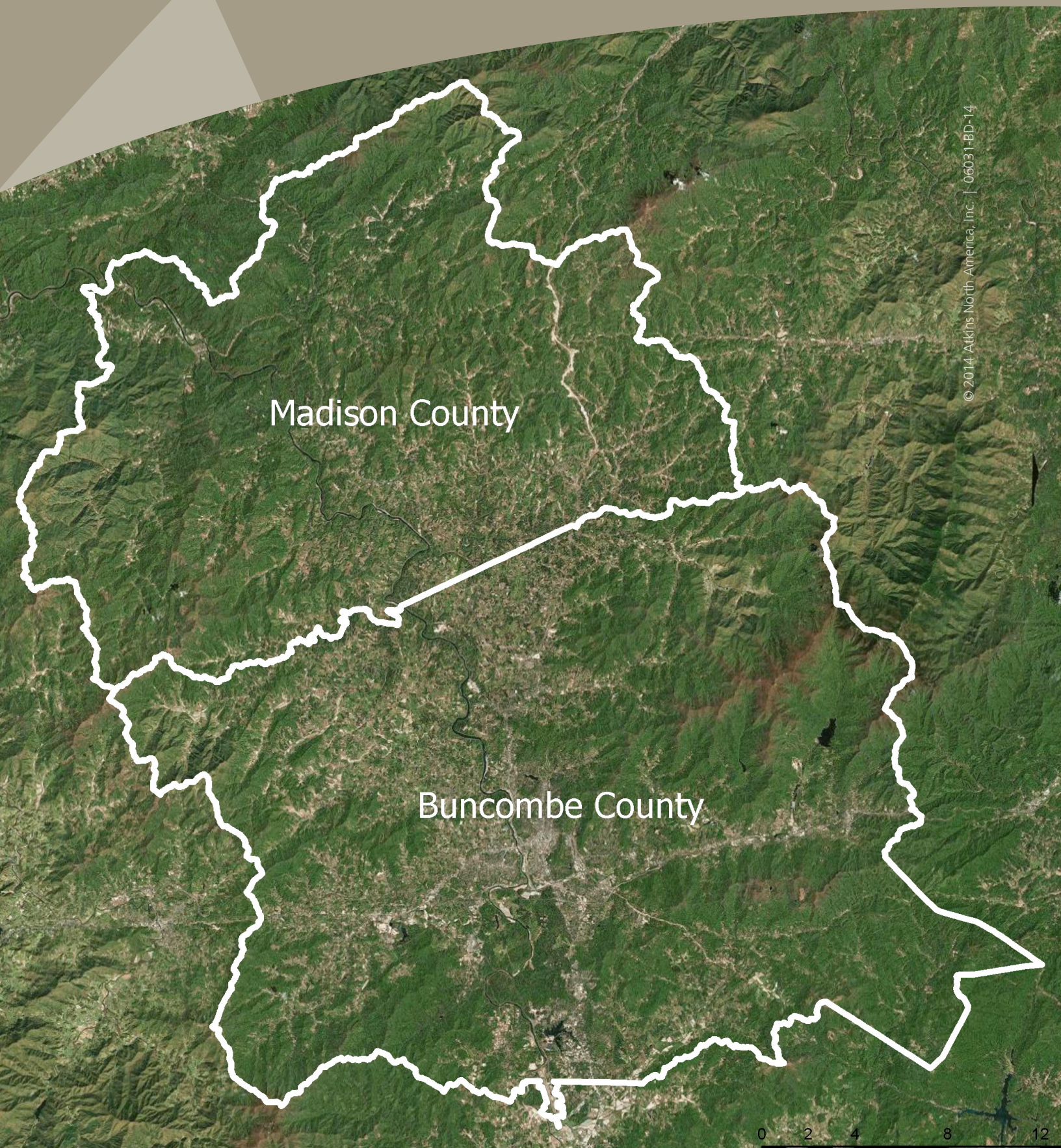

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