Unifour Regional Hazard Mitigation Plan

Alexander County, Burke County, Caldwell County, Catawba County

Prepared by:

Unifour Hazard Mitigation Planning Committee

With Professional Planning Assistance from

AECOM

FINAL DRAFT

February 2014

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Acknowledgements

This regional hazard mitigation plan was made possible through the dedicated efforts of each participating jurisdiction, stakeholders, members of the public, and the project consultant. Detailed information about the planning process and individual participation can be found in the *Planning Process* section of this document.

Participating county and municipal jurisdictions are listed here in alphabetical order by county.

Alexander County
Town of Taylorsville

Burke County
Town of Connelly Springs
Town of Drexel
Town of Glen Alpine
Town of Hildebran
City of Morganton
Town of Rutherford College
Town of Valdese

Caldwell County
Town of Cajah's Mountain
Village of Cedar Rock
Town of Gamewell
Town of Granite Falls
Town of Hudson
City of Lenoir
Town of Rhodhiss
Town of Sawmills

Catawba County
Town of Brookford
Town of Catawba
City of Claremont
City of Conover
City of Hickory
Town of Long View
Town of Maiden
City of Newton

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Section 1: Introduction

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

1.1 Background

Natural hazards, such as floods, tornadoes, and severe winter storms 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 Unifour Region, which is comprised of Alexander, Burke, Caldwell, and Catawba counties, is vulnerable to a wide range of natural hazards. These hazards threaten the life and safety of the Region's residents, and have the potential to damage or destroy both public and private property and disrupt the local economy and overall quality of life.

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 damaging effects of natural 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. Hazard mitigation is defined by the Federal Emergency Management Agency (FEMA) as, "Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards."

Hazard mitigation techniques include structural measures and non-structural measures. Structural measures include activities such as strengthening or protecting buildings and infrastructure from the destructive forces of potential hazards. Non-structural measures include activities 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 overall hazard vulnerability in the planning area.

One of the most effective means that a community can use to implement a comprehensive approach to hazard mitigation is to develop, adopt, and update as needed, a local hazard mitigation plan. A mitigation plan establishes the broad local vision and guiding principles for reducing hazard risk, and further proposes specific mitigation actions to eliminate or reduce identified vulnerabilities.

The Unifour Regional Hazard Mitigation Plan (hereinafter referred to as "Hazard Mitigation Plan" or "Plan") is an effective means to incorporate hazard mitigation principles and practices into the

routine government activities and functions of the four counties and 24 municipalities participating in this Plan. At its most inner core, the Plan recommends specific actions to protect our built environment from the forces of nature and to protect the residents of the Unifour Region 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 Unifour Region's future vulnerability to identified hazards.

The Plan is designed to be a living document, with implementation and evaluation procedures included to help achieve meaningful objectives and successful outcomes over time.

Disaster Mitigation Act of 2000

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) to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act by invoking new and revitalized approaches to mitigation planning. Section 322 of the Act emphasizes the need for state and local 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 government applying for federal mitigation grant funds. 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 declared disaster.

This Plan was prepared in coordination with FEMA and the North Carolina Division of Emergency Management (NCEM) to ensure that it meets all applicable planning requirements. This includes conformance with FEMA's latest *Local Mitigation Planning Handbook* (released March 2013) and *Local Mitigation Plan Review Guide* (released October 2011). A *Local Hazard Mitigation Plan Update Checklist*, found in Appendix B, provides a summary of FEMA and NCEM's current minimum standards of acceptability and notes the location within the Plan where each planning requirement is met.

1.2 Purpose and Vision

The general purpose of this Hazard Mitigation Plan is:

- To protect life and property by reducing the potential for future damages and economic losses that result from natural hazards;
- To qualify for additional grant funding, in both the pre-disaster and post-disaster environment;
- To speed recovery and redevelopment following future disaster events;
- To sustain and enhance existing governmental coordination in the Unifour Region and demonstrate a firm local commitment to hazard mitigation principles; and
- To comply with federal and state requirements for local hazard mitigation plans.

A Unifour Hazard Mitigation Planning Committee was created, consisting of representatives from each of the 28 participating jurisdictions, to develop a regional plan. This committee established a vision statement to help guide the regional planning process and to give all of the participating jurisdictions a common focal point for discussion, coordination, and development of the Plan:

Vision Statement

"Through a coordinated regional planning effort, create and implement an effective hazard mitigation plan that will identify and prioritize risk reduction measures for natural hazards in order to protect the health, safety, quality of life, environment, and economy of the Unifour area."

1.3 Scope

This Hazard Mitigation Plan will be updated and maintained to continually address those hazards determined to be of high and moderate risk through the detailed vulnerability assessment for the Unifour Region (see Section 4: *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 to the Unifour Region.

The geographic scope (i.e., the "planning area") for the Plan includes all incorporated and unincorporated areas of Alexander, Burke, Caldwell, and Catawba counties. This includes the following 28 local government jurisdictions:

Alexander County
- Town of Taylorsville

Burke County
- Town of Connelly Springs
- Town of Drexel
- Town of Glen Alpine
- Town of Hildebran
- City of Morganton
- Town of Rutherford College
- Town of Valdese

Caldwell County
- Town of Cajah's Mountain
- Village of Cedar Rock
- Town of Gamewell
- Town of Granite Falls
- Town of Hudson
- City of Lenoir
- Town of Rhodhiss
- Town of Sawmills

Catawba County
- Town of Brookford
- Town of Catawba
- City of Claremont
- City of Conover
- City of Hickory
- Town of Long View
- Town of Maiden
- City of Newton

These 28 participating jurisdictions have previously been covered under four separate county level plans. The decision was made to create one regional mitigation plan in order to accomplish the following planning goals:

- Support a more holistic regional planning effort, taking into account shared concerns and shareable resources;
- Conform to NCEM's preference for regional hazard mitigation planning in the state; and
- Leverage available funding and resources for mitigation planning.

1.4 Authority

This Hazard Mitigation Plan has been adopted by all participating counties in accordance with the authority and police powers granted to counties as defined by the State of North Carolina (N.C.G.S., Chapter 153A). This Hazard Mitigation Plan has also been adopted by all participating incorporated municipal jurisdictions under the authority granted to cities and towns as defined by the State of

North Carolina (N.C.G.S., Chapter 160A). Copies of all local resolutions to adopt the Plan are included in Appendix A.

This Plan was developed in accordance with current state and federal rules and regulations governing local hazard mitigation plans. The Plan shall be monitored and updated on a routine basis to maintain compliance with the following legislation:

- Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390) and by FEMA's Interim Final Rule published in the Federal Register on February 26, 2002, at 44 CFR Part 201.
- North Carolina General Statutes, Chapter 166A: North Carolina Emergency Management Act, as amended by Senate Bill 300: An Act to Amend the Laws Regarding Emergency Management as Recommended by the Legislative Disaster Response and Recovery Commission (2001).

1.5 Plan Overview

This Hazard Mitigation Plan is divided into eight major sections, each of which is described briefly below. The Plan also includes several appendices for additional or supplemental items not included in the main body of the Plan, including copies of local adoption resolutions (Appendix A), a completed *Local Hazard Mitigation Plan Update Checklist* (Appendix B), Public Outreach Strategy (Appendix C), public participation survey results (Appendix D), copies of meeting agendas, sign-in sheets, and PowerPoint slides (Appendix E), etc.

This *Introduction* (Section 1) provides background on hazard mitigation planning and the Disaster Mitigation Act of 2000, and defines the purpose, scope, and authority of the Plan as adopted by all participating jurisdictions. It also provides the following outline of each section making up the Plan.

The *Planning Process*, found in Section 2, fully documents the process by which the Unifour Region prepared this regional hazard mitigation plan as an update to its four existing county level plans. This includes a description of the key steps involved in the processes followed, who was involved (i.e., the members of the Hazard Mitigation Planning Committee) and full descriptions of community meetings and workshops, how the public and other stakeholders were notified and involved, and how each of the municipal jurisdictions participated in the process.

The *Planning Area Profile*, located in Section 3, describes the general makeup of the Unifour Region, including its counties and local municipalities, including relevant geographic, demographic, and economic characteristics. In addition, building characteristics and land use patterns are discussed along with general historical disaster data. This baseline information provides context for the region-wide planning area and thereby assists the planning team in recognizing the social, environmental, and economic factors that ultimately play a role in determining community vulnerability to natural hazards.

The *Risk Assessment*, found in Section 4, serves to identify, analyze, and assess the Unifour Region's overall risk to natural hazards. The *Risk Assessment* also attempts to define any hazard risks that may uniquely or exclusively affect the individual municipal jurisdictions. The *Risk Assessment* builds on available historical data from past hazard occurrences, establishes detailed profiles for each

hazard, and culminates in a hazard risk ranking based on conclusions about the frequency of occurrence, spatial extent, and potential impact of each hazard. In essence, the information generated through the *Risk Assessment* serves a critical function as communities seek to determine the most appropriate mitigation actions to pursue and implement—enabling communities to prioritize and focus their efforts on those hazards of greatest concern and those structures or areas facing the greatest risk(s).

The *Capability Assessment*, located in Section 5, provides a comprehensive examination of the Unifour Region and the participating municipalities' capacity to implement meaningful mitigation strategies and identifies existing 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 detailed survey questionnaires for local officials 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 (such as participation in the National Flood Insurance Program) in establishing a successful and sustainable community hazard mitigation program. The *Community Profile*, *Risk Assessment*, and *Capability Assessment* collectively serve as a basis for determining the goals for the Hazard Mitigation Plan, each contributing to the development, adoption, and implementation of a meaningful *Mitigation Strategy* that is based on accurate background information.

The *Mitigation Strategy*, found in Section 6, consists of regional goal statements as well as specific mitigation actions for each local government jurisdiction participating in the planning process, along with a set of regional mitigation actions to be implemented by the Unifour Hazard Mitigation Planning Committee. The *Mitigation Strategy* provides the foundation for detailed *Mitigation Action Plans*, found in Section 7, that link specific mitigation actions for each jurisdiction 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 also functional through the identification of short-term and immediate 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 Unifour Region less vulnerable to the damaging forces of nature 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 hazard mitigation policies and programs with complimentary community goals related to housing, economic development, downtown revitalization, recreational opportunities, transportation improvements, environmental quality, land development, and public health and safety.

The *Plan Maintenance Procedures*, found in Section 8, includes the measures each participating jurisdiction 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.

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Section 2: Planning Process

This section of the Plan describes the mitigation planning process undertaken by the Unifour Region in preparing the Hazard Mitigation Plan. It consists of the following eight subsections:

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 results in a hazard mitigation plan that identifies specific mitigation actions, each designed to achieve short-term planning objectives as well as a long-term community vision. To ensure the functionality of each mitigation action, responsibility is assigned to a specific individual, department, or agency along with a schedule for its implementation. Plan maintenance procedures are established for the routine monitoring of implementation progress, as well as 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.

Mitigation planning offers 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, mitigation planning is 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 pre-disaster investments 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 more quickly and with less interruption.

The benefits of mitigation planning go beyond solely reducing hazard vulnerability. Measures such as the acquisition or regulation of land in known hazard areas can help achieve multiple community

goals, such as preserving open space, maintaining environmental health, and enhancing recreational opportunities. Thus, it is vitally important that any local mitigation planning process be integrated with other 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 Unifour Region

Each of the four counties participating in this Plan, along with their incorporated municipal jurisdictions, had a previously approved hazard mitigation plan in place prior to this regional planning effort. The FEMA approval dates for each of these plans, along with a list of their participating municipalities, are listed below.

- *Alexander County and Town of Taylorsville Multi-Jurisdiction Hazard Mitigation Plan* (September 2009)
    - Alexander County
    - Town of Taylorsville

- *Burke County Hazard Mitigation Plan* (December 2009)
    - Burke County
    - Town of Connelly Springs
    - Town of Drexel
    - Town of Glen Alpine
    - Town of Hildebran
    - City of Morganton
    - Town of Valdese
    - Rutherford College

- *Caldwell County Multi-Jurisdictional Hazard Mitigation Plan* (December 2010)
    - Caldwell County
    - Town of Cajah's Mountain
    - Village of Cedar Rock
    - Town of Gamewell
    - Town of Granite Falls
    - Town of Hudson
    - City of Lenoir
    - Town of Rhodhiss
    - Town of Sawmills

- *Catawba County Multi-Jurisdictional Hazard Mitigation Plan* (June 2010)
    - Catawba County
    - Town of Brookford
    - Town of Catawba
    - City of Claremont
    - City of Conover
    - City of Hickory
    - Town of Long View
    - Town of Maiden
    - City of Newton

Each of the plans listed above was developed using the multi-jurisdictional mitigation planning process recommended by FEMA. For this regional plan, all of the jurisdictions listed above have agreed to merge, update, and expand their existing mitigation planning content as part of one new regional format. No new jurisdictions have joined the planning process since the plans above were adopted and all of the jurisdictions that participated in previous planning efforts have agreed to participate in this regional planning effort. The specific process of moving forward with one regional approach is described in more detail in the following subsections.

2.3 Preparing the Regional Plan

Hazard mitigation plans are required by FEMA to be updated every five years in order for the jurisdictions covered under them to remain eligible for federal mitigation and public assistance funding. To simplify and enhance planning efforts for the jurisdictions in the Unifour Region, Alexander, Burke, Caldwell, and Catawba counties made the decision to move forward with the creation of the Unifour Regional Hazard Mitigation Plan. This regional approach allows resources to be shared amongst the participating jurisdictions and eases the administrative duties of all of the participants by combining the four existing county level plans, and the requirements for the five-year plan update, into one coordinated regional planning process.

To help prepare the Unifour Regional Hazard Mitigation Plan, AECOM was hired as a consultant to provide professional mitigation planning services. To meet requirements of the NFIP's Community Rating System, the region ensured that the planning process was facilitated under the direction of a professional planner, Mr. Darrin R. Punchard, AICP, from AECOM who served as the project manager for this project.

Per the contractual scope of work, the consultant team followed the mitigation planning process recommended by FEMA and recommendations provided by North Carolina Division of Emergency Management (NCEM) mitigation planning staff. The *Local Hazard Mitigation Plan Update Checklist*, found in Appendix B, 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 Interim Final Rule as published in the Federal Register on February 26, 2002 in Part 201 of the Code of Federal Regulations (CFR). The planning team used FEMA's *Local Mitigation Planning Handbook* (released March 2013) for reference as they completed the Plan.

Although each participating jurisdiction had already developed a plan in the past, the combination of the four plans into one regional plan still required the making of some plan update revisions. Since all sections of the regional plan are technically new, plan update requirements do not apply. However, since this is the first regional mitigation plan amongst the participating jurisdictions, key elements from the previous approved plans are referenced throughout the document (e.g., existing mitigation 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 and any data that was standardized across the regional planning area. It was also necessary to formulate a single set of goals for the region along with a special set of regional mitigation actions. The *Capability Assessment* (Section 5) includes updated information for all of the participating jurisdictions and the *Mitigation Action Plan* section (Section 7) provides implementation status updates for all of the actions identified in the previous plans.

The process used to prepare this Plan included six major steps that were completed over the course of approximately six months beginning in July 2013. Each of these planning steps (illustrated in **Figure 2.1**) resulted in critical work products and outcomes that collectively make up the Plan.

Figure 2.1: Mitigation Planning Process for the Unifour Region

2.4 Unifour Hazard Mitigation Planning Committee

In order to guide the development of this Plan, the Unifour counties (Alexander County, Burke County, Caldwell County, and Catawba County) created the Unifour Hazard Mitigation Planning Committee (HMPC). This committee represented a community based planning team made up of representatives from various county departments and municipalities and other key stakeholders identified to serve as critical partners in the planning process. In addition, several members of the Western Piedmont Council of Governments (WPCOG) actively participated in the planning process and allowed the HMPC to use their facilities and other resources throughout the duration of the project.

Beginning in July 2013, the planning committee 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, committee members routinely communicated and were kept informed through an email distribution list.

Specifically, the tasks assigned to the Unifour Hazard Mitigation Planning Committee included:

- Participate in hazard mitigation planning committee meetings and workshops (described in more detail in subsection 2.5);
- Provide best available data as required for the *Risk Assessment* portion of the Plan;
- Complete the *Local Capability Assessment Survey* and provide copies of any mitigation or hazard-related documents for review and incorporation into the Plan;
- Support the development of the *Mitigation Strategy* portion of the Plan, including the design and adoption of a regional vision statement, regional mitigation goal statements, and regional mitigation actions;
- Review the existing mitigation actions from each county's previous plan, provide an update on those previously adopted mitigation actions, and propose new mitigation actions for their department/agency for incorporation into the new regional Plan;
- Review and provide timely comments on all study findings and draft plan deliverables; and
- Support the adoption of the Unifour Regional Hazard Mitigation Plan.

Table 2.1 lists the members of the HMPC who were responsible for participating in the development of the Plan. Committee members are generally listed by jurisdiction in Table 2.1 for ease of organizing and presenting the information but it should be noted that the committee worked extremely well as one regional unit thinking beyond traditional jurisdictional boundaries to focus on the mitigation planning issues and tasks at hand. It is also important to note that some planners affiliated with the WPCOG represented multiple jurisdictions.

Table 2.1: Members of the Unifour Regional Hazard Mitigation Planning Committee

Jurisdiction or Agency	Representative	Department, Title, or Role
ALEXANDER COUNTY		
Alexander County	Russell Greene (County Lead)	Emergency Services Director
	Seth Harris	Planner
Town of Taylorsville	Jon Pilkenton	WPCOG Planner
BURKE COUNTY		
Burke County	Michael Long (County Lead)	Emergency Management Director
	Scott Carpenter	Planning Director
	Brock Hall	Community Development
	Ashley Simmons	Health Department Preparedness Coordinator
Town of Connelly Springs	Tamara Brooks	Town Clerk
Town of Drexel	Sherri Bradshaw	Town Manager
Town of Glen Alpine	Jerry Causby	Fire Chief
Town of Hildebran	Jon Pilkenton	WPCOG Planner
City of Morganton	Lee Anderson	Director of Development and Design Services
Town of Rutherford College	Elinor Hiltz	WPCOG Planner
	Johnny Wear	WPCOG Planner
Town of Valdese	Charles Watts	Fire Chief/Emergency Management
	Laurie LoCicero	WPCOG Planner
CALDWELL COUNTY		
Caldwell County	Kenneth Teague (County Lead)	Emergency Management Director
	Chase Keller	Emergency Management Intern
	Jami Bentley	Health Department
Town of Cajah's Mountain	Connie South	Town Manager
Village of Cedar Rock	Jon Pilkenton	WPCOG Planner
Town of Gamewell	Jon Pilkenton	WPCOG Planner
Town of Granite Falls	Greg Wilson	Planner
Town of Hudson	Jon Pilkenton	WPCOG Planner
City of Lenoir	Jenny Wheelock	Planning Director
	Craig Adams	Code Enforcement Officer
	Jared Wright	Stormwater Administrator
Town of Rhodhiss	Barbara Harmon	Town Manager
	Jimmy Drum	Deputy Chief
Town of Sawmills	Elinor Hiltz	WPCOG Planner
	Johnny Wear	WPCOG Planner
CATAWBA COUNTY		
Catawba County	Mary George (County Co-Lead)	Assistant Planning Director
	Karyn Yaussy (County Co-Lead)	Emergency Management Coordinator
Town of Brookford	Marshall Eckerd	Town Manager
Town of Catawba	Shelley Stevens	WPCOG Planner
City of Claremont	Laurie LoCicero	WPCOG Planner
City of Conover	Lance Hight	Planning Director

Jurisdiction or Agency	Representative	Department, Title, or Role
City of Hickory	Cal Overby	Principal Planner
	Steve Moore	Deputy Fire Chief
Town of Long View	Charles Mullis	Planner
	Eric Shepherd	Fire Chief
Town of Maiden	Travis Ramsey	Planner
City of Newton	Alex Fulbright	Assistant Planning Director
OTHER STAKEHOLDERS		
American Red Cross	Charles Avery	Regional Disaster Program Manager
	Mike Townsend	Regional Disaster Program Specialist
Caldwell County Schools	Jeff Church	Assistant Superintendent
Caldwell Memorial Hospital	Kimberly Edmisten	Representative
Catawba Valley Medical Center	Mike Helton	Emergency Management Coordinator
Duke Energy	George Galleher	Hydro Operations Engineer
	Robin Nicholson	District Manager
Frye Regional Medical Center	Mark Robinson	Emergency Preparedness
State of North Carolina	David Wright	NC Forest Service
Additional WPCOG Staff	John Marshall	Planning Director
	Kelly Larkins	Transportation Planner
PROJECT CONSULTANTS		
AECOM	Darrin Punchard	Project Manager
	Mike Robinson	Mitigation Planner
	William Hague	GIS Analyst

Multi-jurisdictional Participation

The Unifour Regional Hazard Mitigation Plan includes four counties and 24 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 meetings and workshops;
- Complete the *Local Capability Assessment Survey*;
- Provide an update on previously adopted mitigation actions;
- Review drafts of the Unifour Regional Hazard Mitigation Plan; and
- Adopt their updated local *Mitigation Action Plan*.

Each jurisdiction participated in the planning process and each jurisdiction has developed and adopted a local *Mitigation Action Plan* unique to that jurisdiction which will be updated over time per the *Plan Maintenance Procedures* described in Section 8.

2.5 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 workshops held by the HMPC during the development of the Plan. In many cases, routine discussions and additional meetings were held by local staff to accomplish planning tasks specific to their department or agency. For example, completing the *Local Capability Assessment Survey* or seeking approval of specific mitigation actions for their department or agency to undertake and include in their *Mitigation Action Plan*. Public meetings are summarized in subsection 2.6.

All of the meetings described below were held at the Western Piedmont Council of Governments (WPCOG) facility at 1880 Second Ave NW in the City of Hickory.

HMPC Meeting #1
Project Kickoff (July 9, 2013)
The Project Kickoff meeting was initiated by Mary George, Catawba County Assistant Planning Director, and was led by Darrin Punchard, AICP (AECOM Project Manager), and Mike Robinson, CFM (AECOM Lead Planner). This meeting consisted of a detailed overview of the project, a review and discussion of the four previous county level mitigation plans, an explanation of the process to be followed for updating and integrating the content from the four previous county plans, an open discussion session, and an explanation of next steps.

The meeting began with a brief welcome and opportunity for each of the 39 attendees to introduce themselves to the group. Particular emphasis was placed on identifying what jurisdiction or organization each participant was there to represent, as there were representatives from the 28 participating jurisdictions, the WPCOG, other state and local stakeholders, and AECOM. As part of this recognition process, a spreadsheet was passed around for representatives to designate one "Designated Local Jurisdiction Lead" to serve as a primary point of contact for each participating jurisdiction for the duration of the project.

The project overview consisted of an explanation of the purpose of the planning process and the concept of creating a regional hazard mitigation plan to build upon and essentially replace the four previous county level mitigation plans. It also covered the geographic scope of the project, the proposed schedule for the project, and a detailed breakdown of the key project tasks. The roles and responsibilities for AECOM, Catawba County as the lead local agency, and for all participating jurisdictions were also covered. These roles and responsibilities were presented as follows:

- AECOM
    - Oversee, manage, and document the completion of all key project tasks
    - Monthly progress reports

- Catawba County
    - Serving as lead coordinating agency
    - Designation of local project manager

    - Assistance with the collection of documents, data, and other information
    - Logistics for project meetings
    - Hosting and managing project website
    - Responding to general questions or inquiries from the public or stakeholders
    - Coordinating with participating jurisdictions

- All participating jurisdictions
    - Designate local jurisdiction lead
    - Attend Hazard Mitigation Planning Committee meetings
    - Coordination between counties, municipalities, and local stakeholders
    - Data collection and information sharing
    - Mitigation strategy development (*Mitigation Action Plans*)
    - Assist with public outreach
    - Review and comment on draft plan materials

The review of the four previous county level plans included a comparison of the hazards addressed in each previous county plan, the types of maps that were included in each of the previous county plans, and the structure and content of the mitigation strategy section in each previous county plan. Initial discussions were held to begin to decide how these items should be addressed in the new regional plan format.

A discussion was also facilitated to discuss ways that existing resources could be leveraged, such as existing plans, studies, and reports; existing data and information; local knowledge sharing; and other resources. Three primary planning resources were also introduced to the HMPC at this time: the *Local Mitigation Planning Handbook*, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, and *Integrating Hazard Mitigation Into Local Planning*, all recent publications from FEMA providing mitigation planning guidance.

Emphasis was also placed on the need for effective communication throughout the duration of the project. This included an overview of the planning team's organization and the idea that municipal jurisdictions would coordinate first through their Designated Local Jurisdiction Lead who would in turn coordinate with the Designated Local Jurisdiction Lead for that county, who would in turn coordinate with the overall local project leads, Mary George and Karyn Yaussy with Catawba County. Active participation and responsiveness were also stressed in light of the aggressive schedule to complete the plan in the desired timeframe.

A detailed discussion also centered on GIS data collection needs and the process to be followed for collecting and submitting the needed data (which was to follow the chain of communication described in the paragraph above). Emphasis was placed on the need for the GIS data to be submitted in a readily usable format and to be the best data readily available.

The committee was also given an overview of a Public Outreach Strategy that would be developed between HMPC Meeting #1 and HMPC Meeting #2. The goals of the Public Outreach Strategy were stated as:

- Generate public interest;
- Solicit citizen input; and
- Engage additional partners in the planning process.

Specific opportunities for public participation were identified as being two in-person open public meetings, the creation of a public project information website, a web-based public participation survey, and use of social media (Facebook, Twitter, RSS, and other various options). It was also decided that a project information fact sheet would be developed as well (see Appendix F).

During the open discussion session, the following talking points were covered by the group: potential opportunities and synergies; potential barriers or impediments; and other local issues, concerns, or ideas.

Next steps were defined as assignment of Designated Local Jurisdiction Leads (to be completed as soon as possible); data collection (to be completed by July 31, 2013); finalize Public Outreach Strategy (to be completed by July 30, 2013); prepare preliminary risk assessment decisions, analysis, and map templates (to be completed by July 30, 2013); and prepare for HMPC Meeting #2 (to be held July 30, 2013).

A copy of the agenda and sign-in sheet for this meeting are included in Appendix E.

HMPC Meeting #2
Public Outreach Strategy (July 30, 2013)
The Public Outreach Strategy meeting was initiated by Mary George, Catawba County Assistant Planning Director, and was led by Mike Robinson, CFM (AECOM Lead Planner) with assistance from William Hague (AECOM GIS Specialist). This meeting consisted of a detailed overview of the final draft Public Outreach Strategy, a hazard identification exercise, recommendations for the *Risk Assessment*, an overview of the *Local Capability Assessment Survey* and *Safe Growth Survey*, discussion of a regional vision statement and mitigation goals, an update on data collection progress, an open discussion session, and an explanation of next steps.

The meeting began with a brief welcome and opportunity for each of the 21 attendees to introduce themselves to the group. (Attendance at the July 30 meeting was lower than the first meeting because many committee members were responding to recent flash flooding in the planning area.)

A printed handout containing the final draft Public Outreach Strategy was distributed to the committee and a review of the document was provided via PowerPoint. The strategy (found in Appendix C) follows the outline presented at the first meeting in terms of goals, outreach opportunities, etc.

Additional details were provided regarding the two proposed in-person open public meetings:

- Public meetings would be scheduled at two key points during the project timeline: following completion of the draft risk and capability assessments and following completion of the draft plan;
- The primary purpose of the meetings would be to inform the public on the process and current status of the regional planning process and to gain input to the process during the drafting stage and prior to plan completion and approval; and
- AECOM would prepare presentations and handout materials to help facilitate two-way communication with public meeting attendees and would also have plotter-sized maps, videos, and other resources available for discussion with meeting attendees.

An update was also given on the public project information website proposed at the first meeting. At the time of the July 30 meeting, the website was live and already contained the final project information fact sheet; contacts, task lists, meeting slides, and handouts for the planning committee; existing plan documents; planning guidance and resources; social media integration; and project contact information. The URL for the project information website is http://www.catawbacountync.gov/emergencyServices/hazard/regionalPlan.asp.

The project information fact sheet was also presented to the group and additional opportunities were discussed for disseminating the fact sheet to the public. The fact sheet contains an overview of the regional mitigation planning effort; an explanation of the planning process including the six main planning steps of public outreach, risk assessment, capability assessment, mitigation strategy development, plan maintenance, and plan adoption; project leadership; project schedule; and contact information.

Another significant topic covered at the meeting was the online public participation survey (https://www.surveymonkey.com/s/unifourhazardsurvey).[1] At the time of the second meeting, screen mock-ups were shown to the group along with several sample questions. It was explained that the survey would go live around August 13, 2013 and would remain open until November 15, 2013. The survey was hosted by AECOM using the SurveyMonkey web hosting service. The primary purpose of the survey was to solicit input from any interested parties in the planning area. The survey also offered individuals that were unable to attend the in-person meetings the opportunity to participate in the planning process. Information from the online survey allows the project team to better understand the types of hazards that most concern the public and the mitigation actions that are of particular interest. The survey was made accessible through hyperlinks posted on the project information website and circulated via email, Facebook, newspaper articles, etc. Additionally, hard copies of the survey would be distributed at the first in-person public meeting on October 1, 2013. The feedback received was ultimately evaluated and incorporated into the HMPC's decision making process and the final plan. Bi-weekly updates on the survey results were submitted to Mary George and Karyn Yaussy as the local project managers from mid-August to mid-November and responses were reviewed periodically to check for consistency with the development of various sections of the Plan.

Attendees were asked to participate in an exercise called "Mayor for the Day" in which each committee member was given $20 in pretend currency (divided into one $10, one $5, and five $1's). Committee members were then asked to "spend" their limited funds on mitigation actions designed to address the natural hazards of most concern to them. The natural hazards were represented by a row of cups each labeled with the name of a natural hazard likely to be addressed in the regional plan. The results of this exercise are as follows:

- Flood $167
- Tornado $58
- Erosion $50
- Winter Weather $49
- Drought/Extreme Heat $31
- Wildfire $30

[1] The online survey was closed on November 15, 2013. This hyperlink is provided for documentation and reference purposes only as the link will no longer access the survey. A complete list of questions and responses can be found in Appendix D.

- Thunderstorm $25
- Hurricane $12
- Dam/Levee Failure $9
- Landslide $5
- Lightning $3
- Hail $2
- Earthquake $0
- Nor'easter $0

The *Local Capability Assessment Survey* (found in Appendix G) was distributed to the HMPC and explained. Essentially, the *Local Capability Assessment Survey* is designed to capture indicators of local capability in the following categories: planning and regulatory capability, administrative and technical capability, fiscal capability, education and outreach capability, political capability, and self assessment. The Designated Local Jurisdiction Lead was given approximately three weeks to complete the survey and return it to Mary George with Catawba County. Results of this survey are presented in the *Capability Assessment* section (Section 5) and Appendix G.

The *Safe Growth Survey* (found in Appendix H) was distributed to the HMPC and explained. Essentially, the *Safe Growth Survey* is designed to capture indicators of safe growth policy in the following categories: comprehensive planning (land use, transportation, environmental management, and public safety), zoning ordinances, subdivision regulations, capital improvement programming and infrastructure policies, and other indicators. The Designated Local Jurisdiction Lead was given approximately three weeks to complete the survey and return it to Mary George with Catawba County. Results of this survey were taken into account by members of the HMPC as they reviewed, revised, and crafted their 2014 *Mitigation Action Plans*.

A suggestion was made by AECOM to develop a regional vision statement to help define the new regional plan. General thoughts about a vision statement that were shared as part of the presentation included that a vision statement:

- Captures the overall purpose of the planning process;
- Expresses the outcome that the participating jurisdictions seek to accomplish as the plan is implemented;
- Helps drive the planning process;
- Unites the planning team around a common purpose;
- Provides a foundation for the rest of the planning process; and
- Communicates the reason for the plan to stakeholders, elected officials, and the public.

The first draft of the vision statement shared with the HMPC was:

"Through a cohesive regional planning effort, create and implement an effective hazard mitigation plan that will identify and reduce risk to natural hazards in order to protect the health, safety, quality of life, environment and economy of the Unifour area."

Based on discussion and input from the HMPC, a final draft vision statement was developed as shown in the *Introduction* section. This final draft vision statement is as follows:

"Through a coordinated regional planning effort, create and implement an effective hazard mitigation plan that will identify and prioritize risk reduction measures for natural hazards in order to protect the health, safety, quality of life, environment, and economy of the Unifour area."

A discussion also followed on mitigation goal development. A matrix was presented to the group comparing the types of mitigation strategy outlines used in the counties' four previous hazard mitigation plans, highlighting similarities and differences in the four plans. For example, some county plans had extra layers of objectives, strategies, or implementation plans that the other county plans did not have. This was the beginning of a discussion on standardizing the counties' existing content into a new agreed upon outline for the regional plan.

An update was given on the GIS data collection effort and a reminder of the upcoming deadline was provided. Other topics covered included early drafts of sample map templates to be used for the *Risk Assessment* and a review of available planning guidance and resources.

The meeting ended with open discussion and a list of next steps, which consisted of the following: final data collection (to be completed by July 31, 2013); development of draft risk assessment results (to be completed by October 1, 2013); development of draft capability assessment results (to be completed by October 1, 2013); and scheduling of HMPC Meeting #3 (to be held in the form of a 4-hour Mitigation Strategy Workshop on October 1, 2013).

HMPC Meeting #3
Mitigation Strategy Workshop (October 1, 2013)

The Mitigation Strategy Workshop was initiated by Mary George, Catawba County Assistant Planning Director, and was led by Mike Robinson, CFM (AECOM Lead Planner) with assistance from William Hague (AECOM GIS Specialist). This meeting consisted of a detailed overview of the draft risk assessment and draft capability assessment results, an update on public outreach, discussion of the regional vision statement, an exercise to formulate regional mitigation goals and regional mitigation actions, and an explanation of next steps.

The meeting began with a brief welcome and opportunity for each of the 23 attendees to introduce themselves to the group.

The meeting continued with an overview of the draft risk assessment findings. The hazards addressed included: flood; erosion; dam/levee failure; drought/extreme heat; thunderstorm, lightning, and hail; tornado; winter weather; hurricane and tropical storm; landslide; earthquake; sinkhole; and wildfire. For each hazard the following information was shared: hazard maps, tables of at-risk buildings and infrastructure, and historical hazard occurrences. Complete inventories and maps were shown for demographic data, parcels and buildings, critical facilities, infrastructure elements, high potential loss properties, and historic properties. The technical information shared during this portion of the presentation is too extensive to share in this section. Copies of the PowerPoint slides are available in Appendix E and the final results of the risk assessment are shown in the *Risk Assessment* section (Section 4).

The next portion of the presentation consisted of an overview of the draft capability assessment findings. Participation from the *Local Capability Assessment Survey* was 100% (28 out of 28 surveys returned). The results centered on findings in the areas of planning and regulatory capability, administrative and technical capability, fiscal capability, education and outreach capability, political capability, and a community self assessment. The point system and overall capability assessment

score for the Region were presented to the group along with a ranking of local capability by jurisdiction. All of this information is presented in its final form in the *Capability Assessment* section (Section 5).

An update on the Public Participation Survey was also provided just prior to a working lunch being served. At the time of the meeting, 160 online surveys had been started and preliminary notes and indications from these surveys were presented to the group. In general, the input being provided by the public was consistent and in-line with the discussions and decisions being made by the HMPC. A reminder was also issued that the first public meeting would be held that evening (October 1, 2013) at the WPCOG facility where the workshop was currently being held.

HMPC Meeting #4
Presentation of Draft Mitigation Plan (December 10, 2013)
The Presentation of Draft Mitigation Plan meeting was initiated by Mary George, Catawba County Assistant Planning Director, and was led by Mike Robinson, CFM (AECOM Lead Planner) and Darrin Punchard, AICP (AECOM Project Manager). This meeting consisted of a high-level walkthrough of the working draft Hazard Mitigation Plan including all of its sections, instructions for the committee's review and comment period, results of the public participation survey, an interactive Mitigation Action Plan exercise, discussion of plan maintenance procedures, an open discussion session, and an explanation of next steps. In addition, a special presentation was made by the Oxford Elementary School titled *Nature's Fury*. This presentation consisted of ideas and recommendations from the school children on a traffic warning device and system for flooded roads.

The portion of the presentation covering a walkthrough of the working draft plan document consisted of an overview of the plan's organization (i.e., table of contents), a brief status update on each section, an explanation of the review and comment process, suggested areas of focus for the committee members, availability of the review files on the project information website, and instructions for submitting review comments by Friday, December 20 if possible.

For the Mitigation Action Plan exercise, participants were asked to pair up with others from their jurisdiction and/or county, to review the *Mitigation Strategy* section of the Plan including regional mitigation goals (provided as a handout), to review the 2014 mitigation actions for their jurisdiction, to review the status of the 2009 mitigation actions for their jurisdiction, make any additional changes that may be needed, and pose questions to the group about mitigation actions they were unsure of.

Some of the questions asked regarding plan maintenance procedures included the following:

- Who will be the lead agency for future mitigation planning meetings, updates, progress reports, etc.?
- What will be the schedule for any ongoing meetings of the HMPC, prior to the next 5-year plan update? (Such as annual meetings, bi-annual meetings, "as-needed" meetings, etc.)
- To what extent will you seek to integrate the regional plan with other local plans, policies and programs? (Such as comprehensive plans, land use plans, emergency operations plans, etc.)
- What other implementation strategies can you use?
- What criteria will be used for 5-year plan updates?

- What kind(s) of reporting procedures would you like to adopt?
- How will you keep the public involved?
- How will you keep stakeholders involved?

Responses and decisions based on these questions are reflected in the *Plan Maintenance Procedures* section (Section 8).

The discussion of next steps consisted of another reminder regarding the review/comment period and deadline, an explanation that the next version of the plan document would be considered a final draft based on the committee's review comments, an overview of the upcoming State and FEMA plan review process, and local adoption procedures and expectations.

2.6 Involving the Public

An important component of any mitigation planning process is 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 planning area safer from the potential effects of hazards.

Public involvement in the development of the Unifour Regional Hazard Mitigation Plan was sought using various methods including open public meetings, an interactive public information website, a project information fact sheet with contact information, a public participation survey, and by making copies of draft Plan documents available for public review on county websites and at government offices. Public meetings were held 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. These public meetings were held at a central location to the planning area to ensure that citizens from each of the four participating counties had reasonable access to the opportunity to participate in-person in the planning process. The public participation survey (discussed in greater detail in subsection 2.6.1) was made available online via the project information website, each county's website, through web links forwarded via email and newspaper articles, Facebook, Twitter, etc., and in hardcopy form at the first public meeting.

Public Meeting #1
Public Meeting #1 was held from 5 p.m. to 8 p.m. on Tuesday, October 1, 2013 at the WPCOG facility. Four "stations" were set up for members of the public to browse through with two County staff, two COG staff, and two AECOM staff to host the stations and "float" as needed. Station #1 consisted of a kiosk presenting a background video on "what is mitigation?" Station #2 consisted of a set of full color, plotter-sized maps of the planning area showing various hazard zones for discussion. Station #3 provided print copies of the Public Participation Survey for members of the public to complete that night. Station #4 consisted of a kiosk presenting a background video on flood insurance. This public meeting was attended by one member of the public and one newspaper reporter.

Public Meeting #2
Public Meeting #2 was held from 4 p.m. to 7 p.m. on Tuesday, December 10, 2013 at the WPCOG facility. Four "stations" were set up for members of the public to browse through with two County staff, two COG staff, and two AECOM staff to host the stations and "float" as needed. Station #1 consisted of a kiosk presenting a background video on "what is mitigation?" Station #2 consisted of a set of full color, plotter-sized maps of the planning area showing various hazard zones for discussion. Station #3 provided print copies of the *Mitigation Strategy* section of the Plan and *Mitigation Action Plans* for each participating jurisdiction for members of the public to review and comment on. (Printed comment forms were provided for the public to leave comments on.) Station #4 consisted of a kiosk presenting a background video on flood insurance. This public meeting was attended by three members of the public. No substantial comments were received.

2.6.1 Public Participation Survey

The Unifour Natural Hazard Mitigation Public Participation Survey was made available on August 13, 2013 and remained available until November 15, 2013 per the Public Outreach Strategy. During this time, 178 surveys were started and 148 surveys (83.1%) were completed.[2] Five additional surveys were submitted on hand-written forms and manually entered into the online system. The complete results of the survey can be found in a summary report found in Appendix D. Charts and figures are also provided in the PowerPoint file for Meeting #4 (found in Appendix E).

The following list is a high-level summary of the dominant responses obtained from the survey.

- 77.1% said they have been personally impacted by a disaster.
- When asked how concerned they are about the possibility of their community being impacted by natural hazards, the top three concerns were severe thunderstorms, severe winter storms, and flooding, in that order.
- When asked which category of community assets are the most *susceptible* to natural hazards, most respondents chose cultural and historic resources.
- When asked how *important* each type of community asset is to them, the top three answers were hospitals and medical care facilities, fire stations, and police stations, in that order.
- When asked which type(s) of mitigation actions are most important to them, most respondents said protecting critical facilities.
- When asked which category(ies) of mitigation techniques are most important to them, most respondents said actions relating to emergency services.
- 63.5% of respondents said that the best way for them to receive information related to natural hazards and hazard mitigation is via the Internet.
- 91.9% said they are interested in making their home or neighborhood more hazard resistant.
- 86.6% said their home is not located in the floodplain.

[2] It appeared that the incomplete surveys were close to being completely filled out, and that the respondents that did not "complete" the survey probably closed their browser window without clicking the final button to conclude the process. This is important to note as the 30 incomplete surveys still contributed to the process by providing valuable information even if they were technically "incomplete."

- 88.5% said they do not carry flood insurance.
- 56.2% said they have lived in the Unifour area 20+ years.
- 90.3% said they own their home.
- 90.4% live in a single-family home.

The results of the survey were presented to members of the HMPC at HMPC Meeting #4 so that public opinion could be factored into final changes and additions to each jurisdiction's *Mitigation Action Plan*.

2.7 Involving Stakeholders

The Unifour Hazard Mitigation Planning Committee included a variety of stakeholders beyond the representatives from each participating jurisdiction. These included representatives from the American Red Cross, Duke Energy, Frye Regional Medical Center (FRMC), and the State of North Carolina Forest Service. Input from additional stakeholders, including neighboring communities, was welcomed through the open public meetings and online survey. If any additional stakeholders representing other agencies and organizations participated through the Public Participation Survey, that information is unknown due to the anonymous nature of the survey.

2.8 Documentation of Plan Progress

Progress in hazard mitigation planning for the participating jurisdictions in the Unifour 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 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 Unifour Region. The actions that have been completed are documented in the Mitigation Action Plans found in Section 7.

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 5: *Capability Assessment*. The participating jurisdictions continue to demonstrate their commitment to hazard mitigation and hazard mitigation planning and have proven this by reconvening the Hazard Mitigation Planning Committee to update and combine the previous hazard mitigation plans into this new regional plan and by continuing to involve the public in the hazard mitigation planning process.

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Section 3: Planning Area Profile

This section provides a general overview of the Unifour Region which has been defined as the planning area for this Plan. 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 Unifour Region is comprised of the four counties in the Catawba Valley region of western North Carolina: Alexander County, Burke County, Caldwell County, and Catawba County. The Unifour Region is the same as the "Hickory-Lenoir-Morganton Metropolitan Statistical Area" as defined by the U.S. Census Bureau. A map profiling the planning area is shown in **Figure 3.1**.

Table 3.1 shows total land and water area for the four counties and for the Unifour Region as a whole.

Table 3.1: Total Land and Water Area for the Unifour Region

County	Total Land Area (In Square Miles)	Total Water Area (In Square Miles)	Total Area (In Square Miles)
Alexander	260	3	263
Burke	507	8	515
Caldwell	472	3	474
Catawba	400	14	414
TOTAL UNIFOUR	**1,639**	**28**	**1,666**

Source: U.S. Census Bureau, 2010.

Alexander County's main geographic feature is the Brushy Mountains, a deeply eroded spur of the Blue Ridge Mountains to the west. They rise from 300 to 1,000 feet above the surrounding countryside, and dominate the county's northern horizon. The highest point in Alexander County is Hickory Knob with an elevation of 2,560 feet above sea level. Barrett Mountain, an isolated mountain ridge, is located in the western portion of the county. The remainder of Alexander County's terrain consists of gently rolling countryside.

The varied landscape of Burke County ranges from the Blue Ridge escarpment to the rolling plains of the western piedmont. Table Rock, a prominent peak in Burke County in the east rim of Linville Gorge, is part of the Pisgah National Forest and has been described as "the most visible symbol in the region." The county has abundant natural resources including South Mountains State Park, Pisgah National Forest and the Linville Gorge Wilderness Area, the Catawba River, the Johns River, the Henry River, Table Rock Mountain, the Blue Ridge Parkway, and the 3,000-acre expansion of the Lake James State Park. These natural resources offer excellent recreational opportunities and attract visitors from across the southeastern United States.

Figure 3.1: Planning Area Profile Map

Caldwell County is divided into three distinct geographic sections: the Blue Ridge Mountains, which dominate the northern and western parts of the county; the gently rolling Piedmont country in the middle and southern parts of the county; and the Brushy Mountains, an isolated remnant of the Blue Ridge Mountains. The Brushy Mountains run across much of Caldwell County's eastern section. Hibriten Mountain, located within the city limits of Lenoir, the county's largest city, marks the western end of the Brushy Mountain range. In the western part of the county is the Wilson Creek area.

Catawba County is located in the foothills of the Blue Ridge Mountains. It is located in the region referred to as the Upper Piedmont Plateau, more commonly known as the "foothills." The elevation of the county averages 995 feet with a range from a high of 1,780 feet at Bakers Mountain in the west-central portion of the county to a low of 705 feet where the Catawba River leaves the county. The county's landscape can be described as "rolling" with fairly broad ridges and some short steep slopes. Geologically, Catawba County lies within the Inner Piedmont Belt comprised mostly of metamorphic and intrusive rocks. About 45.5% of the county's acreage is wooded, of which 98% is privately owned.

The Catawba River, which is influential to all four counties in the planning area, begins in the Blue Ridge Mountains and flows 225 miles into Lake Wateree in South Carolina. The river is an extraordinary eco-system that provides habitat for 50 fish species, 160 bird species, and 120 tree species. The river also serves as a source of electric power, provides recreational opportunities for residents and tourists, and is one of the major economic foundations of the region. It transects Burke County, creates the southern borders of Caldwell and Alexander counties, and the northern and eastern borders of Catawba County.

3.2 Population and Demographics

Catawba County has the largest population of the four participating counties and the City of Hickory is the largest city located within the planning area. Several participating jurisdictions experienced a decrease in population between 2000 and 2010. The Town of Catawba experienced the largest percentage decrease of -15.75% (from a 2000 population of 698 to a 2010 population of 603). The Town of Rhodhiss experienced the largest percentage increase with an increase of 65.79% (from a 2000 population of 366 to a 2010 population of 1,070). Population counts from the U.S. Census Bureau for 1990, 2000, and 2010 for each of the participating counties and jurisdictions are presented in **Table 3.2**.

Table 3.2: Population Counts for Participating Jurisdictions

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Alexander County (Unincorporated Area)	**25,457**	**31,804**	**35,100**	**9.39%**
Taylorsville	2,087	1,799	2,098	14.25%
Subtotal Alexander	*27,544*	*33,603*	*37,198*	*9.66%*
Burke County (Unincorporated Area)	**49,109**	**59,746**	**59,578**	**-0.28%**
Connelly Springs	1,389	1,814	1,669	-8.69%
Drexel	1,760	1,938	1,858	-4.31%
Glen Alpine	1,060	1,090	1,517	28.15%
Hildebran	1,363	1,472	2,023	27.24%
Morganton	15,875	17,310	16,918	-2.32%

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	% Change 2000-2010
Valdese	4,002	4,485	4,490	0.11%
Rutherford College	1,186	1,293	1,341	3.58%
Subtotal Burke	*75,744*	*89,148*	*90,912*	*1.94%*
Caldwell County (Unincorporated Area)	**36,172**	**41,003**	**43,501**	**5.74%**
Cajah's Mountain	2,540	2,683	2,823	4.96%
Cedar Rock	280	315	300	-5.00%
Gamewell	3,431	3,644	4,051	10.05%
Granite Falls	3,904	4,612	4,722	2.33%
Hudson	3,094	3,078	3,776	18.49%
Lenoir	16,278	16,793	18,228	7.87%
Rhodhiss	321	366	1,070	65.79%
Sawmills	4,689	4,921	5,240	6.09%
Subtotal Caldwell	*70,709*	*77,415*	*83,029*	*6.76%*
Catawba County (Unincorporated Area)	**62,571**	**75,145**	**83,533**	**10.04%**
Brookford	431	434	382	-13.61%
Catawba	580	698	603	-15.75%
Claremont	1,037	1,060	1,352	21.60%
Conover	5,564	6,667	8,165	18.35%
Hickory	29,474	37,222	40,010	6.97%
Long View	4,365	4,722	4,871	3.06%
Maiden	3,191	3,177	3,310	4.02%
Newton	11,199	12,560	12,968	3.15%
Subtotal Catawba	*118,412*	*141,685*	*154,358*	*8.21%*
TOTAL UNIFOUR	**292,409**	**341,851**	**365,497**	**6.47%**

Source: U.S. Census Bureau.

Based on the 2010 Census, the median age for residents of the participating counties ranges from 39 to 41 years. The racial characteristics of the participating counties are presented in **Table 3.3**. Generally, whites make up the vast majority of the population of the Region, accounting for almost 89% percent of the Region's population.

Table 3.3: Demographics of Participating Counties

County	White Persons	Black Persons	Other Race	Persons of Hispanic Origin*
Alexander	91.6%	5.7%	2.7%	4.3%
Burke	86.7%	6.8%	6.5%	5.7%
Caldwell	92.2%	5.1%	2.7%	4.8%
Catawba	85.3%	8.7%	6.0%	8.5%

Source: U.S. Census Bureau, 2010.
**Hispanics may be of any race, so also are included in applicable race categories.*

3.3 Housing, Infrastructure, and Land Use

3.3.1 Housing

According to the U.S. Census Bureau, there are 163,144 housing units in the Unifour Region, most of which are single family homes (according to the 2010 census). Housing information for the four participating counties is presented in **Table 3.4**. As shown in the table, Catawba County has the highest number of housing units compared to the other counties. Alexander County has the least. In terms of median home value, Catawba County has the highest and Caldwell County has the lowest.

Table 3.4: Housing Characteristics

County	Housing Units (2011)	Median Home Value (2007-2011)
Alexander	16,341	$121,400
Burke	41,040	$110,500
Caldwell	37,841	$106,800
Catawba	67,922	$129,000
TOTAL/AVERAGE UNIFOUR	**163,144**	**$116,925**

Source: U.S. Census Bureau, 2010.

3.3.2 Infrastructure

Major roads in the planning area include I-40, US 64, US 70, US 221, US 321, NC 10, NC 16, NC 18, NC 90, NC 114, NC 126, NC 127, NC 150, NC 181, and NC 268. Hickory Regional Airport is the primary commercial aviation airport in the region. It was served by commercial airlines until 2005.

National protected areas in the planning area include Blue Ridge Parkway and Pisgah National Forest.

Colleges and universities in the planning area include Appalachian Center at Hickory, Appalachian Center at Lenoir, Appalachian Center at Morganton, Catawba Valley Community College Alexander Campus, Catawba Valley Community College in Hickory, Gardner-Webb University Hickory Center, Lenoir-Rhyne University in Hickory, N.C. Center for Engineering Technologies, and Western Piedmont Community College in Morganton.

3.3.3 Land Use

Current land use in Alexander County can be characterized as being mainly "residential" or "vacant." Given the county's rural and agricultural history, these land use patterns are not surprising. Unlike other counties in the Unifour Region, Alexander County is the only county with a single municipality. Taylorsville, the County seat, is the center of its local government services and its low population also reflects the county's rural heritage. The vast majority of land in Alexander County is devoted to residential uses. Of the nearly 160,800 acres in the county, 96% is occupied by residential uses or is vacant and could be used for residential purposes. To state the opposite, only slightly more than 1,000 of the county's 24,300 land parcels are designated for uses other than residential, mostly industrial or commercial. In terms of future land use in Alexander County, future

policy makers should continue to think about the amount of land currently zoned residential, especially in the RA-20 Zoning District and used primarily for agriculture. These parcels represent land that could potentially be subdivided into residential uses in the coming decades. While market forces basically drive these decisions, existing data provides some indication of development pressures across the Unifour Region.

Growth and development in Burke County is predominantly located around the incorporated areas along the I-40 corridor. There is also a growing trend of second home development in the area around Lake James and the Jonas Ridge Community in the northwest portion of the county. Small area plans have been completed for the I-40 corridor and for the watershed around Lake James. In some cases, growth and development result in the alteration of natural topographic features that, in turn, affect the extent of flooding and the boundary of the floodplain.

In terms of undeveloped land in Caldwell County that could potentially be developed for allowable uses, there are approximately 149,140 undeveloped acres currently zoned as residential, 1,060 undeveloped acres zoned commercial, 1,255 undeveloped acres zoned industrial, and 51,400 undeveloped acres zoned for other land use types. This is a total of 202,855 undeveloped acres that could be developed and that could potentially be located in various hazard areas.

While Catawba County is becoming more developed and more urban in nature, it still consists of a large amount of rural and farm lands. As described in Catawba County's Farm & Food Sustainability Plan (2013), Catawba County has a cropland acreage of approximately 36,600 acres with 14,100 acres of woodland. The total "farmland" of 71,906 acres represents approximately 28 percent of the county's land area. These non-urban uses represent approximately 210 square miles; roughly half of the county. Furthermore, nearly half of the county's population is now located within incorporated areas. These numbers all seem to paint a picture of a changing county; one with a generous amount of rural, undisturbed land and at the same time one with a number of emerging centers of human activity. Catawba County has seven small area plans that were completed from 2000 to 2005 which serve as County long-range plans. All have a goal of rural preservation which came from citizen input during a series of community meetings.

3.4 Employment and Industry

The Hickory area in Catawba County is home to many leading manufacturers of furniture, fiber optic cable, and pressure-sensitive tape. It is estimated that 60% of the nation's furniture used to be produced within a 200-mile radius of the City of Hickory. Forty percent of the world's fiber optic cable is made in the Hickory area. The Hickory area is additionally known as a datacenter corridor and is home to large datacenters operated by Apple and Google. Hickory is the retail hub of the foothills and Unifour Region, and is home to the largest shopping mall in the region, Valley Hills Mall.

Section 4: Risk Assessment

This section comprises the risk assessment portion of the Unifour Regional Hazard Mitigation Plan, including identification of hazards, hazard profiling and analysis, and assessment of vulnerability. It consists of the following six subsections:

4.1 Overview

A risk assessment is performed to determine the potential impacts of hazards on the people, built and natural environments, and economy of a given planning area. The *Risk Assessment* provides the foundation for the rest of the mitigation planning process, which is focused on identifying and prioritizing actions to reduce risk to hazards. In addition to informing the *Mitigation Strategy*, the *Risk Assessment* can also be used to establish emergency preparedness and response priorities, for land use and comprehensive planning, and for decision making by elected officials, city and county departments, businesses, and organizations in the community.

A typical risk assessment consists of three primary components. Some form of hazard identification process needs to take place, followed by a detailed profiling of the hazards that will be addressed in the plan. Then the profiled hazards are assessed to determine the vulnerability of the planning area to each hazard being addressed. It is also important to document key details regarding the methodologies and assumptions used to perform the risk assessment, the asset inventories used to perform the risk assessment, and finally conclusions on hazard risk. The conclusions on hazard risk essentially consist of a prioritized ranking of hazards of concern.

4.2 Hazard Selection

The Unifour Region is vulnerable to a wide range of natural hazards that threaten life and property. Current regulations and interim guidance under the Disaster Mitigation Act of 2000 (DMA 2000) require, at a minimum, an evaluation of a full range of natural hazards.[1]

Upon a thorough review of the full range of natural hazards covered in the existing mitigation plans for the four participating counties in the Unifour area, the hazards suggested under FEMA mitigation planning guidance, and the hazards addressed in the North Carolina State Hazard Mitigation Plan, the participating jurisdictions in the Unifour Region have identified 12 hazards that are to be addressed in the Unifour Regional Hazard Mitigation Plan. These hazards were identified through an extensive process that included input from Unifour Hazard Mitigation Planning Committee (HMPC) members.

[1] An evaluation of human-caused hazards (e.g., technological hazards, terrorism, etc.) is permitted, though not required, for plan approval. The Unifour Region has chosen to focus solely on natural hazards for the purposes of this plan, except where technological hazards directly relate to a natural hazard (for example, a hazardous materials facility located in a mapped floodplain).

Table 4.1 lists the full range of natural hazards initially considered for inclusion in the Plan. This table includes a total of 16 individual hazards and documents the evaluation process used for determining which of the initially identified hazards were considered significant enough for 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 assessed further, 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).

Table 4.1: Documentation of the Hazard Selection Process

Natural Hazard Considered	Was this hazard considered significant/appropriate enough to be addressed in the plan at this time?	How was this determination made?	Why was this determination made?
ATMOSPHERIC HAZARDS			
Hail	Yes, grouped with the thunderstorm hazard.	By consensus of the Unifour HMPC.	The threat of property damage from hail is of sufficient concern to warrant study.
Hurricane/Tropical Storm	Yes	By consensus of the Unifour HMPC.	Despite the inland location of the planning area, hurricanes and tropical storms are of sufficient concern to warrant study.
Lightning	Yes, grouped with the thunderstorm hazard.	By consensus of the Unifour HMPC.	The threat of property damage or loss of life from lightning is of sufficient concern to warrant study.
Nor'easter	No	By consensus of the Unifour HMPC.	No nor'easters are known to have significantly impacted the planning area in recent history.
Thunderstorm	Yes	By consensus of the Unifour HMPC.	The threat of damage from thunderstorms is of sufficient concern to warrant study.
Tornado	Yes	By consensus of the Unifour HMPC.	The threat of damage and loss of life from tornadoes is of sufficient concern to warrant study.
Winter Weather	Yes	By consensus of the Unifour HMPC.	The threat of damage and loss of life from winter weather is of sufficient concern to warrant study.
HYDROLOGIC HAZARDS			
Dam/Levee Failure	Yes	By consensus of the Unifour HMPC.	The threat of damage and loss of life from the failure of a dam or levee is of sufficient concern to warrant study.

Natural Hazard Considered	Was this hazard considered significant/appropriate enough to be addressed in the plan at this time?	How was this determination made?	Why was this determination made?
Drought/Extreme Heat	Yes	By consensus of the Unifour HMPC.	The threat of damage and loss of life from the drought and extreme heat hazard is of sufficient concern to warrant study.
Erosion	Yes	By consensus of the Unifour HMPC.	The threat of damage from erosion is of sufficient concern to warrant study.
Flood	Yes	By consensus of the Unifour HMPC.	The threat of damage and loss of life from flooding is of sufficient concern to warrant study.
GEOLOGIC HAZARDS			
Earthquake	Yes	By consensus of the Unifour HMPC.	Even though the threat of damaging earthquake activity in the planning area is relatively low, the threat of damage and loss of life from earthquakes within the state is of sufficient enough concern to warrant study.
Landslide	Yes	By consensus of the Unifour HMPC.	The threat of damage and loss of life from landslides is of sufficient concern to warrant study.
Sinkholes	Yes	By consensus of the Unifour HMPC.	Due to local concerns and recent occurrences.
OTHER HAZARDS			
Climate Change	Yes, but as a sub-factor of other hazards.	By consensus of the Unifour HMPC.	Prevailing thoughts are that it is more appropriate to address climate change in light of how it can exacerbate the effects of other natural hazards rather than addressed as a hazard in and of itself.
Wildfire	Yes	By consensus of the Unifour HMPC.	The threat of damage and loss of life from wildfires is of sufficient concern to warrant study.

The final list of hazards to be presented in the Plan, as agreed upon by the HMPC, is as follows:

Hydrologic Hazards (Water Hazards)

- Flood
- Erosion
- Dam/Levee Failure
- Drought/Extreme Heat

Atmospheric Hazards (Severe Storms)

- Thunderstorm, Lightning, and Hail
- Tornado
- Winter Weather
- Hurricane and Tropical Storm

Geologic Hazards

- Landslide
- Earthquake
- Sinkhole

Other Hazards

- Wildfire

This list is repeated at the beginning of subsection 4.5.

Another consideration in the selection of the hazards to be addressed in the Plan is the history of major disaster declarations in the planning area. According to the FEMA Disaster Declarations web page, there have been 40 major disaster declarations issued in the state of North Carolina since 1954. Twelve of these declarations involved one or more of the counties included in the planning area (**Table 4.2**).

Table 4.2: Major Disaster Declarations for Alexander, Burke, Caldwell, and Catawba Counties from 1954 to 2013

Event	Declaration Date	Declaration Number	County(s) in the Planning Area Declared
Tornadoes	04/12/1974	DR-428	Burke, Caldwell
Severe Storms and Flooding	11/09/1977	DR-542	Burke, Caldwell, Catawba
Tornadoes	05/10/1989	DR-827	Catawba
Hurricane Hugo	09/25/1989	DR-844	Alexander, Burke, Caldwell, Catawba
Blizzard of '96	01/13/1996	DR-1087	Alexander, Burke, Caldwell, Catawba
Storms/Flooding	02/23/1996	DR-1103	Alexander, Burke, Caldwell, Catawba
Severe Ice Storm	12/12/2002	DR-1448	Alexander, Burke, Caldwell, Catawba
Tropical Storm Frances	09/10/2004	DR-1546	Alexander, Burke, Caldwell, Catawba
Hurricane Ivan	09/18/2004	DR-1553	Burke, Caldwell
Severe Winter Storms and Flooding	02/02/2010	DR-1871	Burke, Caldwell
Severe Storms, Flooding, Landslides, and Mudslides	09/25/2013	DR-4146	Burke, Caldwell
Severe Storms, Flooding, Landslides, and Mudslides	10/29/2013	DR-4153	Catawba

Source: Federal Emergency Management Agency.

As shown in Table 4.2, the earliest major disaster declaration to occur in the planning area was in 1974. The last were in 2013. The 12 major disaster declarations shown above cover the hazards of flood, hurricane/tropical storm, severe storms, severe winter weather, and tornado relevant to the planning area. This history of disaster declarations is consistent with the hazards identified by the HMPC to be addressed in the Plan.

4.3 Methodologies and Assumptions

Certain assumptions are inherent in any risk assessment. For the Unifour Regional Hazard Mitigation Plan, three primary assumptions were discussed by the HMPC from the beginning of the risk assessment process: (1) that the best readily available data would be used, (2) that the hazard data selected for use is reasonably accurate for mitigation planning purposes, and (3) that the risk assessment will be regional in nature with local, municipal-level data provided where appropriate and practical.

The following list provides key points by hazard type that are relevant to understanding the risk assessment presented in this section:

Flood

- Pre-FIRM[2] buildings have been selected as a subset of at-risk buildings following the assumption that structures built prior to the community joining the National Flood Insurance Program (NFIP) are likely to be at greater risk than post-FIRM buildings.
- If the NFIP entry date for a given community is between January and June, buildings constructed the same year as the entry date are considered to be post-FIRM (e.g., if the NFIP entry date is 02/01/1991, buildings constructed in 1990 and before are pre-FIRM. Buildings constructed from 1991 to the present are post-FIRM.). If the NFIP entry date is between July and December, then the following year applies for the year built cut-off (e.g., if the NFIP entry date is 12/18/2007, buildings constructed in the year 2007 and before are pre-FIRM, 2008 and newer are post-FIRM).
- Effective FEMA DFIRM data was used for the flood hazard areas. Flood zones used in the analysis consist of Zone AE (1-percent-annual-chance flood), Zone AE Floodway, and the 0.2-percent-annual-chance flood hazard area.
- Building footprints were received from all four participating counties. To refine the results, footprints with an area less than 500 square feet were excluded from the analysis. To determine if a building is in a hazard area, the building footprints were intersected with each of the mapped hazard areas. If a building intersects two or more hazard areas (such as the 1-percent-annual-chance flood zone and the 0.2-percent-annual-chance flood zone), it is counted as being in the hazard area of highest risk.
- Parcels were received from all four participating counties. The parcel data provided building value and year built. Building value was used to determine the value of buildings at risk. Year built was used to determine if the building was constructed prior to or after the community had joined the NFIP and had an effective FIRM and building codes enforced.

[2] A Flood Insurance Rate Map (FIRM) is the official map of a community on which is delineated both the special hazard areas and the risk premium zones applicable to the community.

- Census blocks and Summary File 1 from the 2010 Census were used to determine population at risk. This included the total population, as well as the vulnerable elderly and children age groups. To determine population at risk, the census blocks were intersected with the hazard area. To better determine the actual number of people at risk, the intersecting area of the census block was calculated and divided by the total area of the census block to determine a ratio of area at risk. This ratio was applied to the population of the census block. For example, a census block has a population of 400 people. Five percent of the census block intersects the 1-percent-annual-chance flood hazard area. The ratio estimates that 20 people are then at risk within the 1-percent-annual-chance flood hazard area (5% of the total population for that census block).
- Limitations: There can be multiple buildings located on one parcel. However, the parcel only provides one value for building value and year built, and it is not known from the provided data if the building value is cumulative or for the primary structure on the parcel. For the analysis, building value was only counted once per parcel, regardless of the number of structures. This was done to prevent grossly over-estimating the value of buildings at risk. For example, a parcel has three buildings with a value of $300,000. If two of those buildings intersect the 1-percent-annual-chance flood hazard area, the assumed building value at risk is $300,000 not $600,000. Even though only two out of three buildings are at risk, there is no way to determine the individual value of each building, so the building value for the whole parcel is counted. The value at risk is also the value of the entire building, and does not take into account flood damage based on elevation, number of floors, or value of contents.

Lightning

- Based on NCDC data, the number of cloud-to-ground lightning flashes was calculated for each day, month, and year as well as for the 1986-to-present period of record. Additionally, the number of flashes was calculated for each hour and summarized by month, year, and period of record. Grids were created to show only positive polarity flashes for all time periods. The summary grids are defined as a 4 km Albers Equal Area grid, fit to the continental United States. The data was re-sampled to 150-meter cells using bilinear interpolation (for cartographic purposes).
- Average annual lightning strikes are the 25-year-average of annual average lightning strikes from 1987-2012. Accuracy depends on the distribution of lightning detection sensors which is unknown.

Wildfire

- Wildfire hazard areas were determined using the Wildland Fire Susceptibility Index (WFSI).
    - Areas with a WFSI value of 0.01 – 0.05 were considered to be at moderate risk.
    - Areas with a WFSI value greater than 0.05 were considered to be at high risk.
    - Areas with a WFSI value less than 0.01 were considered to not be at risk.
- The WFSI data used for the wildfire risk analysis is a value between 0 and 1. It was developed consistent with the mathematical calculation process for determining the probability of an acre burning. The WFSI integrates the probability of an acre igniting and the expected final fire size based on the rate of spread in four weather percentile categories into a single measure of wildland fire susceptibility. Due to some necessary assumptions, mainly fuel homogeneity, it is not the true probability. But since all areas of the state have this value determined consistently, it allows for comparison and ordination of areas of the state as to the likelihood of an acre burning.

- Building footprints were received from all four participating counties. To refine the results, footprints with an area less than 500 square feet were excluded from the analysis. To determine if a building is in a hazard area, the building footprints were intersected with each of the hazard areas. If a building intersects two or more hazard areas, it is considered to be in the hazard area of highest risk.
- Parcels were received from all four participating counties. This data provided building value and year built. Building value was used to determine the value of buildings at risk.
- Census blocks and Summary File 1 from the 2010 Census were used to determine population at risk. This included the total population, as well as the vulnerable elderly and children age groups. To determine population at risk, the census blocks were intersected with the hazard area. To better determine the actual number of people at risk, the intersecting area of the census block was calculated and divided by the total area of the census block to determine a ratio of area at risk. This ratio was applied to the population of the census block. For example, a census block has a population of 400 people. Five percent of the census block intersects a high wildfire hazard area. The ratio estimates that 20 people are at risk within that hazard area (5% of the total population for that census block).
- There can be multiple buildings on one parcel. However, the parcel only provides one value for building value and year built, and it is not known from the provided data if the building value is cumulative or for the primary structure on the parcel. For the analysis, building value was only counted once per parcel, regardless of the number of structures. This was done to prevent grossly over-estimating the value of buildings at risk. For example, a parcel has three buildings with a value of $300,000. If two of those buildings intersect the high risk area, the assumed building value at risk is $300,000 not $600,000. Even though only two out of three buildings are at risk, there is no way to determine the individual value of each building, so the building value for the whole parcel is counted. The value at risk is also the value of the entire building, and does not take into account the value of contents.

Winter Weather

- Winter storm maps are an interpolation of recorded values (historical maximums and 30-year-average) derived from individual point locations.

Definitions for Descriptors Used for Probability of Future Hazard Occurrences

- Unlikely: Less than 1% annual probability
- Possible: Between 1 and 10% annual probability
- Likely: Between 10 and 100% annual probability
- Highly Likely: 100% annual probability

4.4 Inventory of Community Assets

Each participating jurisdiction assisted in the identification of assets to be used for analysis to determine what assets may be potentially at risk to the hazards covered in the Plan. These assets are defined broadly as anything that is important to the function and character of the community. For the purposes of this *Risk Assessment*, the individual types of assets include:

- Population
- Parcels and Buildings

- Critical Facilities
- Infrastructure
- High Potential Loss Properties
- Historic Properties

Although all assets may be affected by certain hazards (such as hail or tornadoes), some assets are more vulnerable because of their location (e.g., the floodplain), certain physical characteristics (e.g., slab-on-grade construction), or socioeconomic uses (e.g., major employers). The following subsections document the numbers and values used for the *Risk Assessment*.

4.4.1 Population

The population counts shown in **Table 4.3** are derived from 2010 census data and include a breakdown of two subpopulations assumed to be at greater risk to natural hazards than the "general" population: elderly (ages 65 and older) and children (under the age of 5). **Figure 4.1** shows population density per square mile, along with the distribution of potentially at-risk populations, across the planning area.

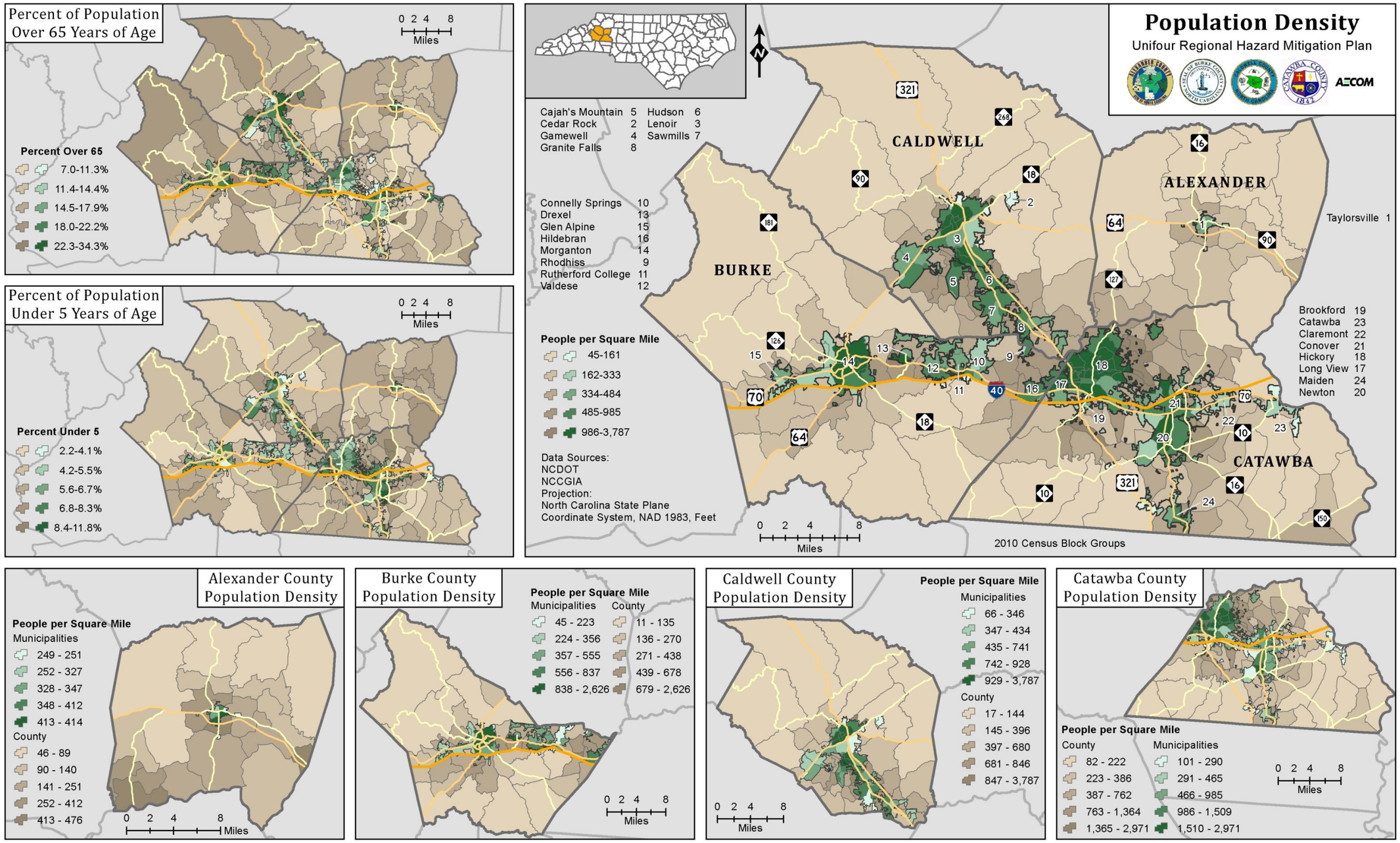
Table 4.3: Population Counts with Vulnerable Population Breakdown

Jurisdiction	2010 Census Population	Elderly (Age 65 and Over)	Children (Age 5 and Under)
Alexander County (Unincorporated Area)	**35,100**	**5,102**	**2,055**
Taylorsville	2,098	525	154
Subtotal Alexander	*37,198*	*5,627*	*2,209*
Burke County (Unincorporated Area)	**59,578**	**8,865**	**3,085**
Connelly Springs	1,669	289	86
Drexel	1,858	398	94
Glen Alpine	1,517	255	104
Hildebran	2,023	398	118
Morganton	16,918	3,079	1,150
Valdese	4,490	900	265
Rutherford College	1,341	234	78
Subtotal Burke	*90,912*	*14,673*	*5,068*
Caldwell County (Unincorporated Area)	**43,501**	**6,141**	**2,264**
Cajah's Mountain	2,823	519	184
Cedar Rock	300	93	7
Gamewell	4,051	625	215
Granite Falls	4,722	667	332
Hudson	3,776	655	204
Lenoir	18,228	3,373	1,109
Rhodhiss	1,070	149	67
Sawmills	5,240	697	302
Subtotal Caldwell	*83,029*	*12,816*	*4,645*

Jurisdiction	2010 Census Population	Elderly (Age 65 and Over)	Children (Age 5 and Under)
Catawba County (Unincorporated Area)	**83,533**	**11,124**	**4,809**
Brookford	382	72	18
Catawba	603	130	27
Claremont	1,352	196	77
Conover	8,165	1,389	563
Hickory	40,010	5,733	2,719
Long View	4,871	770	343
Maiden	3,310	456	208
Newton	12,968	2,056	955
Subtotal Catawba	*154,358*	*21,773*	*9,670*
TOTAL UNIFOUR	**365,497**	**54,889**	**21,592**

Source: U.S. Census Bureau.

Figure 4.1: Population Density in the Unifour Region



4.4.2 Parcels and Buildings

The parcel counts, building counts, and building values shown in **Table 4.4** represent the built environment inventories used for the analyses included in the *Risk Assessment*. In order to provide a more accurate reflection of buildings that contain livable space and/or commercial, industrial, or other uses, all building footprints less than 500 square feet have been eliminated from the counts and analysis.

Table 4.4: Parcel and Building Counts and Values by Jurisdiction

Jurisdiction	Parcel Count	Building Count	Building Value
Alexander County (Unincorporated Area)	**22,700**	**26,193**	**$1,347,565,360**
Taylorsville	1,276	1,324	$135,674,552
Subtotal Alexander	*23,976*	*27,517*	*$1,483,239,912*
Burke County (Unincorporated Area)	**40,817**	**32,482**	**$2,104,478,844**
Connelly Springs	1,238	859	$58,744,312
Drexel	866	766	$77,219,195
Glen Alpine	945	723	$58,307,152
Hildebran	1,069	1,056	$93,714,888
Morganton	7,818	7,265	$991,355,959
Valdese	2,806	2,071	$246,727,313
Rutherford College	796	712	$60,761,106
Subtotal Burke	*56,355*	*45,934*	*$3,691,308,769*
Caldwell County (Unincorporated Area)	**30,345**	**26,119**	**$1,593,124,250**
Cajah's Mountain	1,359	1,330	$112,893,800
Cedar Rock	230	140	$37,048,600
Gamewell	1,976	2,047	$125,991,900
Granite Falls	2,609	1,995	$269,868,250
Hudson	1,943	1,664	$244,247,500
Lenoir	10,001	8,602	$1,090,178,404
Rhodhiss	199	482	$7,519,100
Sawmills	2,443	2,607	$161,156,400
Subtotal Caldwell	*51,530*	*44,986*	*$3,662,721,835*
Catawba County (Unincorporated Area)	**51,668**	**55,194**	**$4,943,884,600**
Brookford	288	295	$15,166,700
Catawba	569	463	$50,115,900
Claremont	964	819	$193,177,000
Conover	4,383	3,945	$698,896,200
Hickory	17,953	16,241	$3,249,206,200
Long View	2,241	2,614	$175,341,400
Maiden	2,040	1,944	$210,768,400
Newton	6,473	6,358	$847,798,000
Subtotal Catawba	*87,132*	*87,873*	*$10,481,702,043*
TOTAL UNIFOUR	**218,993**	**206,310**	**$19,318,972,559**

Source: Participating jurisdictions.

4.4.3 Critical Facilities

Table 4.5 shows counts of critical facilities under a variety of categories attributed to each participating jurisdiction.

Table 4.5: Critical Facilities Counts by Jurisdiction

Jurisdiction	Day Care	EMS	EOCs	Fire Stations	Govt. Buildings	Hospitals	Law Enforce-ment	Schools	Senior Care	Shelters
Alexander County (Unincorporated Area)	**8**	**1**	**0**	**9**	**6**	**0**	**0**	**9**	**3**	**9**
Taylorsville	5	1	1	1	15	0	2	2	2	2
Subtotal Alexander	*25*	*2*	*1*	*10*	*21*	*1*	*2*	*10*	*5*	*11*
Burke County (Unincorporated Area)	**27**	**2**	**0**	**17**	**7**	**0**	**0**	**12**	**6**	**12**
Connelly Springs	-	0	0	1	-	0	***	0	0	0
Drexel	-	0	0	1	-	0	1	1	1	2
Glen Alpine	-	1	0	1	-	0	1	1	0	1
Hildebran	-	1	0	1	-	0	***	1	1	1
Morganton	-	2	1	3	-	1	4	11	5	10
Valdese	3	1	0	2	1	1	1	3	1	1
Rutherford College	-	0	0	2	-	1	***	3	0	1
Subtotal Burke	-	*7*	*1*	*27*	-	*2*	*7*	*30*	*14*	*28*
Caldwell County (Unincorporated Area)	**26**	**1**	**0**	**6**	-	**0**	**0**	**11**	**1**	**12**
Cajah's Mountain	0	1	0	1	1	0	0	0	1	0
Cedar Rock	0	0	0	0	0	0	0	0	0	0
Gamewell	7	1	0	1	1	0	0	2	0	2
Granite Falls	6	1	0	1	1	0	1	2	1	2
Hudson	5	1	0	1	1	0	2	5	0	3
Lenoir	24	1	2	3	11	1	2	6	7	7
Rhodhiss	0	0	0	2	0	0	1	0	0	0
Sawmills	6	0	0	1	1	0	0	1	0	2

Jurisdiction	Day Care	EMS	EOCs	Fire Stations	Govt. Buildings	Hospitals	Law Enforce-ment	Schools	Senior Care	Shelters
Subtotal Caldwell	*74*	*6*	*2*	*15*	*16*	*1*	*6*	*27*	*10*	*28*
Catawba County (Unincorporated Area)	**54**	**4**	**0**	**17**	**1**	**0**	**1**	**18**	**1**	**19**
Brookford	0	0	0	0	1	0	1	0	0	0
Catawba	3	1	0	1	1	0	1	1	0	1
Claremont	4	0	0	1	1	0	1	1	0	2
Conover	12	0	0	3	1	0	1	1	4	1
Hickory	39	1	1	7	1	2	1	9	8	12
Long View	5	0	0	1	1	0	1	2	0	2
Maiden	5	0	0	2	1	0	1	3	0	2
Newton	17	1	1	3	1	0	2	5	3	6
Subtotal Catawba	*139*	*7*	*1*	*31*	*9*	*2*	*9*	*40*	*16*	*45*
TOTAL UNIFOUR	**238**	**22**	**5**	**85**	**46**	**6**	**26**	**107**	**45**	**112**

Source: Numbers in black supplied by participating jurisdictions. Numbers in orange derived from alternate sources via NC OneMap.
**** A facility exists but a GPS point location for GIS analysis is not currently available.*

Figures 4.2 through **4.5** show the general locations of critical facilities across the planning area by county.

Figure 4.2: Critical Facilities Locations in Alexander County

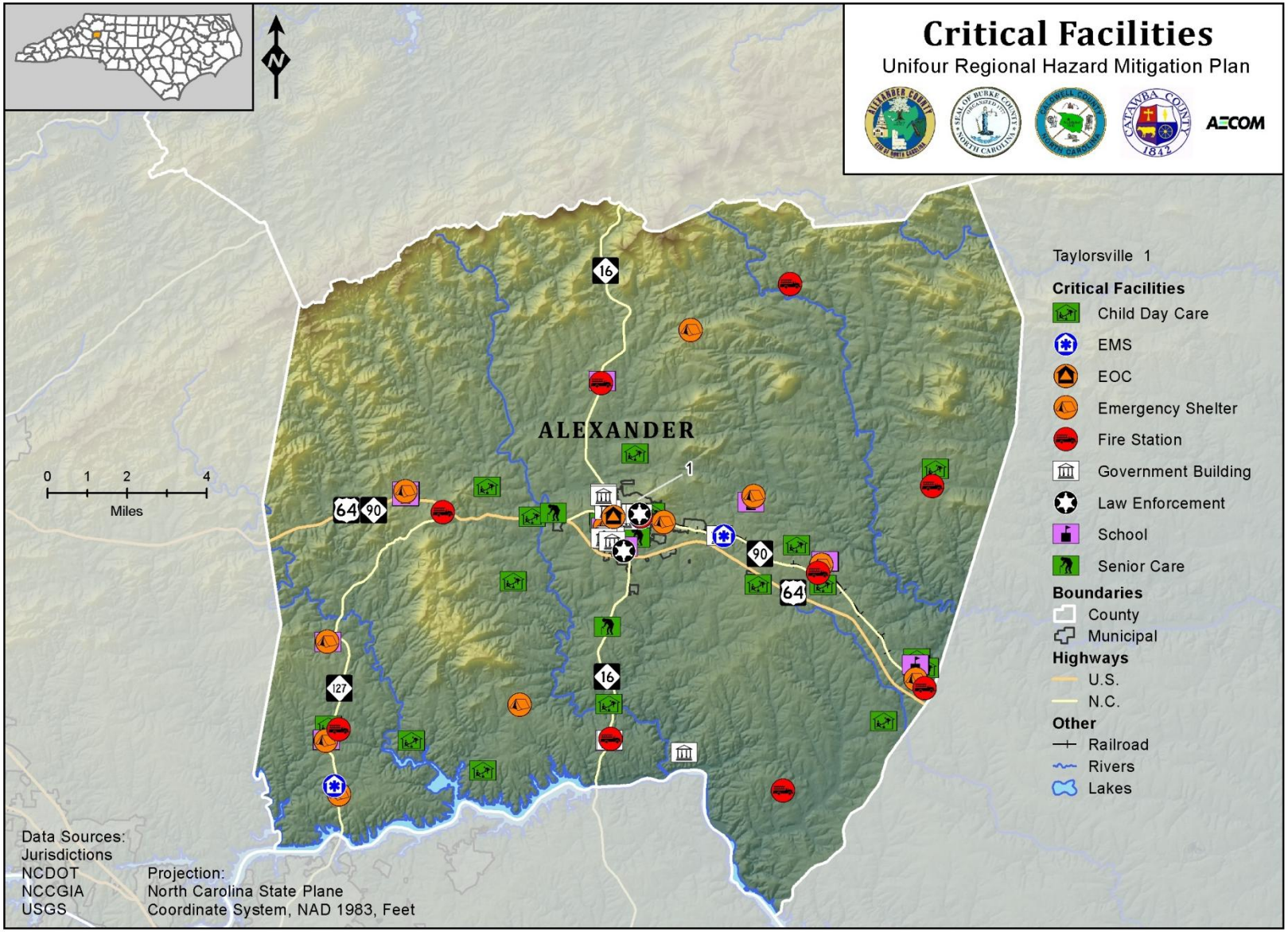


Figure 4.3: Critical Facilities Locations in Burke County

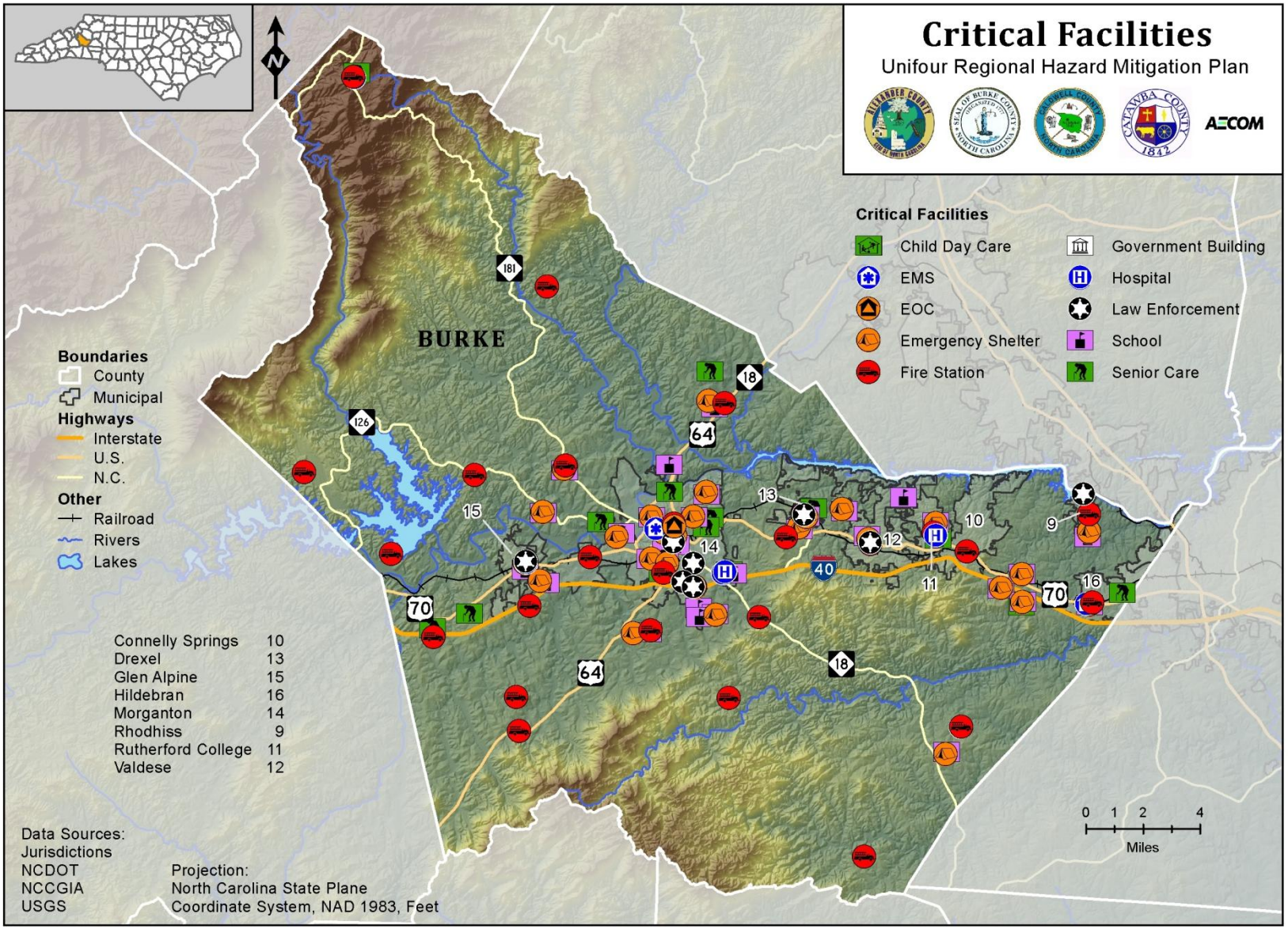


Figure 4.4: Critical Facilities Locations in Caldwell County

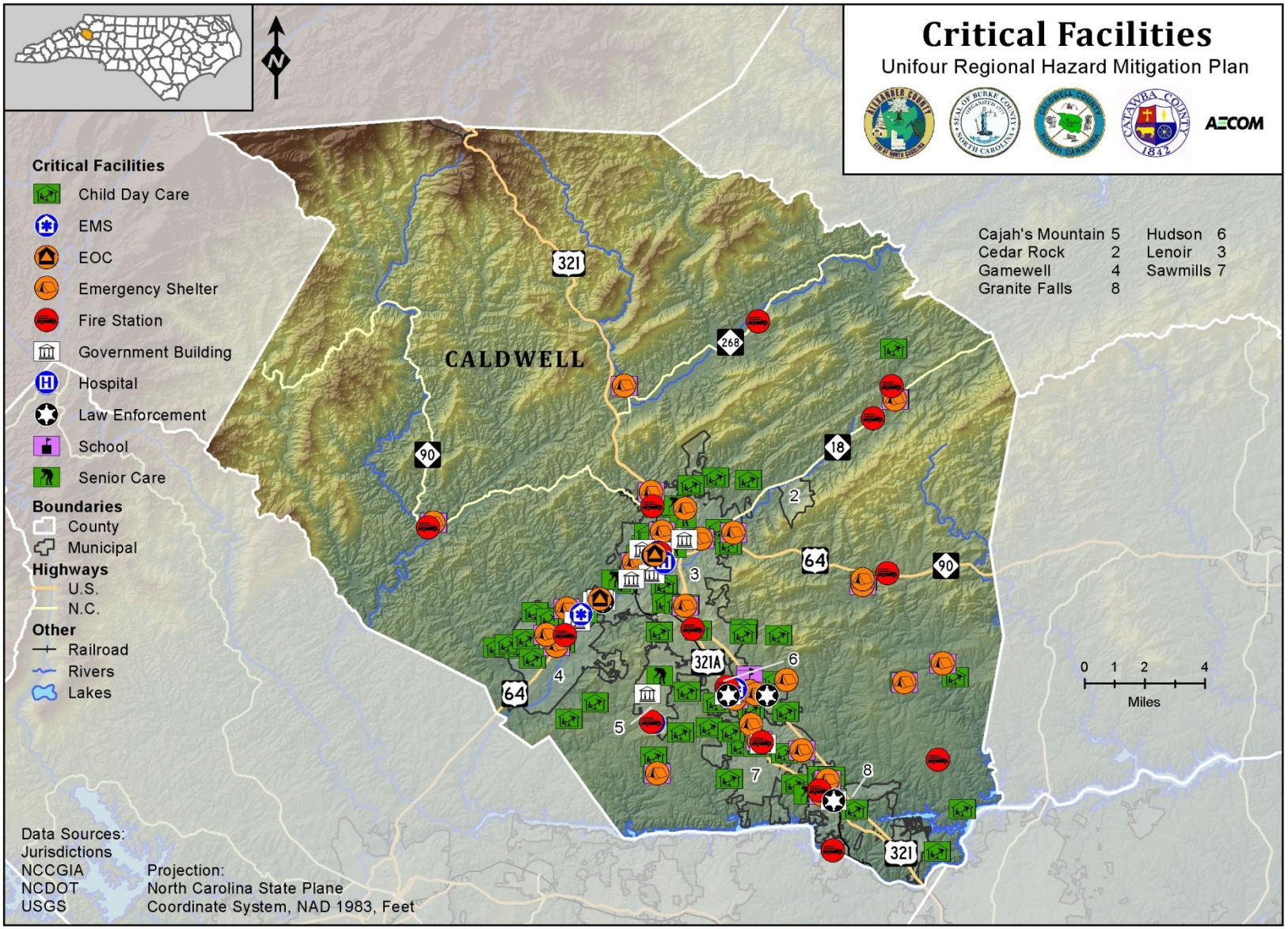
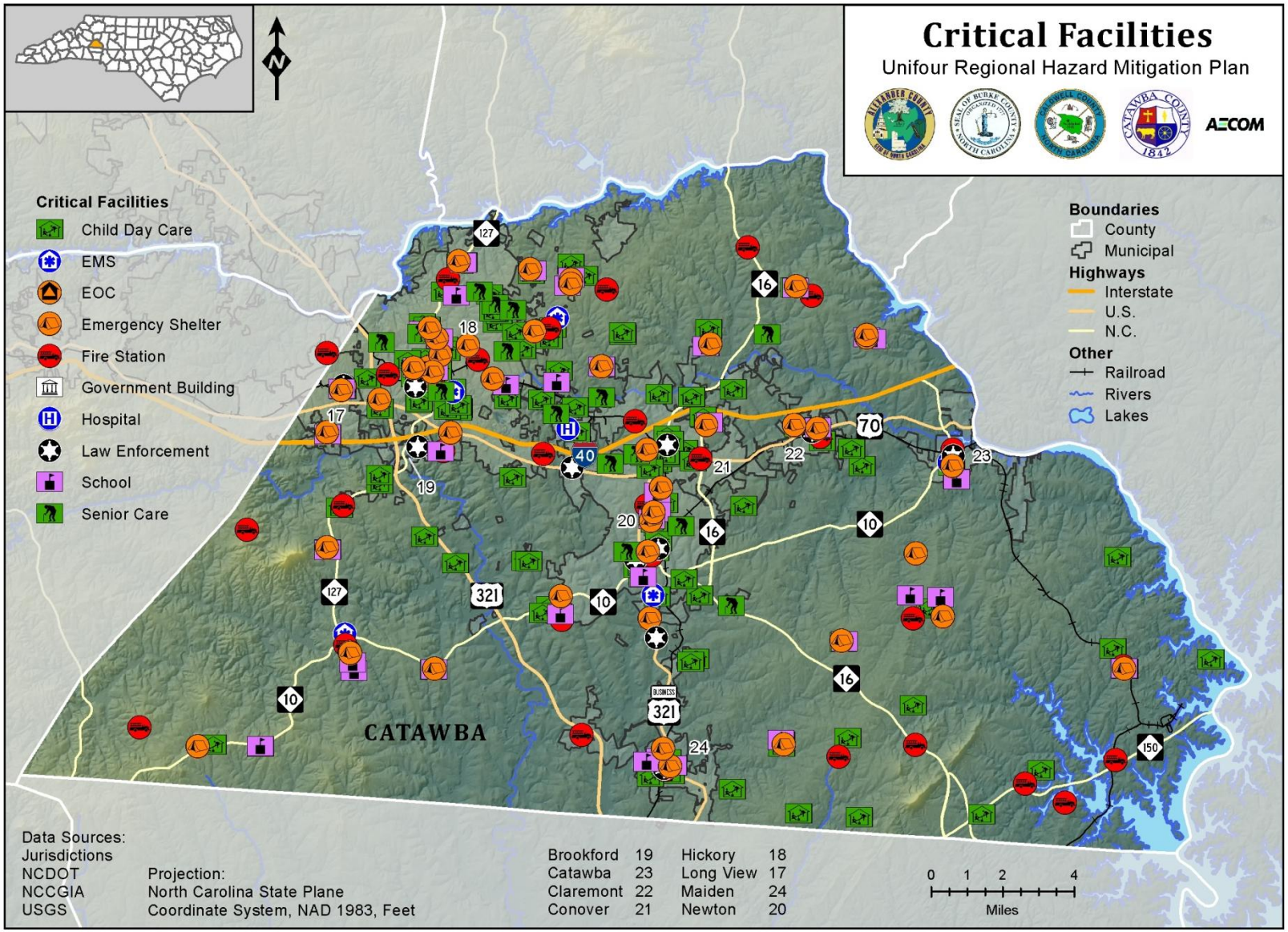


Figure 4.5: Critical Facilities Locations in Catawba County



4.4.4 Infrastructure

Certain infrastructure elements as shown in **Table 4.6** were identified for analysis. These include major roads[3], railroads, power plants, water/wastewater facilities, and water/wastewater lines.

Table 4.6: Infrastructure Counts and Measurements (in Miles) by Jurisdiction

Jurisdiction	Major Roads	Railroad[4]	Power Plants	Water/Wastewater Facilities[5]	Water/Wastewater Lines
Alexander County (Unincorporated Area)	**51.8**	**8.0**	**0**	**0**	**384.6**
Taylorsville	4.3	1.7	0	1	43.5
Subtotal Alexander	*56.1*	*9.7*	*0*	*2*	*428.1*
Burke County (Unincorporated Area)	**139.5**	**18.0**	**1**	**1**	**362.8**
Connelly Springs	2.1	1.8	0	0	8.2
Drexel	0.6	1.0	0	0	30.2
Glen Alpine	1.2	1.3	0	0	15.6
Hildebran	1.9	1.9	0	0	34.6
Morganton	31.4	7.7	0	2	307.2
Valdese	2.5	0.6	0	2	103.2
Rutherford College	3.2	2.5	0	0	21.1
Subtotal Burke	*182.4*	*34.8*	*1*	*5*	*882.9*
Caldwell County (Unincorporated Area)	**95.8**	**1.5**	**1**	**2**	**317.6**
Cajah's Mountain	0.0	0.0	0	0	31.1
Cedar Rock	0.0	0.0	0	0	6.3
Gamewell	3.2	0.0	0	0	9.8
Granite Falls	6.1	3.2	0	1	96.2
Hudson	7.5	2.5	0	0	72.9
Lenoir	21.2	12.1	0	3	337.1
Rhodhiss	0.0	0.6	0	1	8.6
Sawmills	4.4	2.4	0	0	20.1
Subtotal Caldwell	*138.2*	*22.3*	*1*	*7*	*891.3*
Catawba County (Unincorporated Area)	**119.2**	**41.3**	**2**	**-**	**-**
Brookford	1.6	0.0	0	-	-
Catawba	2.3	5.1	0	-	-
Claremont	2.6	3.9	0	-	-
Conover	17.8	9.1	0	-	-
Hickory	32.2	11.7	0	4	1,417

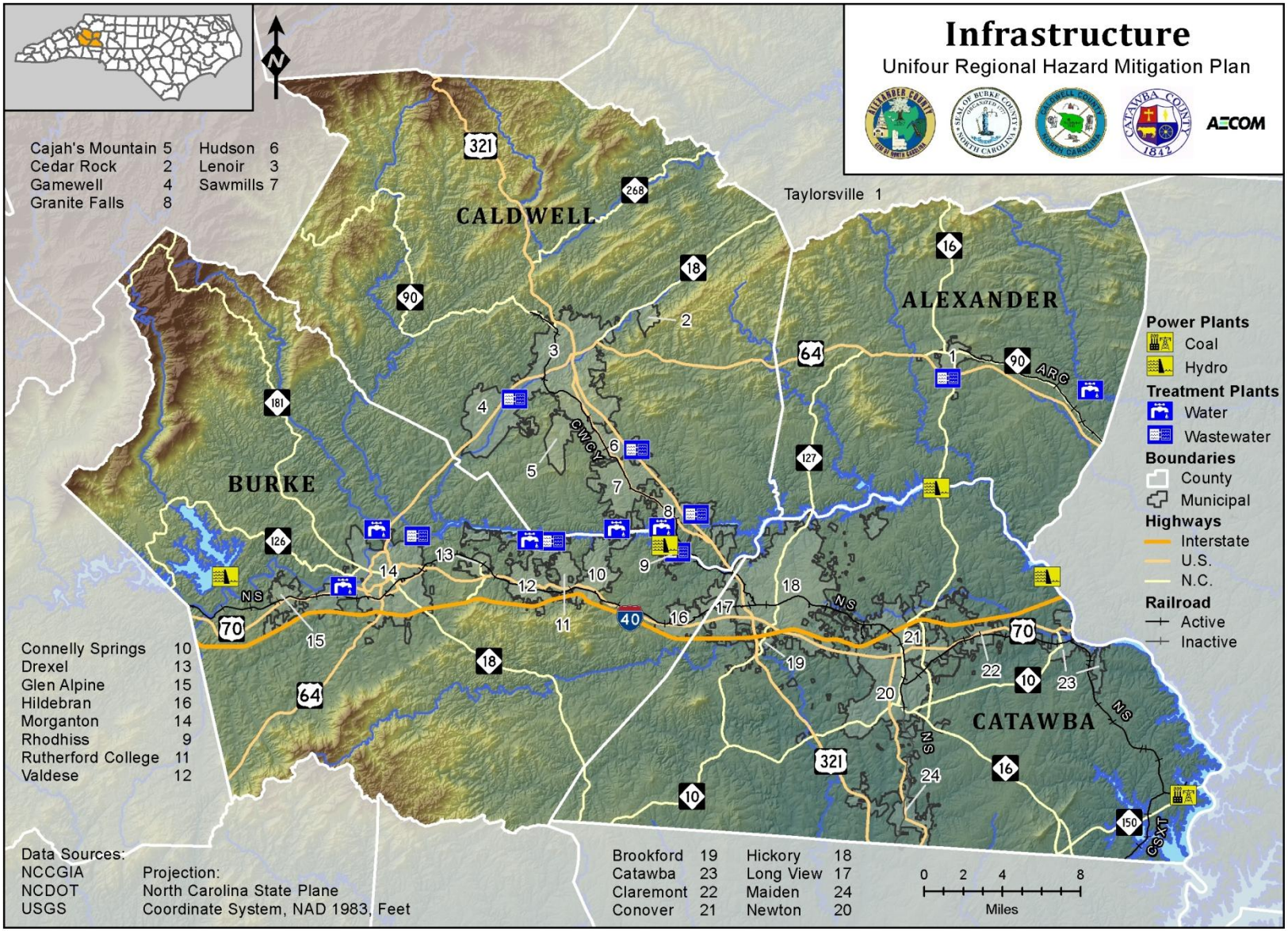
[3] The major roads and railroads accounted for in this table are the same as those depicted on the "Community Profile" map found in Section 2.
[4] Does not include inactive/abandoned railroads.
[5] Water and wastewater facilities and lines data were not made publicly available for Catawba County for the purposes of the Plan, including most of the incorporated municipalities within the county.

Jurisdiction	Major Roads	Railroad[4]	Power Plants	Water/Wastewater Facilities[5]	Water/Wastewater Lines
Long View	5.0	2.2	0	-	11.1
Maiden	6.0	0.0	0	-	-
Newton	14.6	4.9	0	-	-
Subtotal Catawba	*201.3*	*78.2*	*2*	-	-
TOTAL UNIFOUR	**578.0**	**141.8**	**4**	**-**	**-**

Source: NCDOT, USGS, participating jurisdictions.

Figure 4.6 shows the general locations of infrastructure elements across the planning area.

Figure 4.6: Infrastructure Locations



4.4.5 High Potential Loss Properties

Table 4.7 shows counts of high potential loss properties attributed to each participating jurisdiction. **Figure 4.7** shows the general locations of these properties across the planning area.

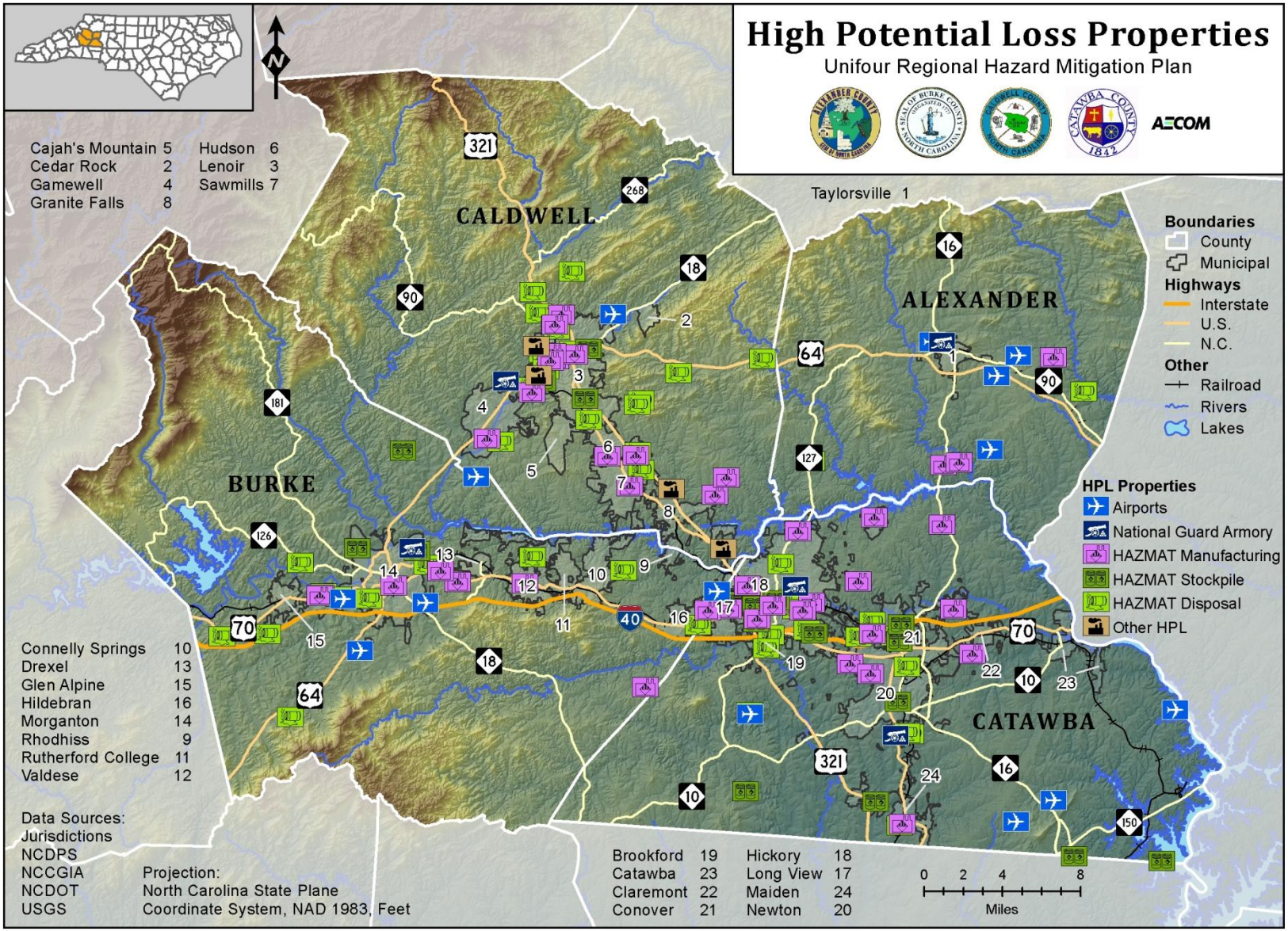
Table 4.7: High Potential Loss Properties by Jurisdiction

Jurisdiction	Airports	Dams[6]	Military Facilities	Hazardous Materials Sites	Other[7]
Alexander County (Unincorporated Area)	**4**	**42**	**1**	**6**	**-**
Taylorsville	0	1	0	0	-
Subtotal Alexander	*4*	*43*	*1*	*6*	-
Burke County (Unincorporated Area)	**2**	**37**	**0**	**9**	**-**
Connelly Springs	0	0	0	0	-
Drexel	0	0	0	0	-
Glen Alpine	0	0	0	0	-
Hildebran	0	0	0	1	-
Morganton	1	6	1	10	-
Valdese	0	0	0	2	-
Rutherford College	0	0	0	0	-
Subtotal Burke	*3*	*43*	*1*	*22*	-
Caldwell County (Unincorporated Area)	**2**	**32**	**0**	**7**	**-**
Cajah's Mountain	0	0	0	0	-
Cedar Rock	0	0	0	0	-
Gamewell	0	2	0	2	-
Granite Falls	0	1	0	0	1
Hudson	0	0	0	3	-
Lenoir	0	4	1	24	2
Rhodhiss	0	0	0	0	-
Sawmills	0	1	0	2	-
Subtotal Caldwell	*2*	*40*	*1*	*38*	*3*
Catawba County (Unincorporated Area)	**4**	**74**	**0**	**5**	**-**
Brookford	0	1	0	2	-
Catawba	0	2	0	0	-
Claremont	0	0	0	1	-
Conover	0	1	0	8	-
Hickory	1	5	1	23	1
Long View	0	0	0	3	-
Maiden	0	2	0	3	-
Newton	0	2	1	5	-
Subtotal Catawba	*5*	*87*	*2*	*50*	*1*
TOTAL UNIFOUR	**14**	**213**	**5**	**116**	**4**

Source: Local sources and NCGIA.

[6] Locations of dams are provided in the dam failure section and are not shown on the following map.
[7] This category consists of a variety of facilities specified by participating jurisdictions.

Figure 4.7: Locations of High Potential Loss Properties



4.4.6 Historic Properties

Historic property counts including districts, buildings, and other cultural resources as shown in **Table 4.8** were derived from a combination of sources consisting of the National Register of Historic Places (National Park Service) and participating jurisdictions.

Table 4.8: Historic Property Counts by Jurisdiction

Jurisdiction	Districts	Buildings	Other
Alexander County (Unincorporated Area)	**0**	**1**	**0**
Taylorsville	0	0	0
Subtotal Alexander	*0*	*1*	*0*
Burke County (Unincorporated Area)	**0**	**8**	**1**
Connelly Springs	0	0	0
Drexel	0	0	0
Glen Alpine	0	0	0
Hildebran	0	0	0
Morganton	9	25	1
Valdese	0	2	0
Rutherford College	0	0	0
Subtotal Burke	*9*	*35*	*2*
Caldwell County (Unincorporated Area)	**2**	**7**	**0**
Cajah's Mountain	0	0	0
Cedar Rock	0	0	0
Gamewell	0	0	0
Granite Falls	0	1	0
Hudson	0	0	0
Lenoir	1	44	0
Rhodhiss	0	0	0
Sawmills	0	0	0
Subtotal Caldwell	*3*	*52*	*0*
Catawba County (Unincorporated Area)	**6**	**21**	**1**
Brookford	0	0	0
Catawba	1	0	0
Claremont	0	0	0
Conover	1	1	1
Hickory	7*	467**	0
Long View	0	1	0
Maiden	0	2	0
Newton	3	7	0
Subtotal Catawba	*18*	*499*	*2*
TOTAL UNIFOUR	**30**	**587**	**4**

Source: Jurisdictions and National Register of Historic Places.
**GIS data is only currently available for 5 of the 7 districts in the City of Hickory.*
***GIS data is only available for 15 of the 320 nationally recognized structures and the 147 locally recognized structures (467 total) in the City of Hickory. Many of these buildings are assumed to be within the 7 districts.*

4.5 Hazard Profiles, Analysis, and Vulnerability

As stated in subsection 4.2, the following hazards are addressed in this *Risk Assessment* and are presented in the following order in the subsections to follow:

Hydrologic Hazards (Water Hazards)
- Flood
- Erosion
- Dam/Levee Failure
- Drought/Extreme Heat

Atmospheric Hazards (Severe Storms)
- Thunderstorm, Lightning, and Hail
- Tornado
- Winter Weather
- Hurricane and Tropical Storm

Geologic Hazards
- Landslide
- Earthquake
- Sinkhole

Other Hazards
- Wildfire

4.5.1 Hydrologic Hazards (Water Hazards)

Hydrologic hazards are essentially "water-based" hazards that include flood, erosion, dam/levee failure, and drought/extreme heat. It is important to note that some hydrologic hazards result from the activity of atmospheric hazards, such as thunderstorms producing large amounts of rain, etc.

4.5.1.1 Flood

Flood Hazard Description

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

Riverine flooding is generally the result of excessive precipitation. 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. Riverine floods can be long-term events that may last for several days.

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 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 intervals, and floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will be inundated by the 10-year flood and the 100-year floodplain by the 100-year flood. 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-annual-chance of occurring in any given year. The 500-year flood has a 0.2-percent-annual-chance of occurring in any given year.

Flood Hazard Analysis

There are numerous rivers and streams flowing through the planning area. When heavy or prolonged rainfall events occur, these rivers and streams are susceptible to some degree of flooding. There have been a number of past flooding events throughout the planning area, ranging widely in terms of location, magnitude, and impact. The most frequent flooding events have been localized in nature, resulting from heavy rains in a short period of time over urbanized areas that are not able to adequately handle stormwater runoff. These events typically do not threaten lives or property and do not result in emergency or disaster declarations, therefore historical data is limited to the larger, most notable events.

Location Within the Planning Area

Figures 4.8 through **4.36** show the boundaries of the floodway, 1-percent-annual-chance and 0.2-percent-annual-chance floods, based on effective DFIRM data as of August 2013. These are the three mapped flood hazard areas used as the basis for this analysis.

Extent (Magnitude and Severity)

This regional hazard analysis focuses on the three flood hazard extents shown in Figures 4.8 through 4.36: the floodway, the 1-percent-annual-chance flood (100-year return period) and the 0.2-percent-annual-chance flood (500-year return period).

Historical Occurrences

The following historical occurrences ranging from 1993 to the present have been identified based on the National Climatic Data Center (NCDC) Storm Events database (**Table 4.9**). It should be noted that only those historical occurrences listed in the NCDC database are shown here and that other, unrecorded or unreported events may have occurred within the planning area during this timeframe.

Figure 4.8: Flood Hazard Areas in the Unifour Region

Figure 4.9: Flood Hazard Areas in Alexander County

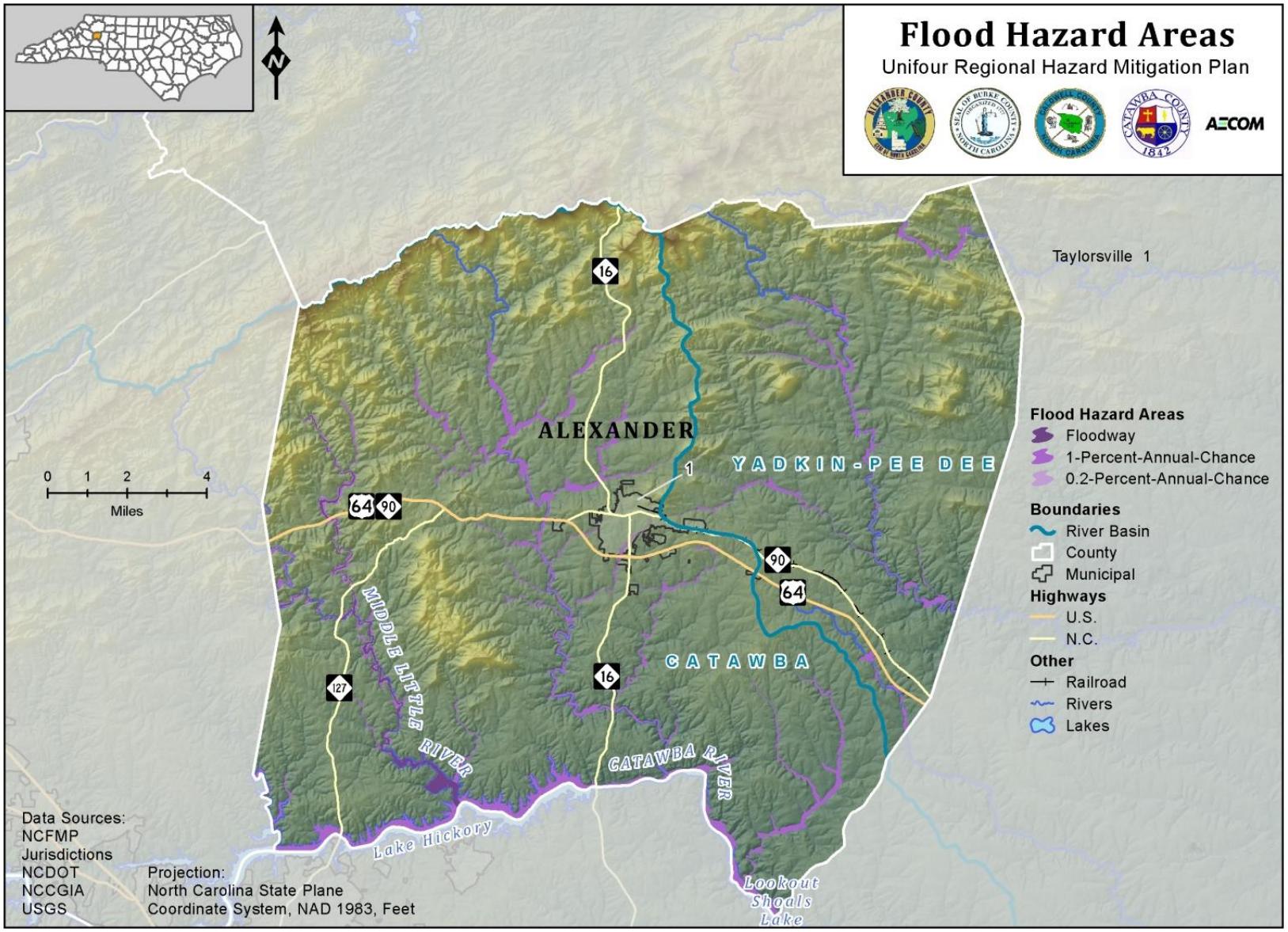


Figure 4.10: Flood Hazard Areas in the Town of Taylorsville

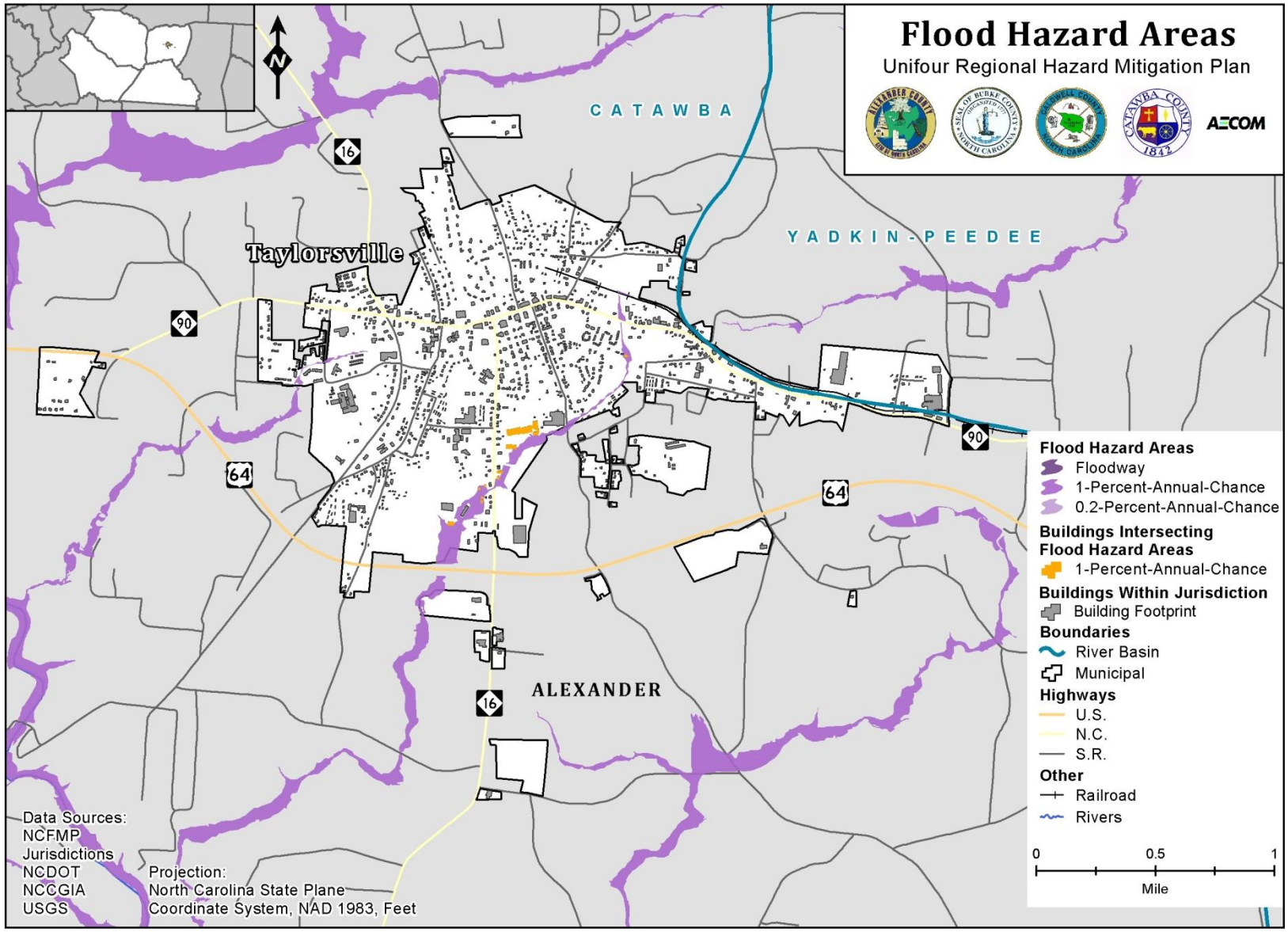


Figure 4.11: Flood Hazard Areas in Burke County

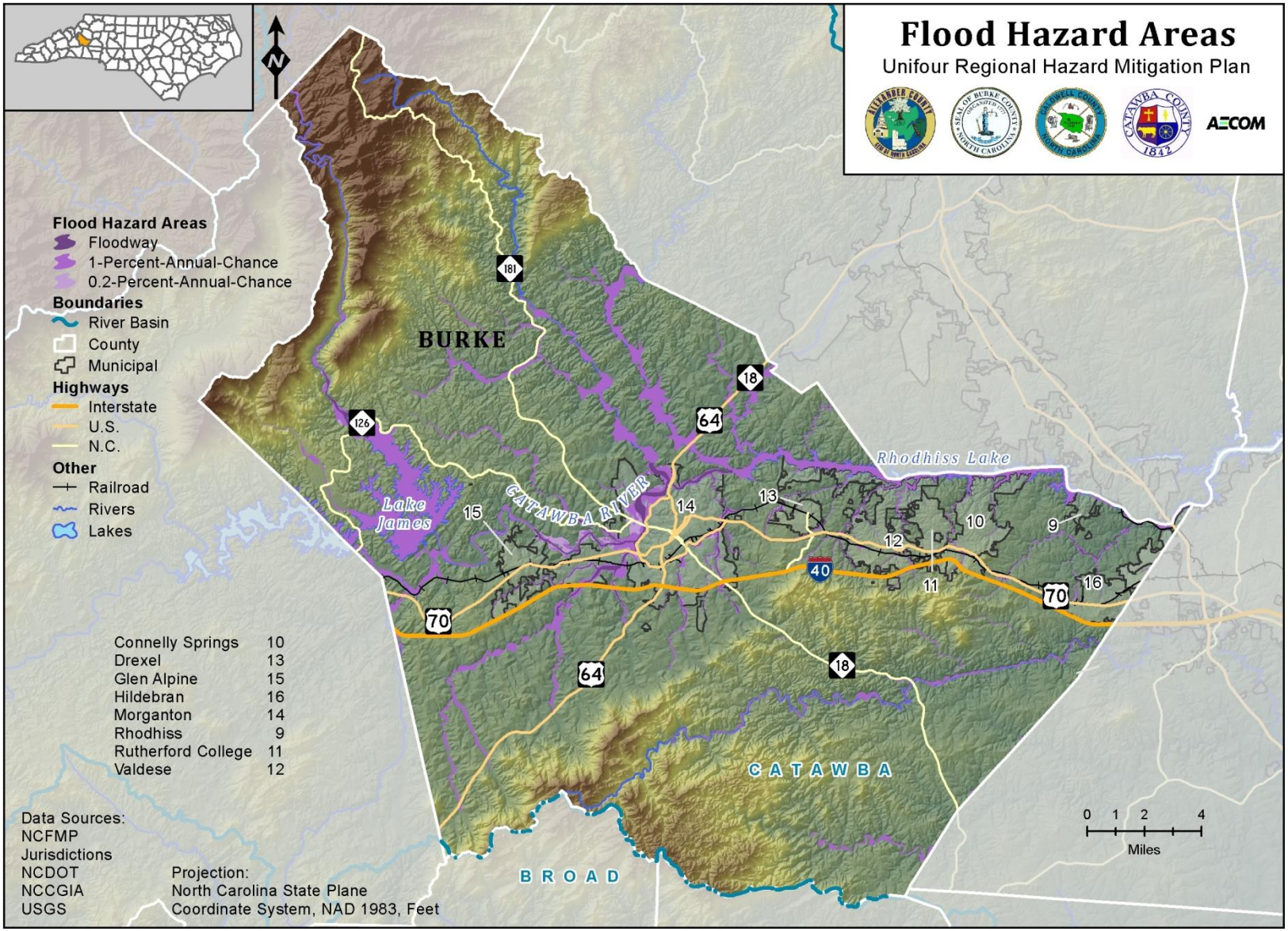


Figure 4.12: Flood Hazard Areas in the Town of Connelly Springs

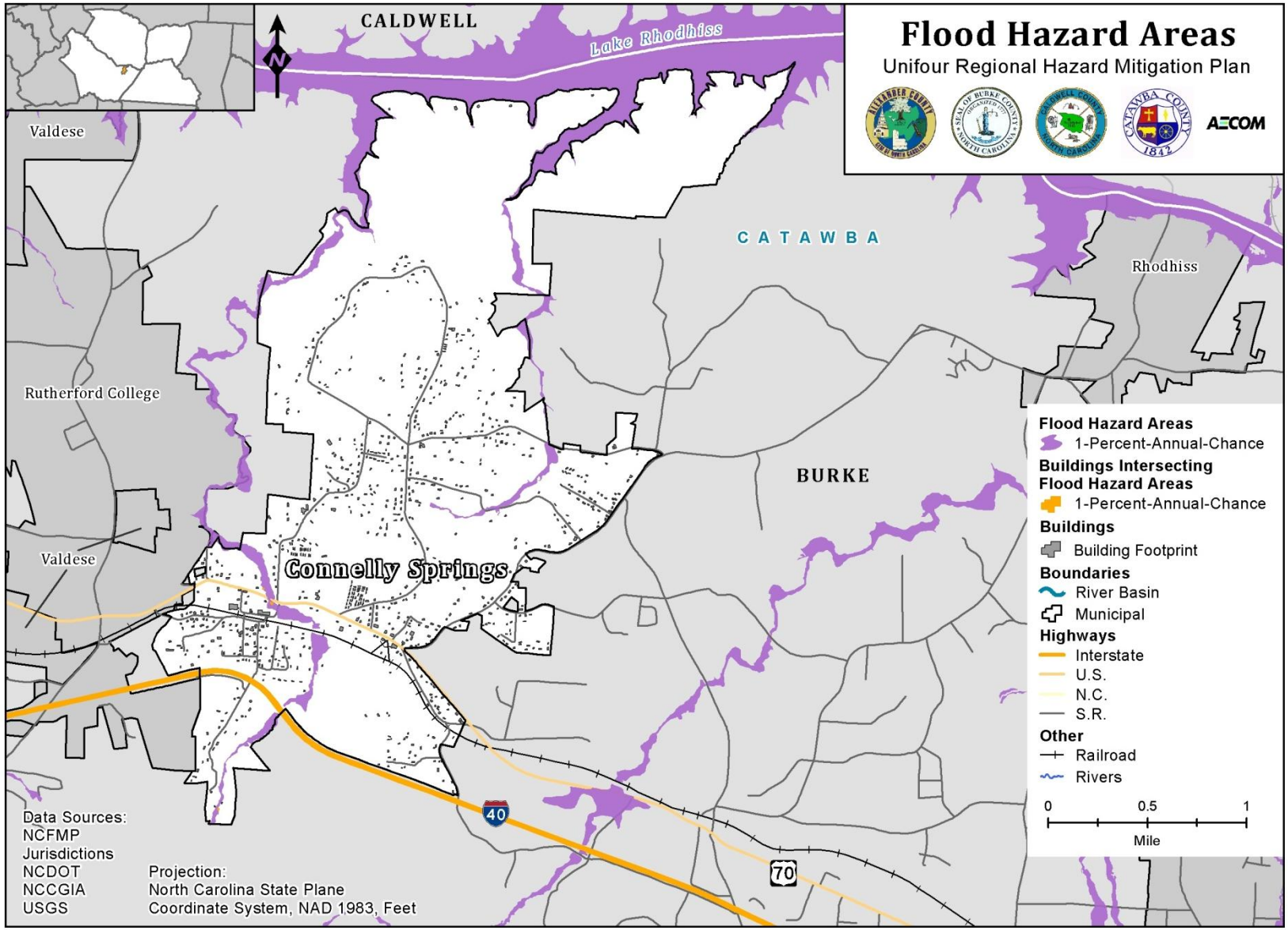


Figure 4.13: Flood Hazard Areas in the Town of Drexel

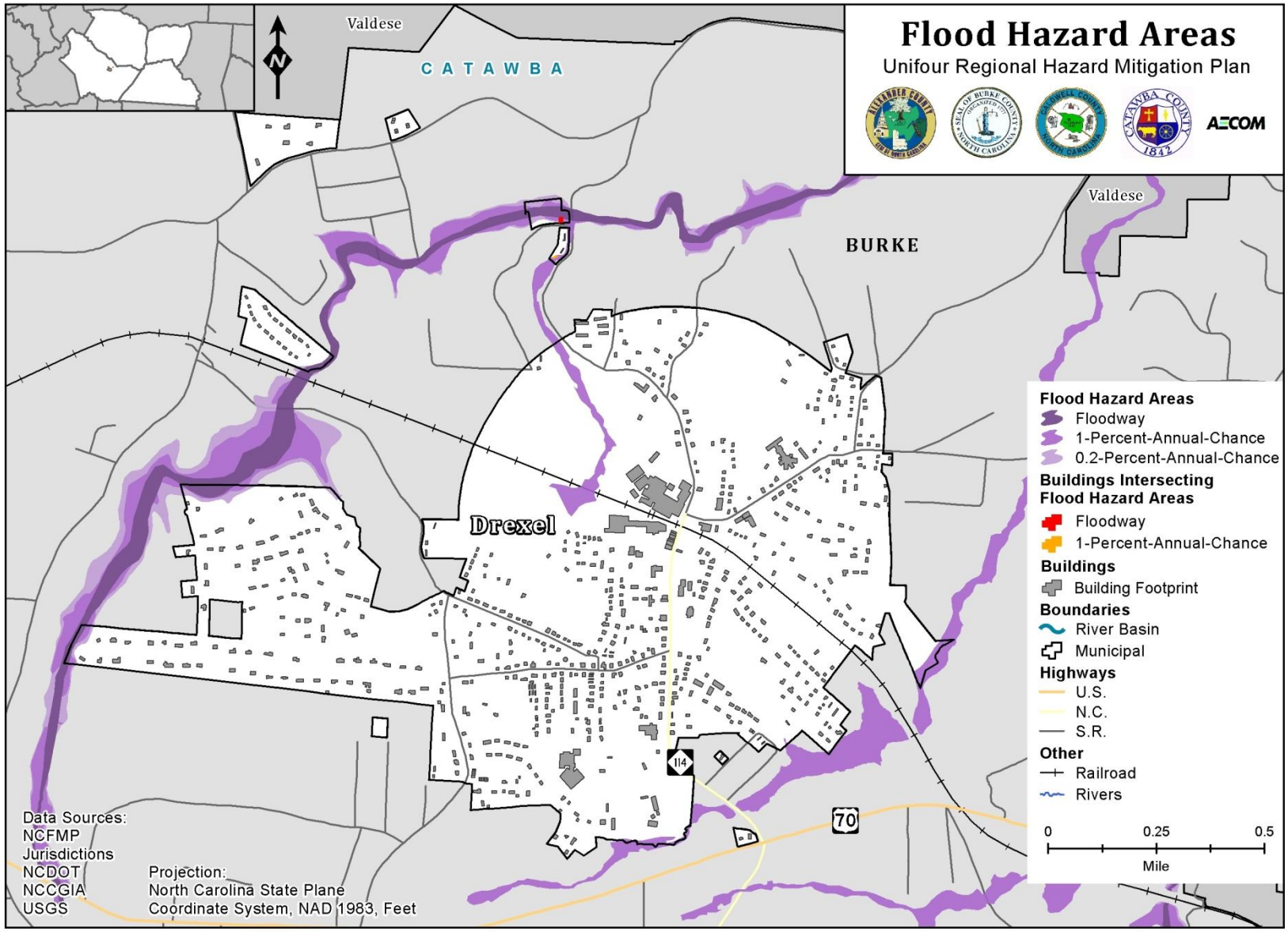


Figure 4.14: Flood Hazard Areas in the Town of Glen Alpine

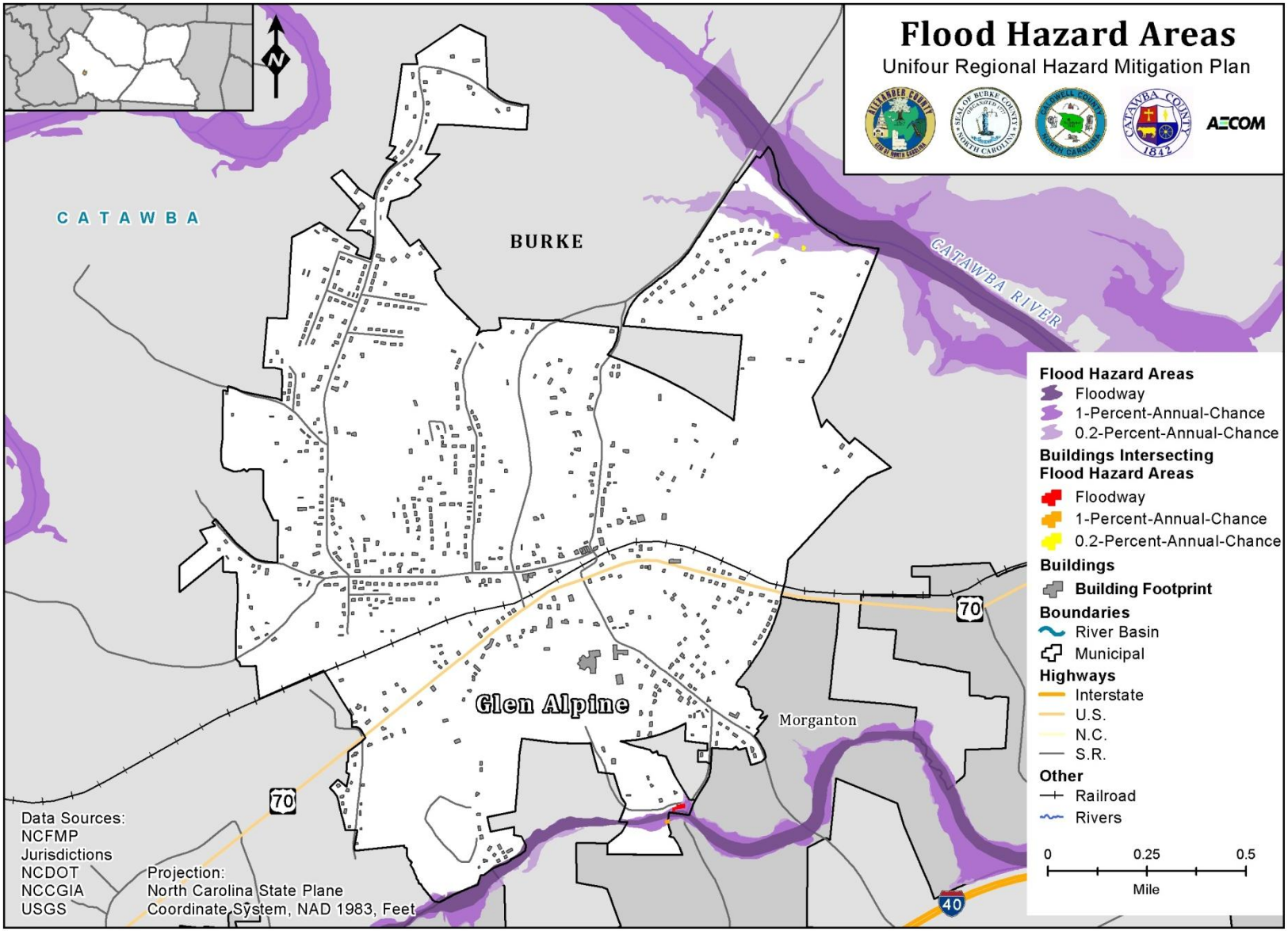


Figure 4.15: Flood Hazard Areas in the Town of Hildebran

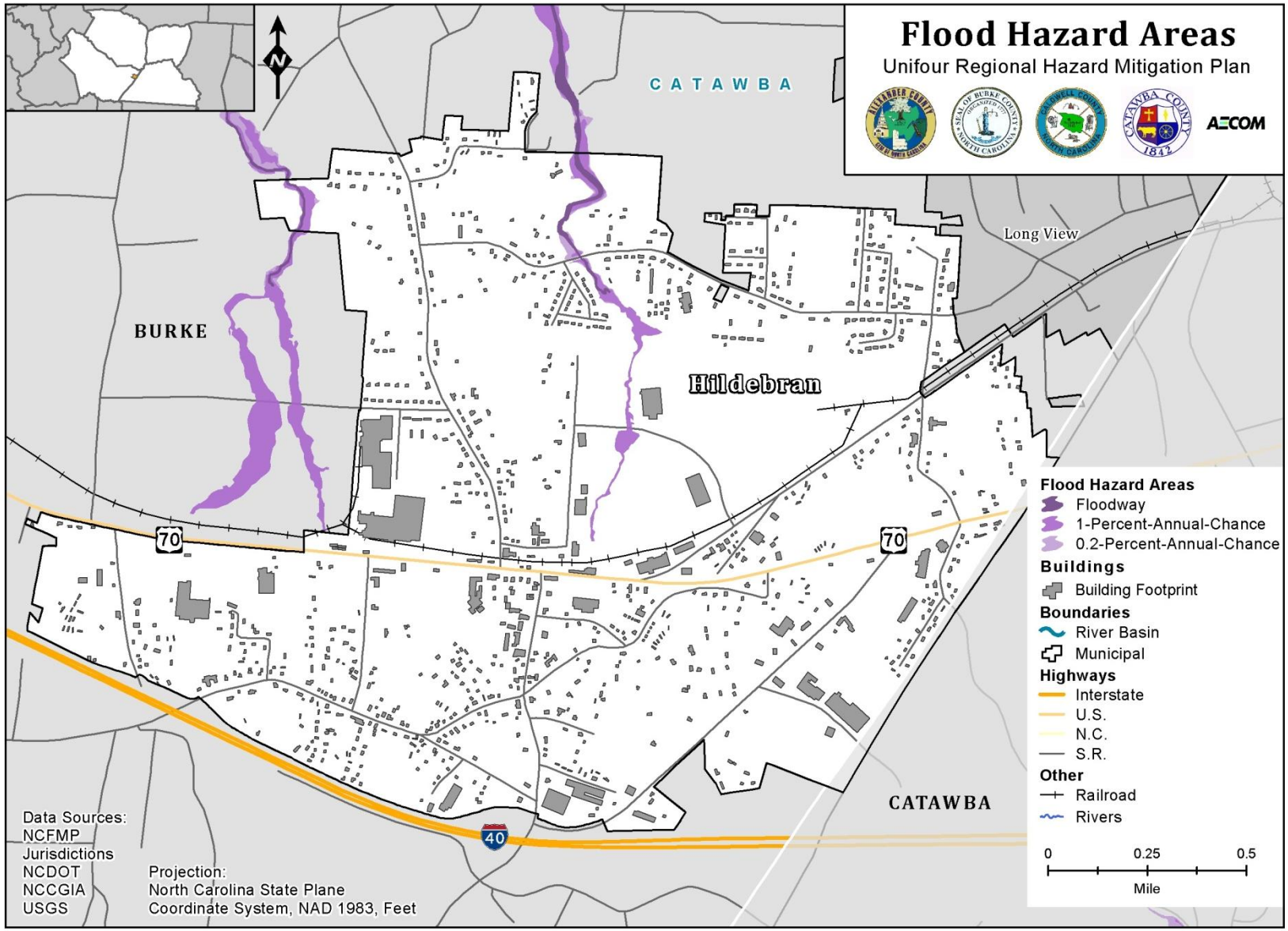


Figure 4.16: Flood Hazard Areas in the City of Morganton

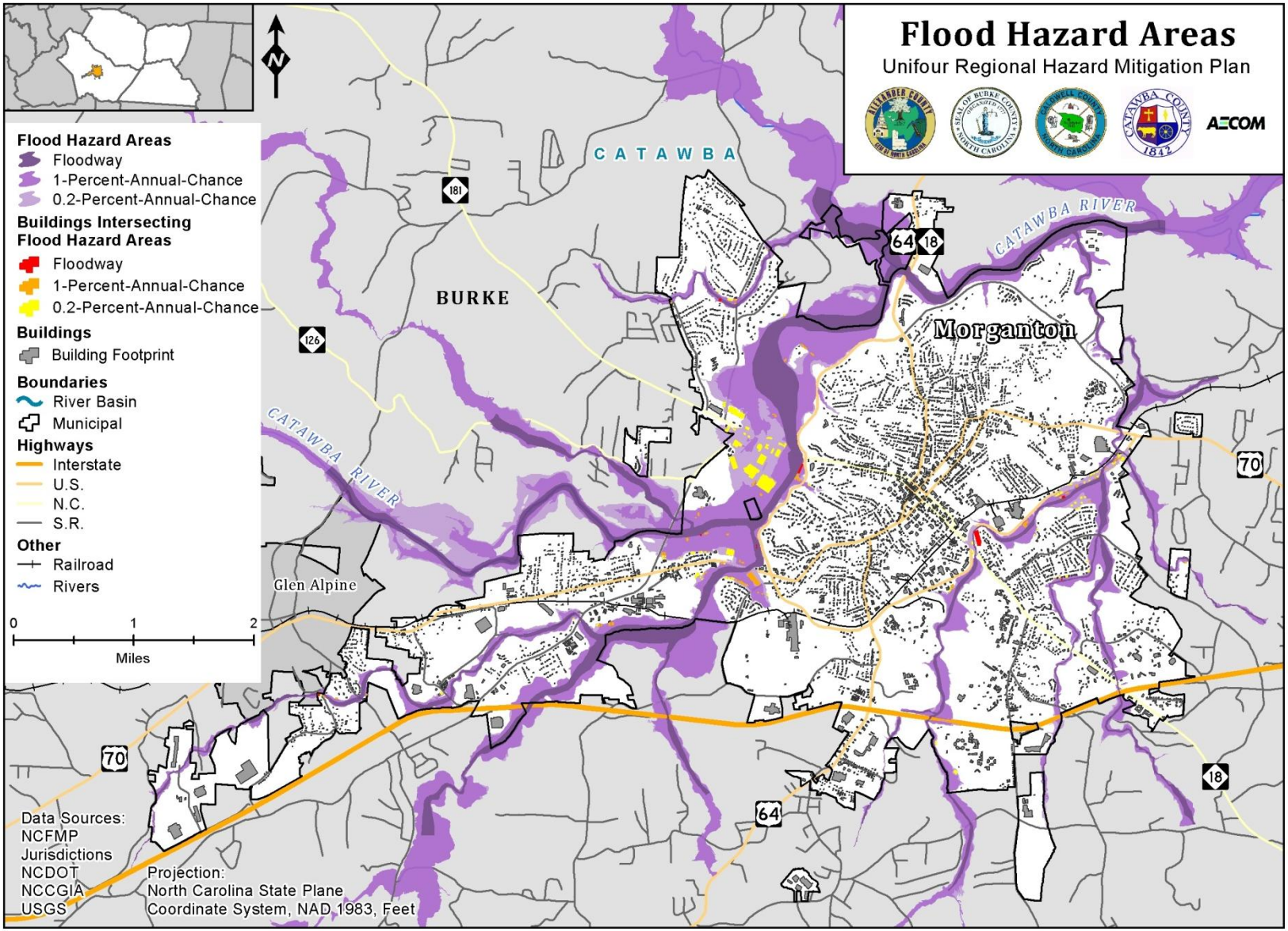


Figure 4.17: Flood Hazard Areas in the Town of Valdese

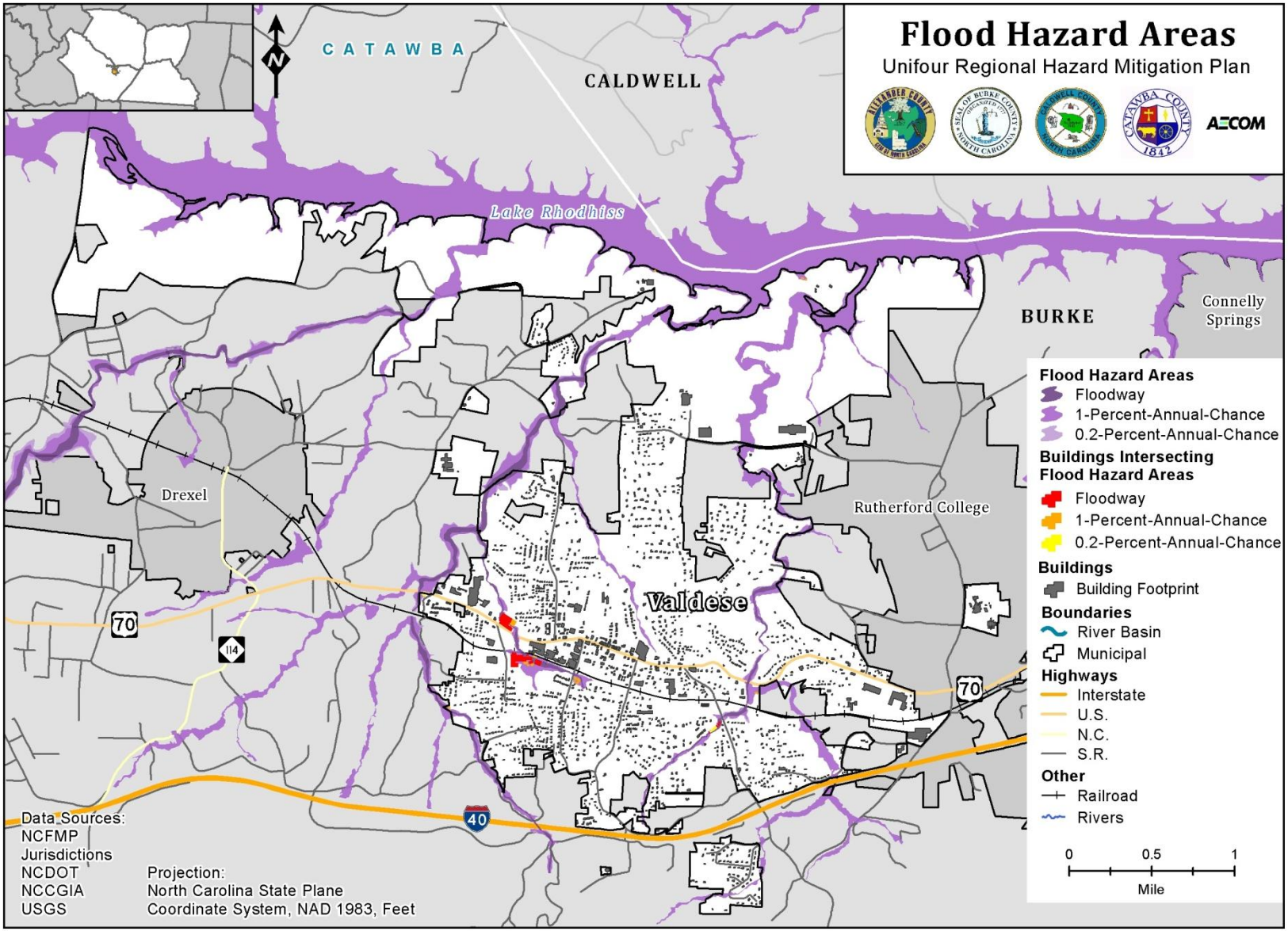


Figure 4.18: Flood Hazard Areas in Rutherford College

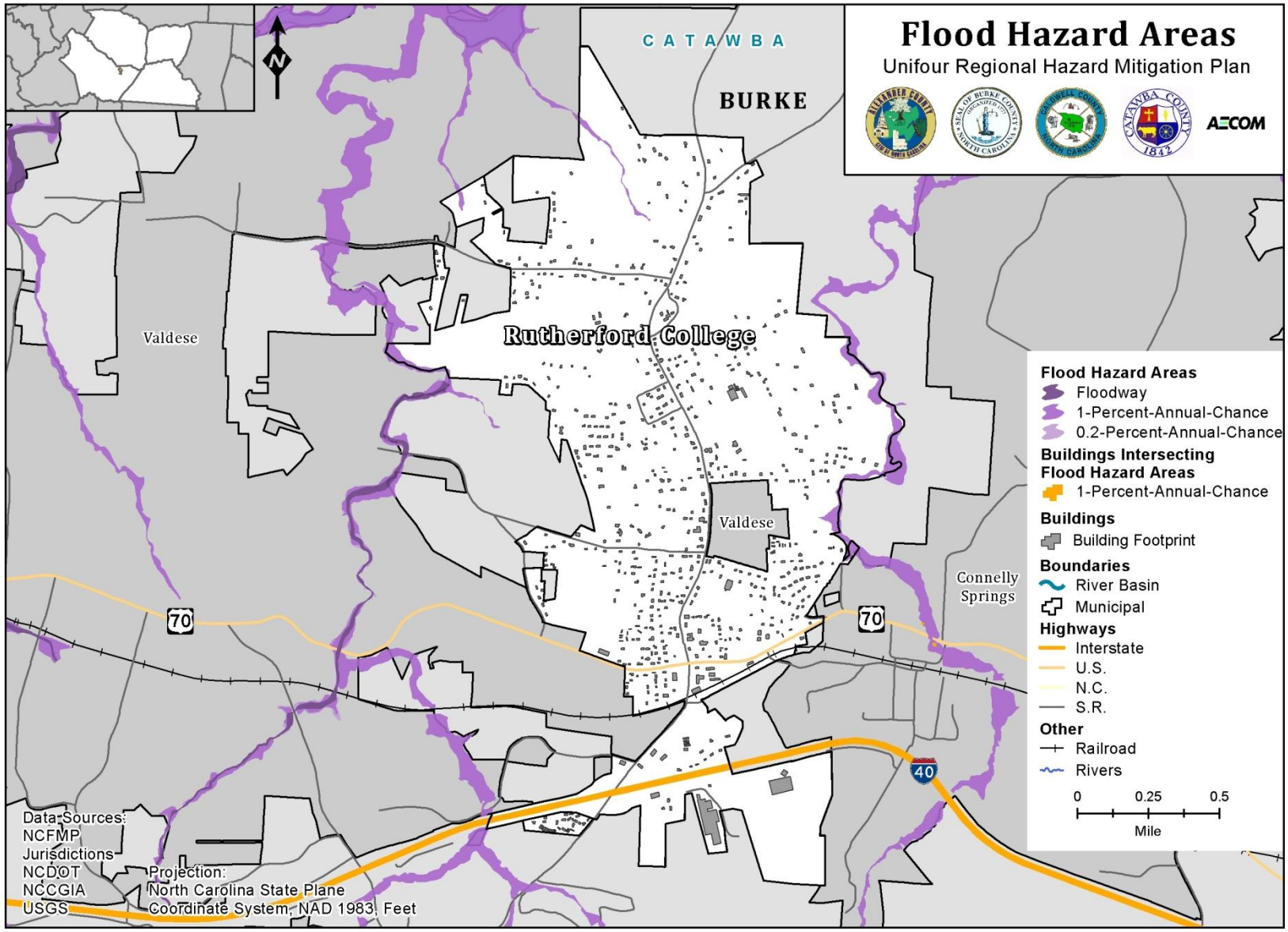


Figure 4.19: Flood Hazard Areas in Caldwell County

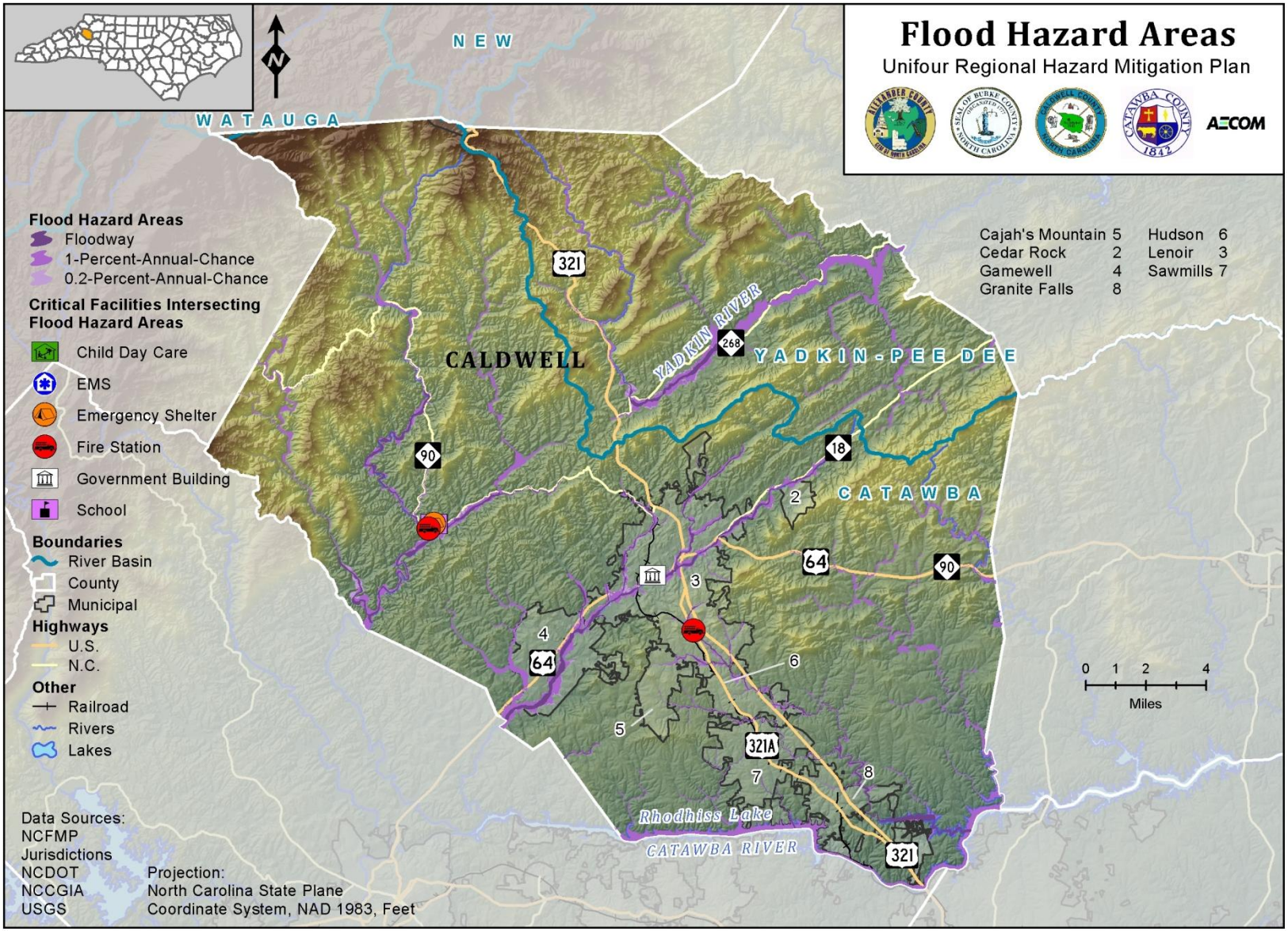


Figure 4.20: Flood Hazard Areas in the Town of Cajah's Mountain

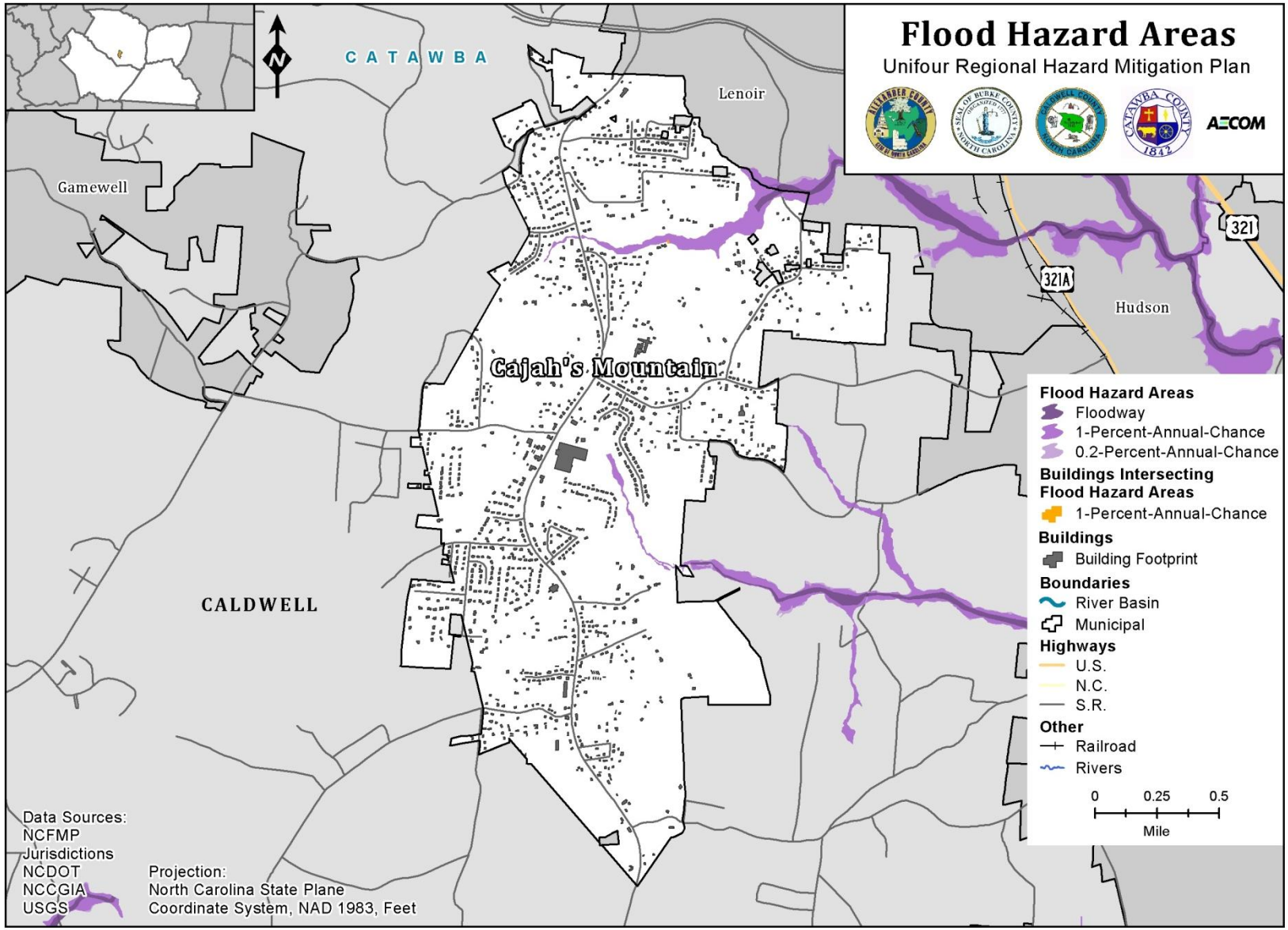


Figure 4.21: Flood Hazard Areas in the Village of Cedar Rock

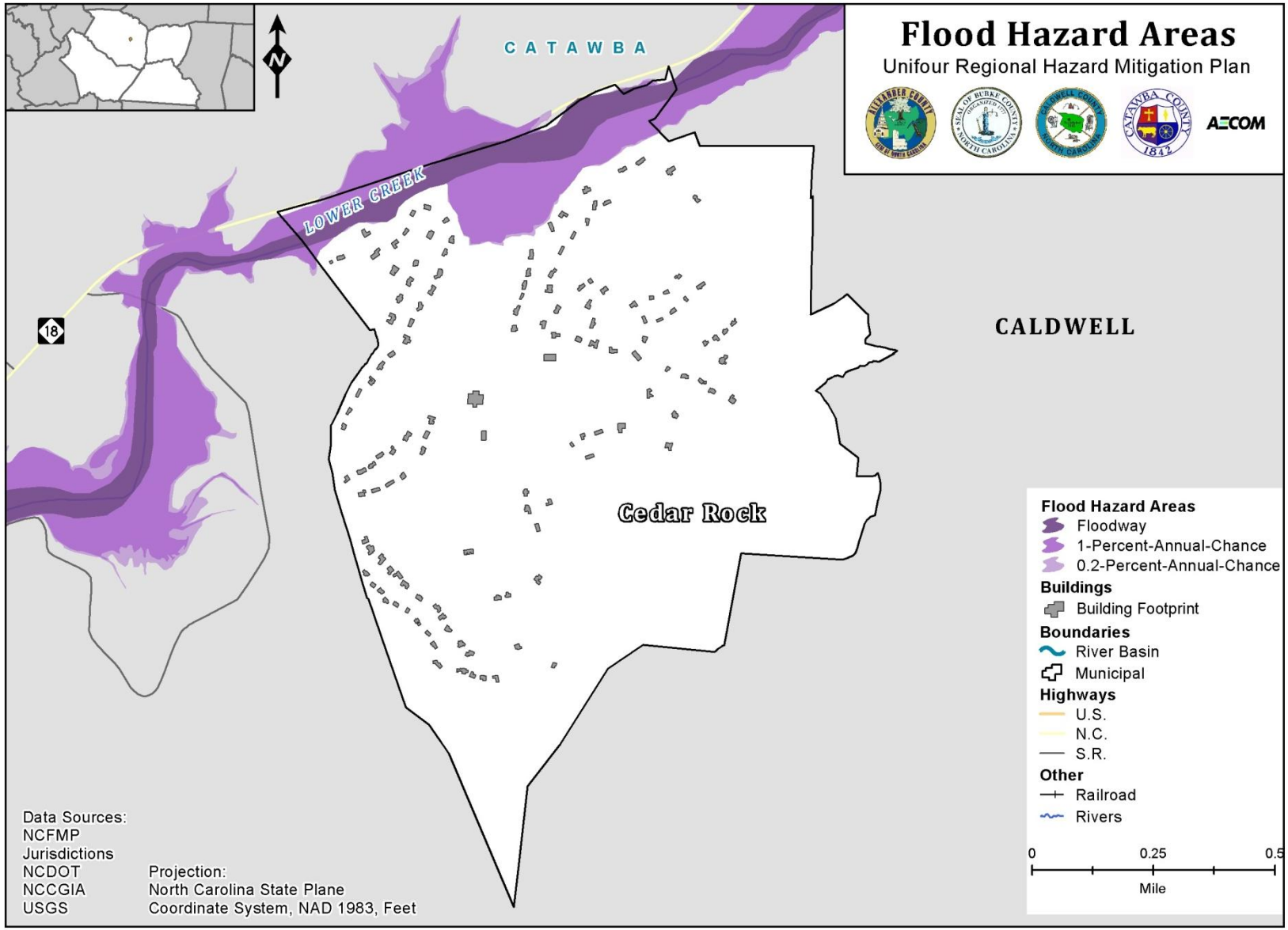


Figure 4.22: Flood Hazard Areas in the Town of Gamewell

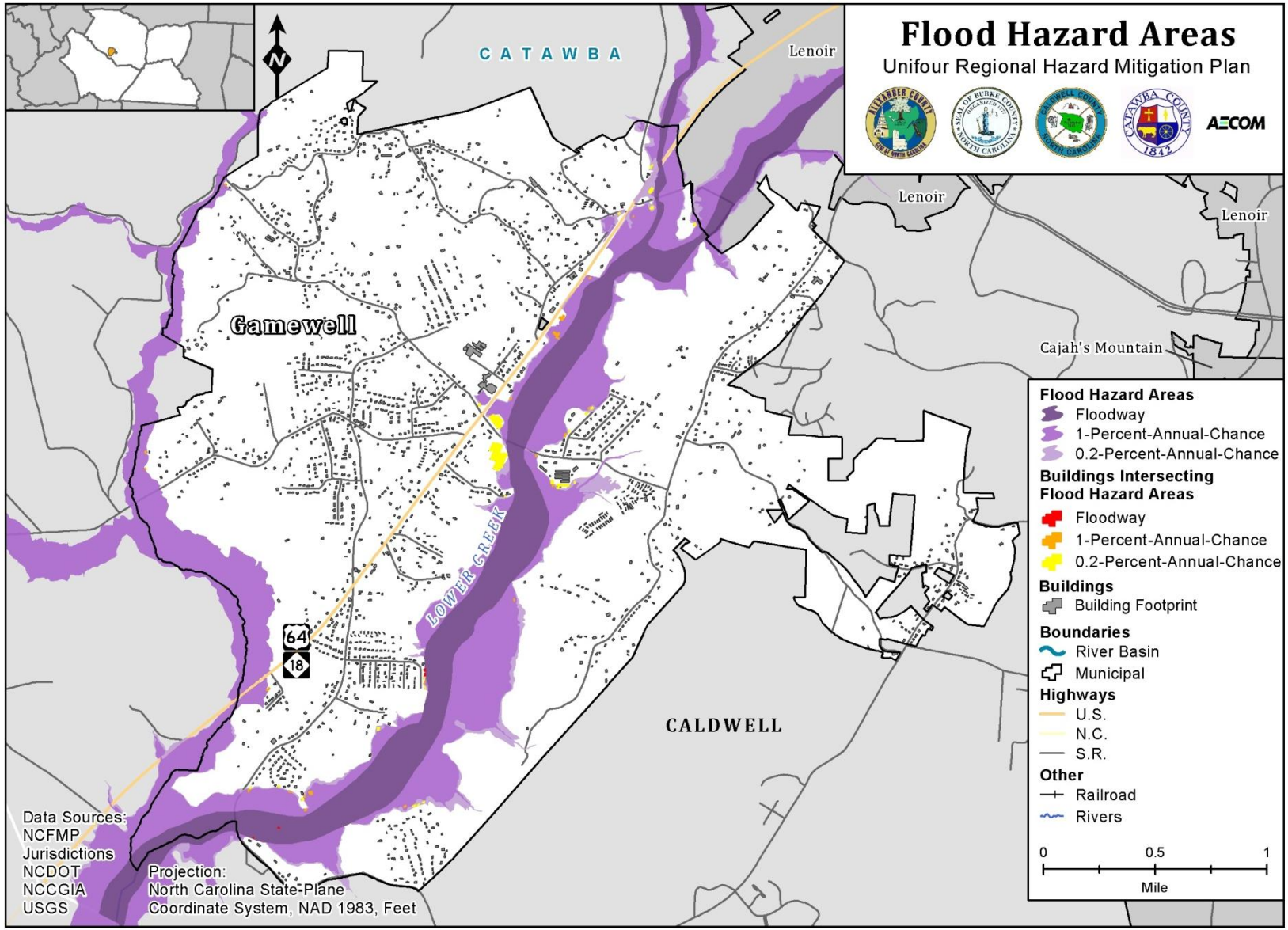


Figure 4.23: Flood Hazard Areas in the Town of Granite Falls

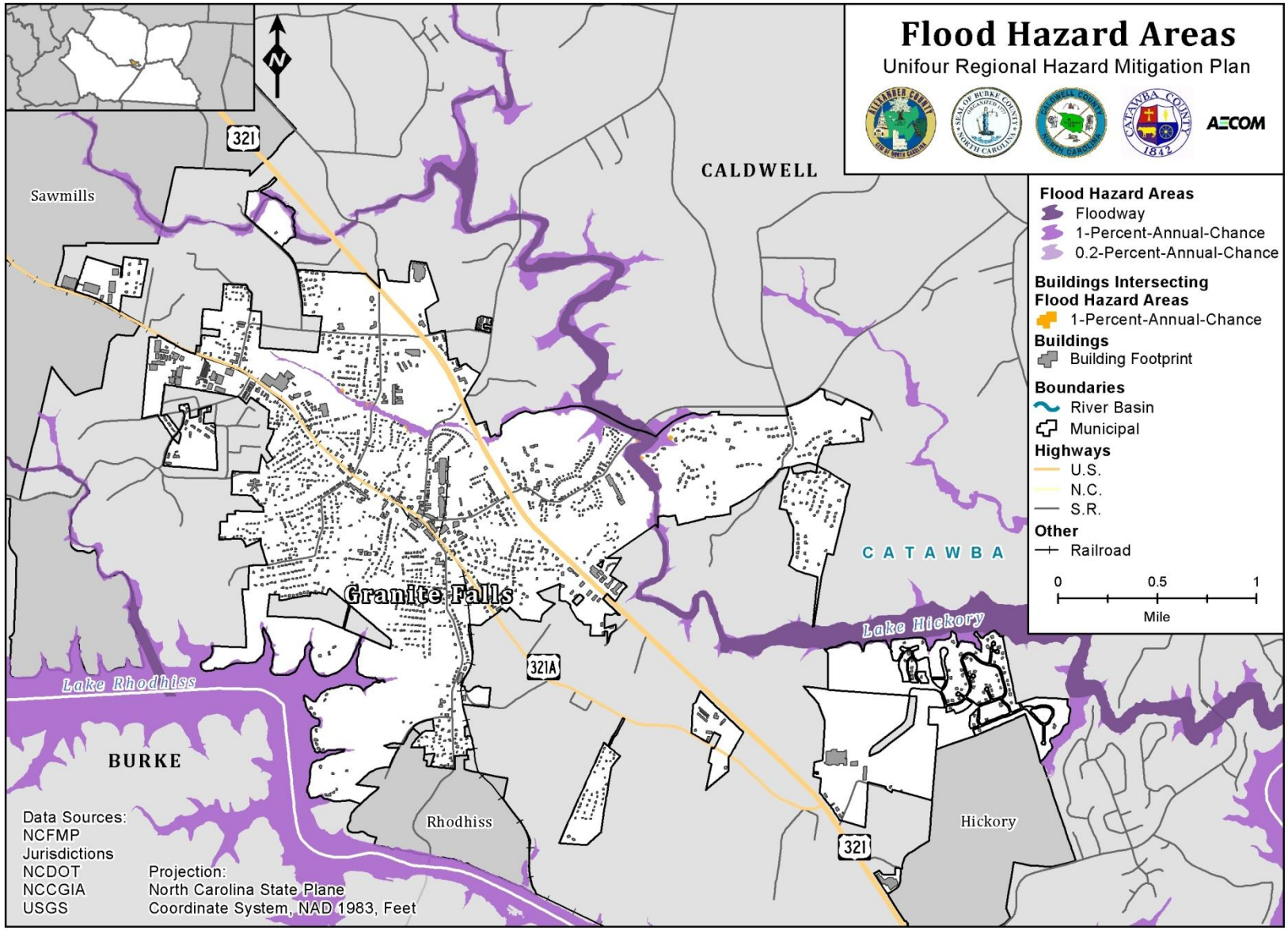


Figure 4.24: Flood Hazard Areas in the Town of Hudson

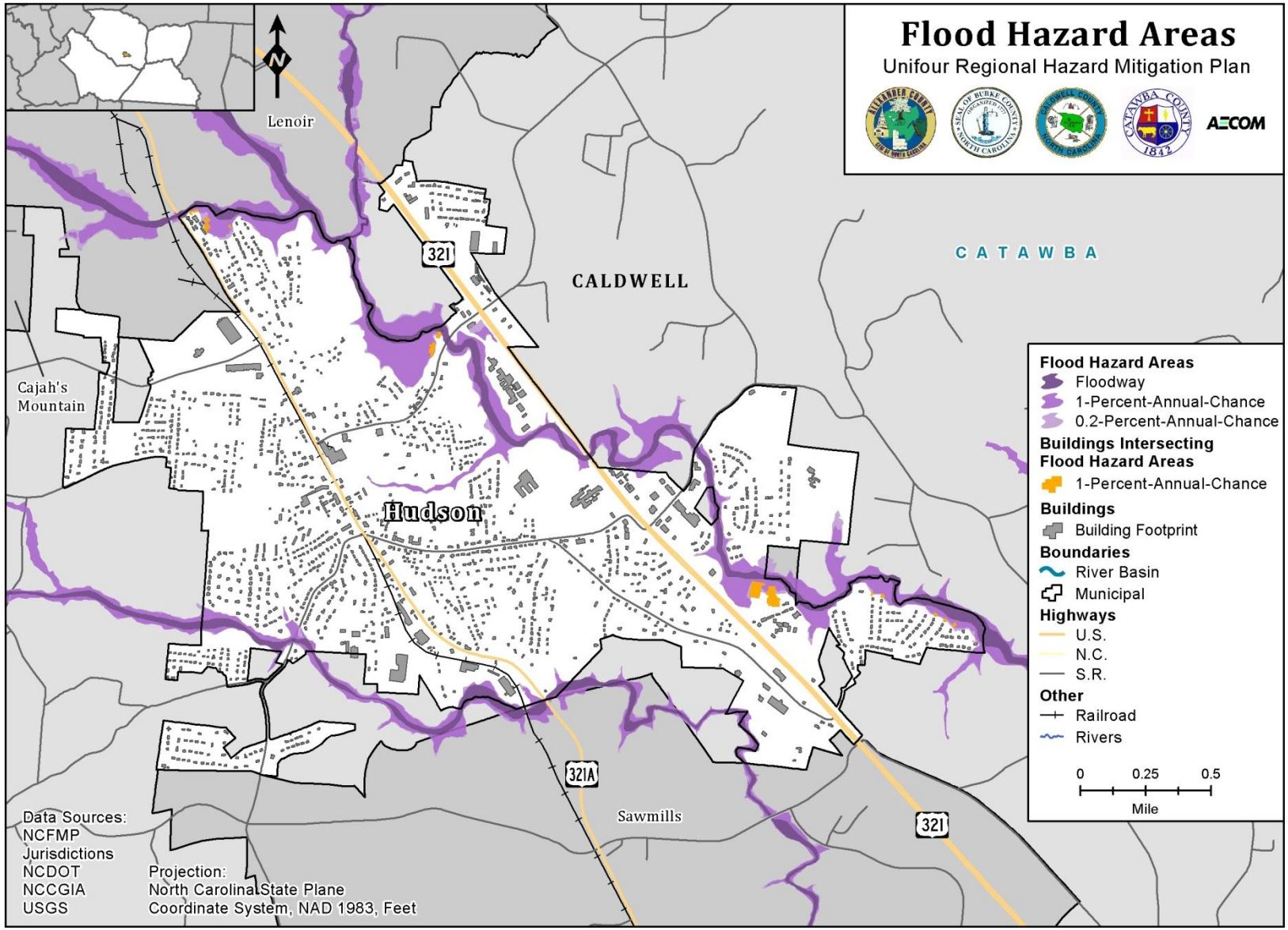


Figure 4.25: Flood Hazard Areas in the City of Lenoir

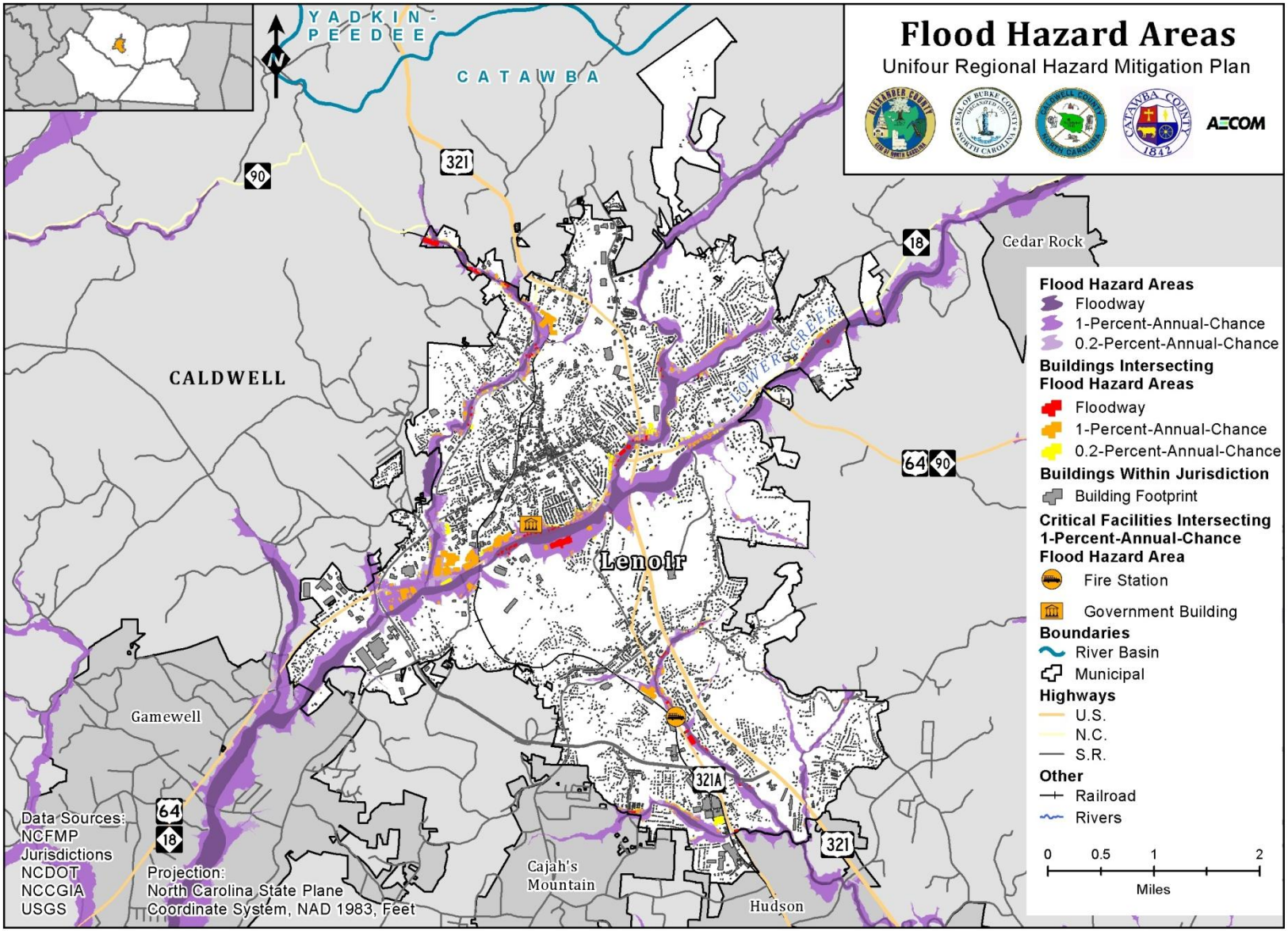


Figure 4.26: Flood Hazard Areas in the Town of Rhodhiss

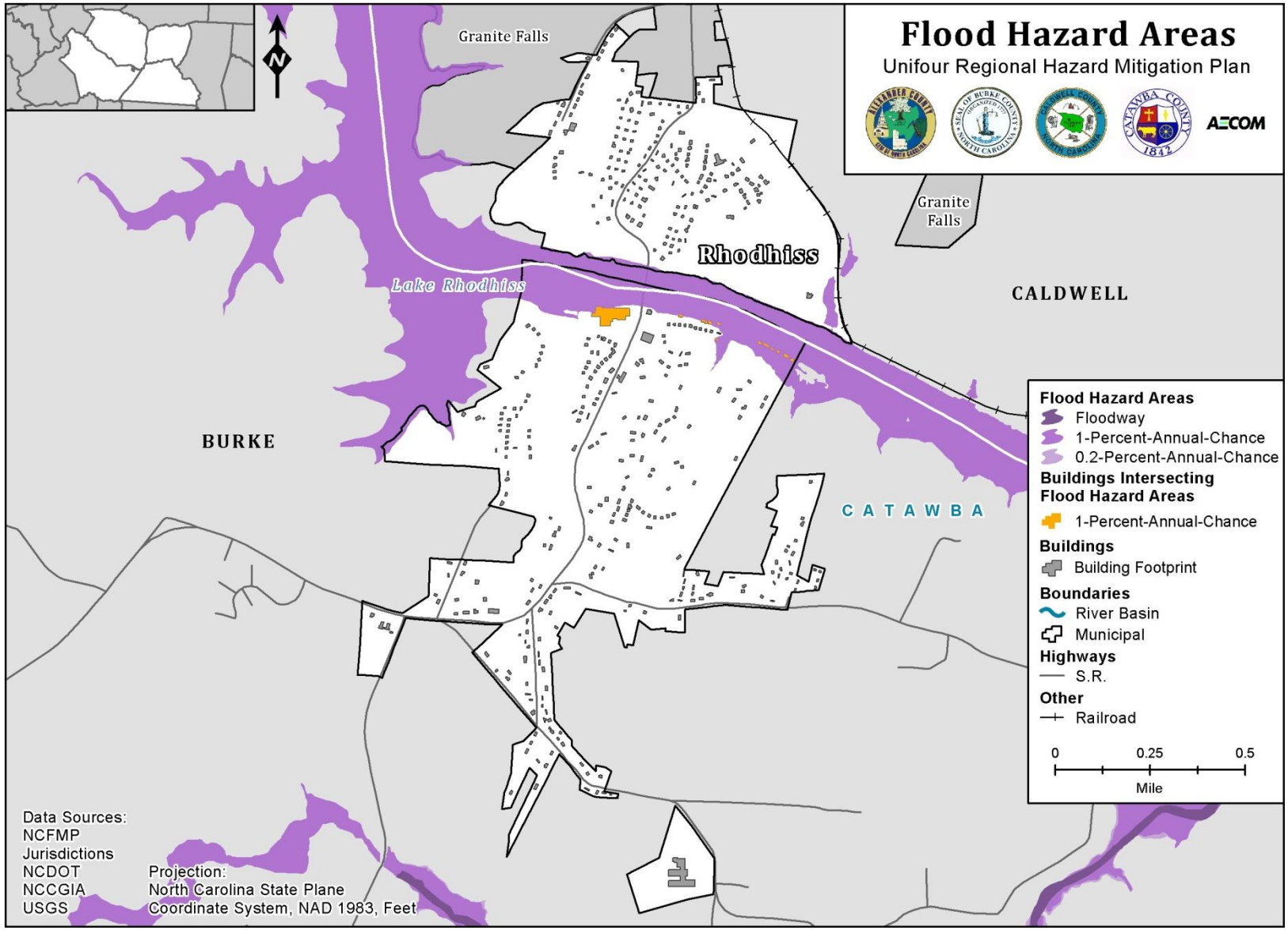


Figure 4.27: Flood Hazard Areas in the Town of Sawmills

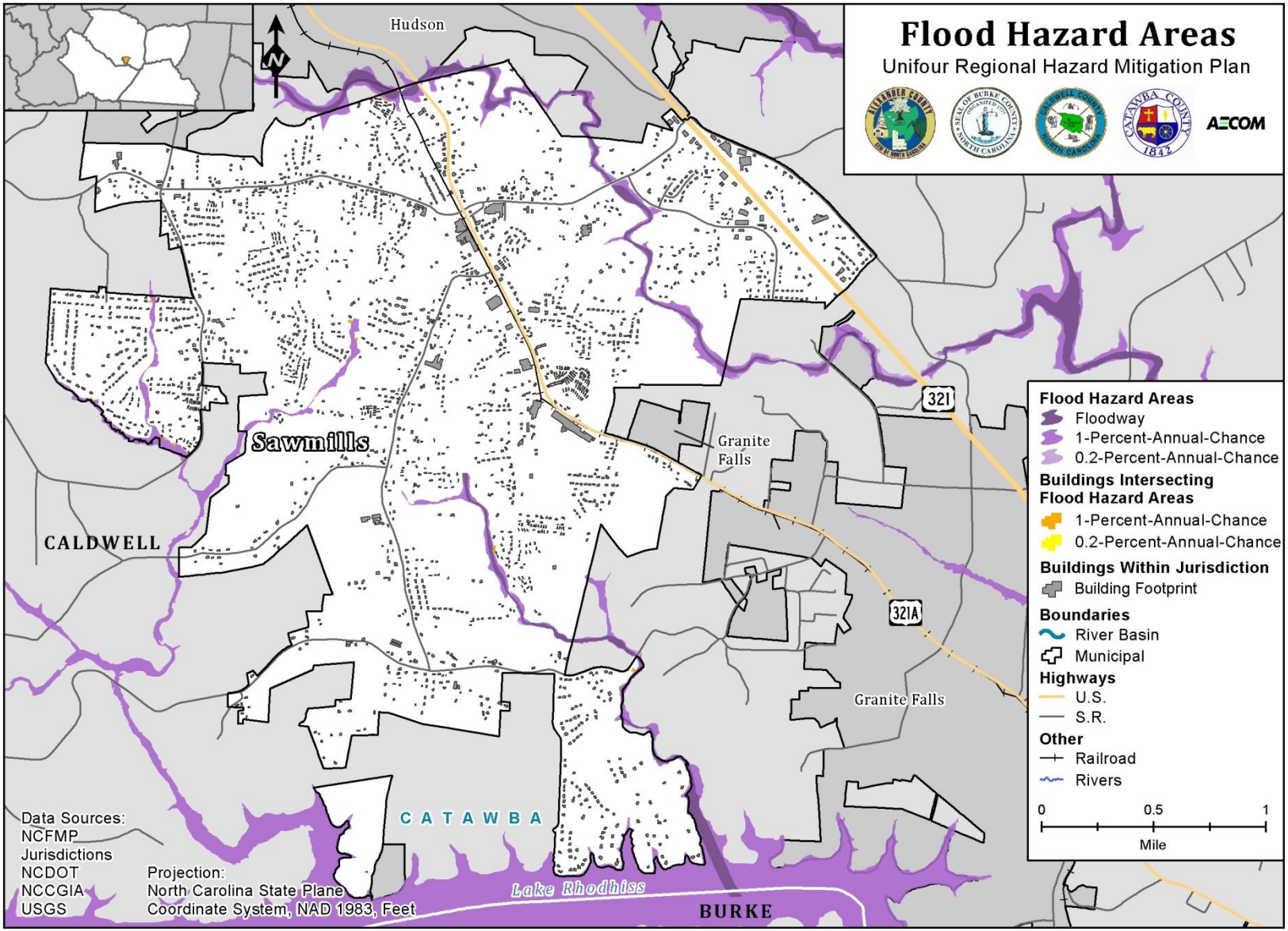


Figure 4.28: Flood Hazard Areas in Catawba County

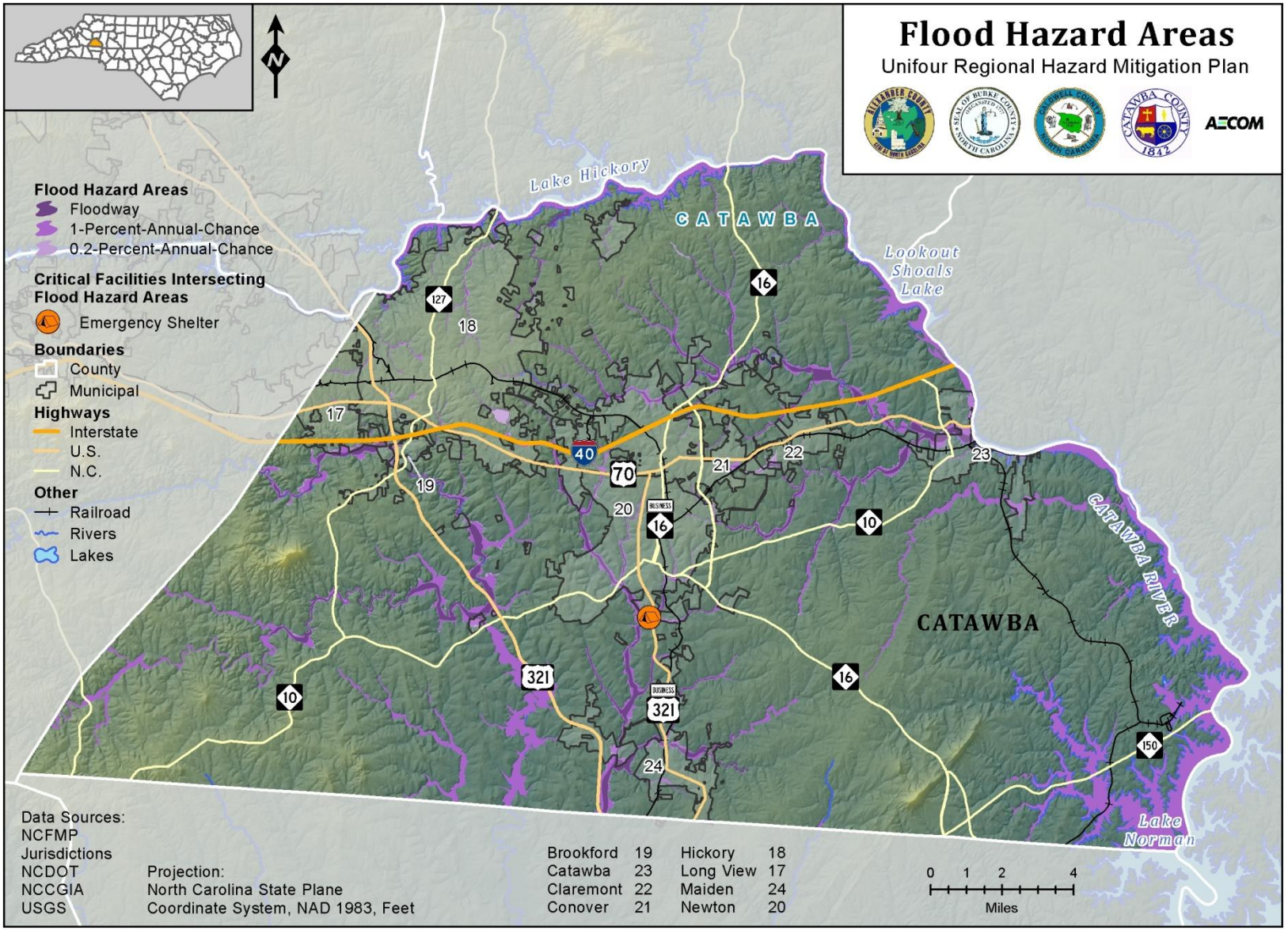


Figure 4.29: Flood Hazard Areas in the Town of Brookford

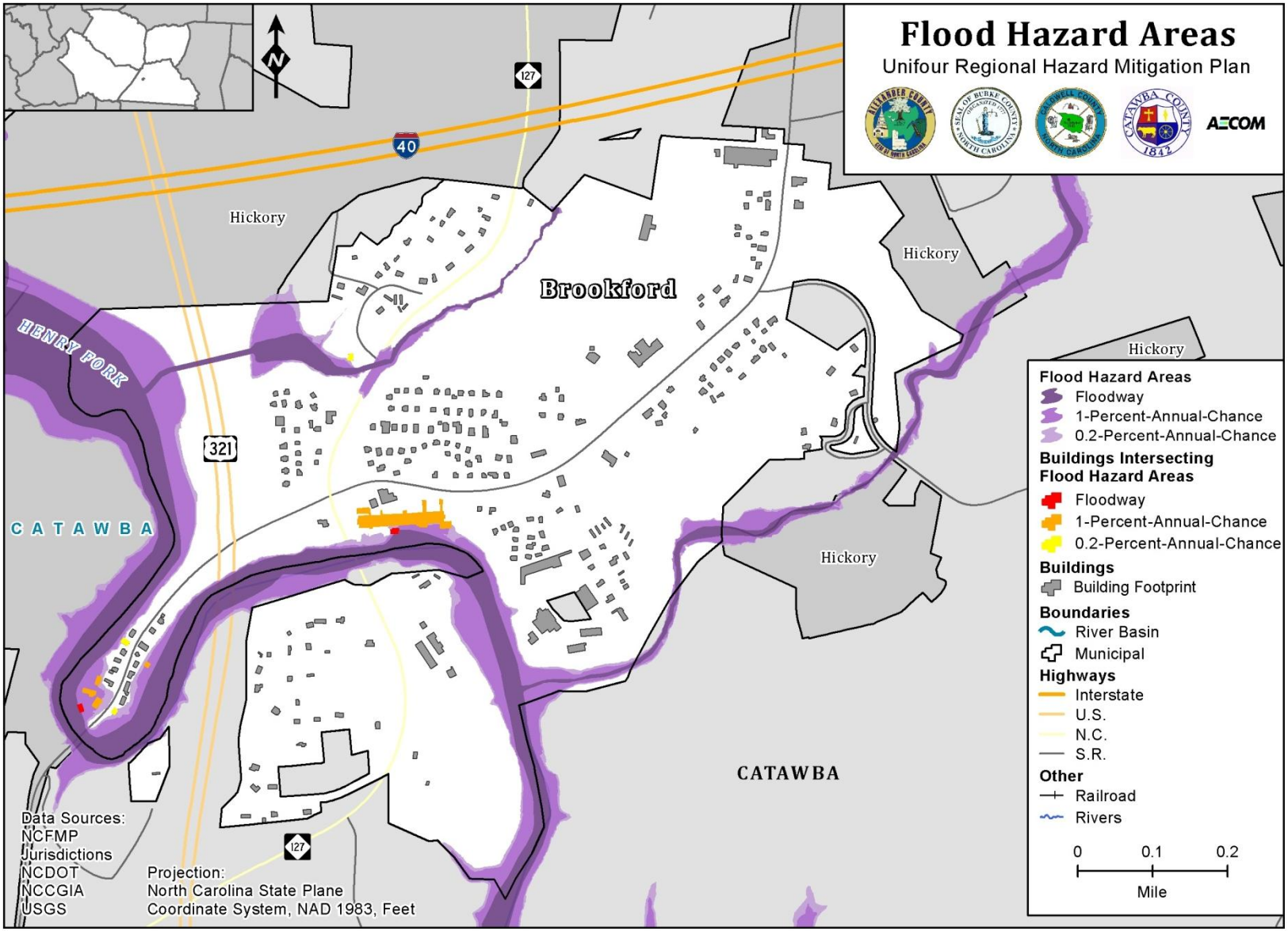


Figure 4.30: Flood Hazard Areas in the Town of Catawba

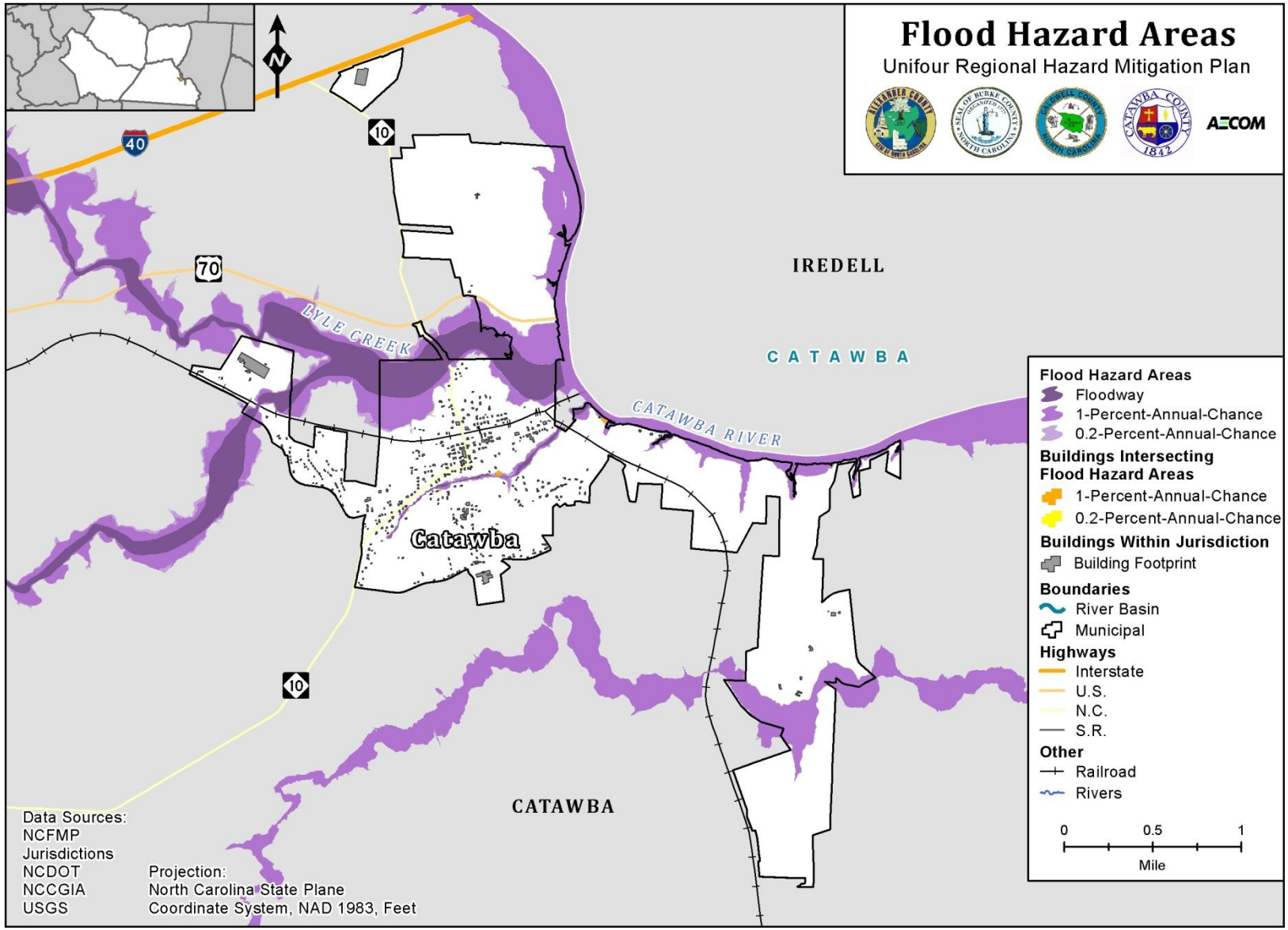


Figure 4.31: Flood Hazard Areas in the City of Claremont

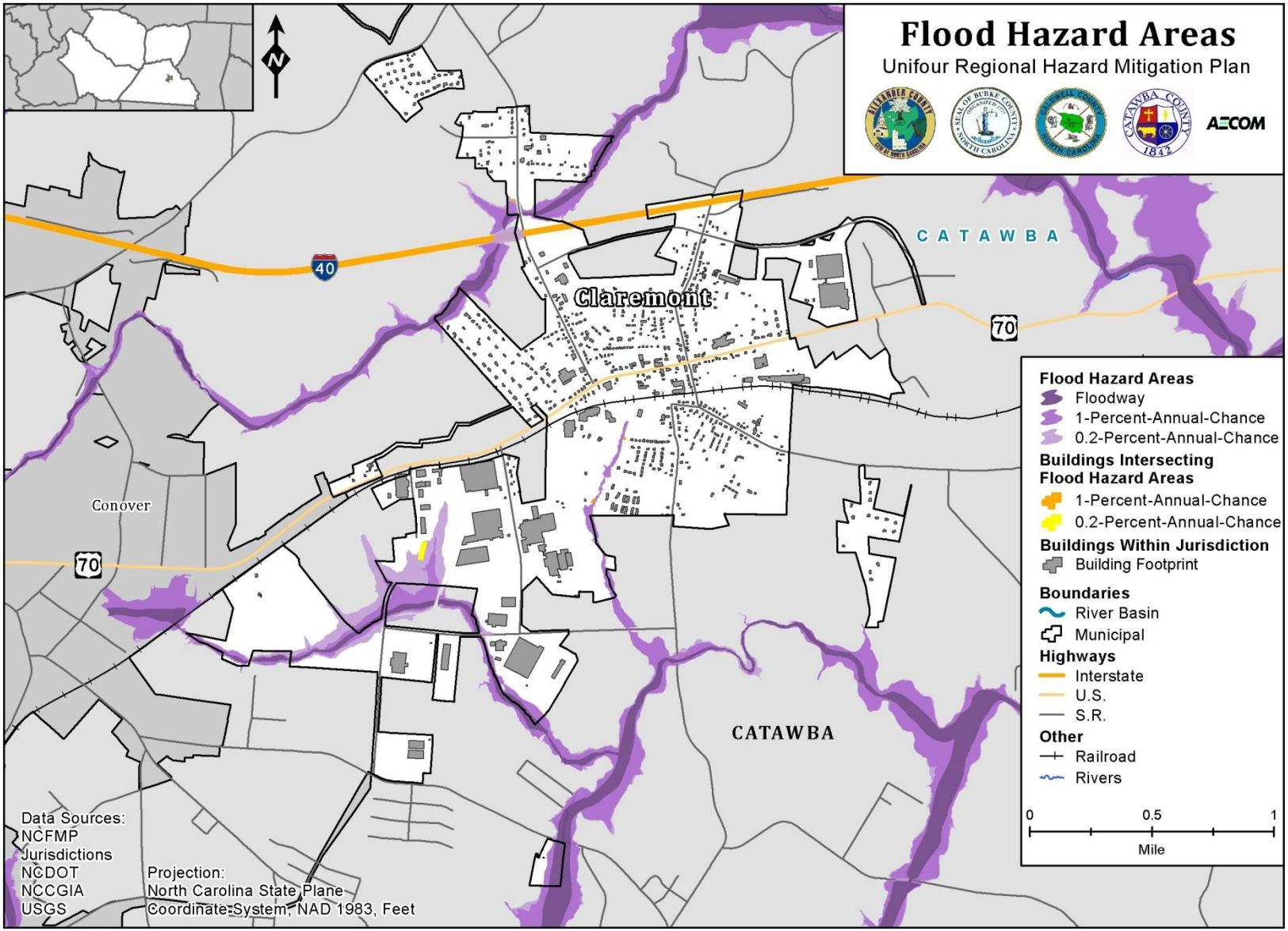


Figure 4.32: Flood Hazard Areas in the City of Conover

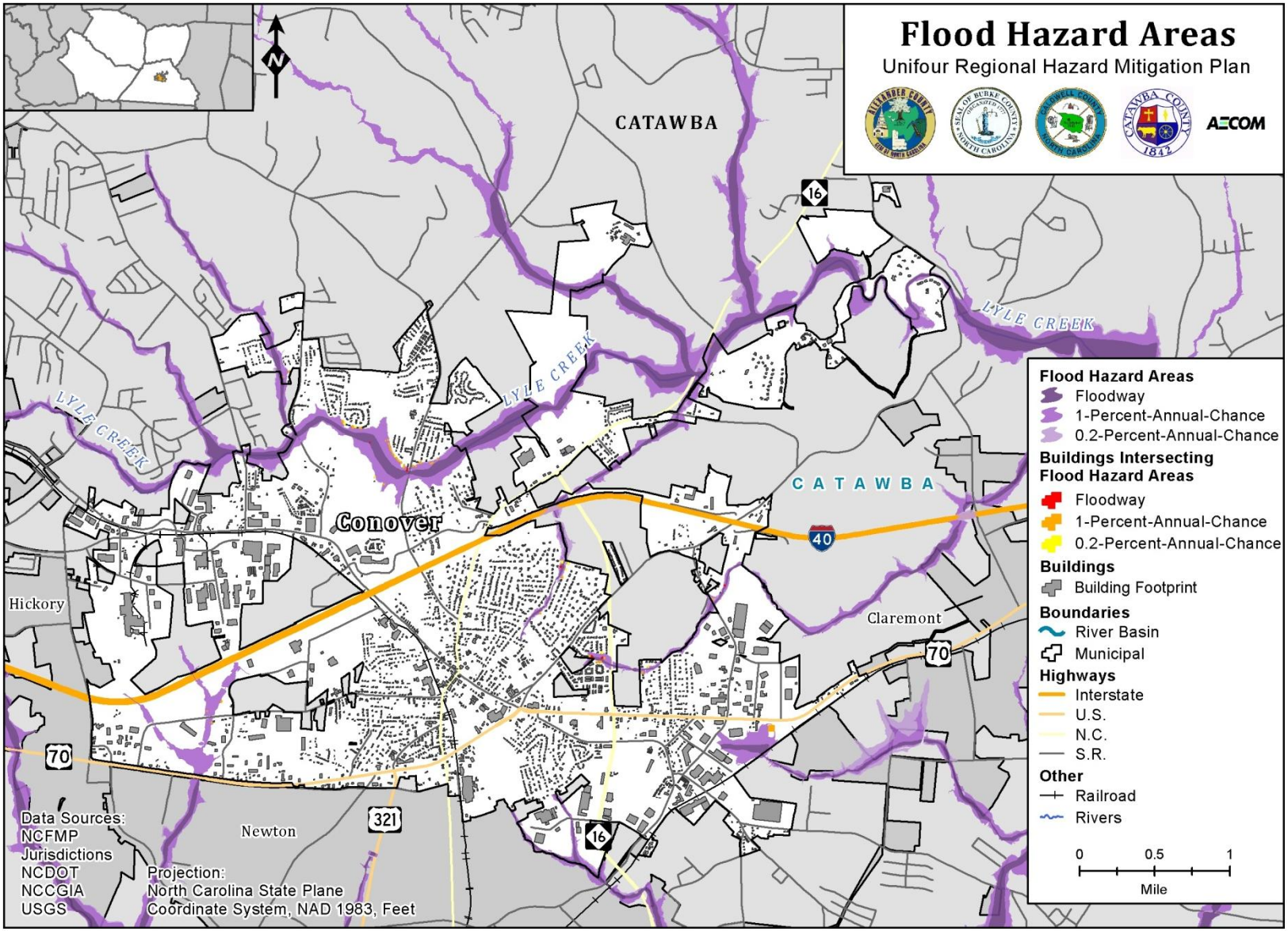


Figure 4.33: Flood Hazard Areas in the City of Hickory

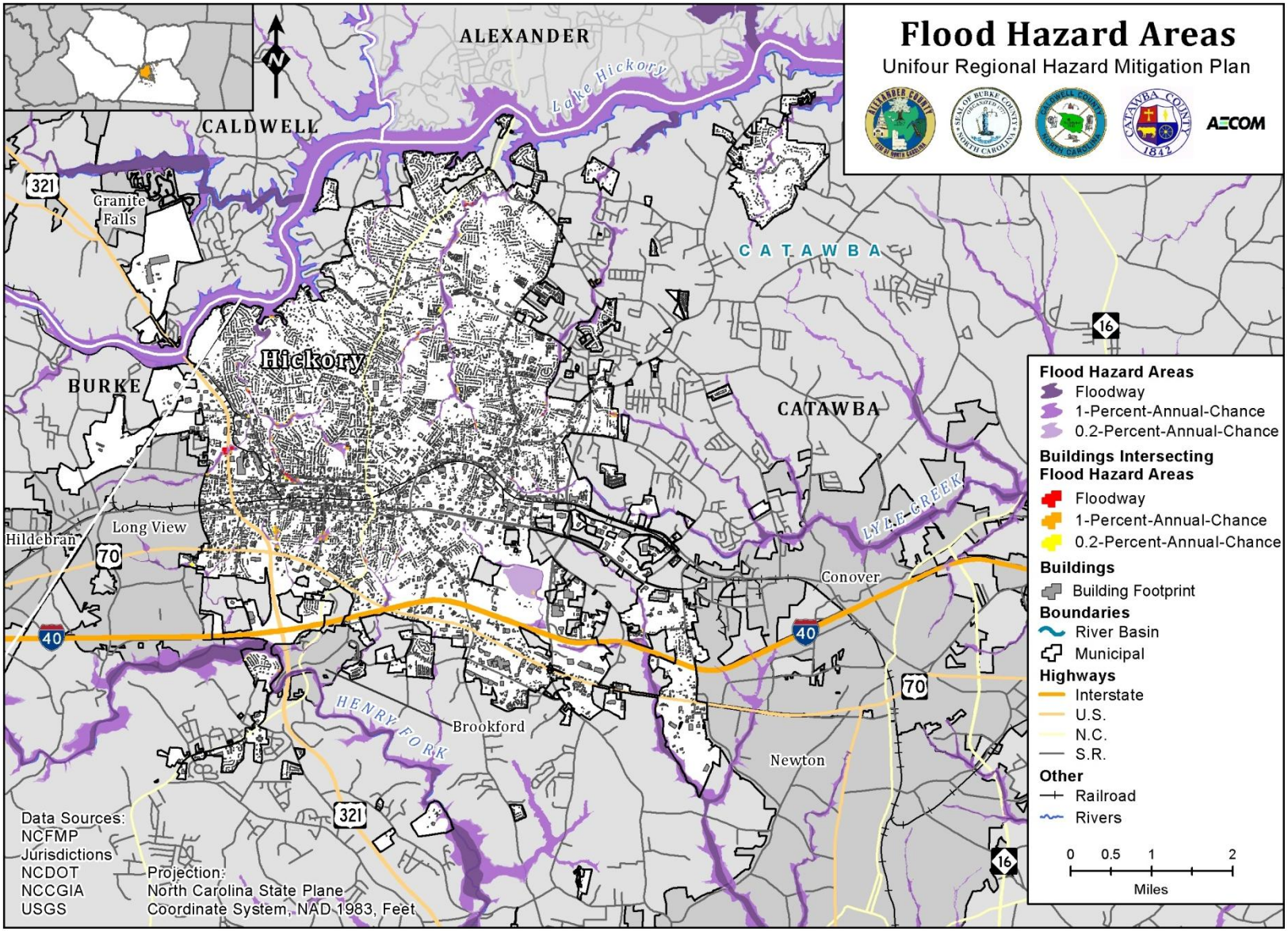


Figure 4.34: Flood Hazard Areas in the Town of Long View