

# Cabarrus Stanly Union Regional Hazard Mitigation Plan 2020 Update

FINAL- APRIL 2020



# TABLE OF CONTENTS

Introduction.....SECTION 1

Planning Process.....SECTION 2

Community Profile.....SECTION 3

Hazard Identification..... SECTION 4

Hazard Profiles..... SECTION 5

Vulnerability Assessment..... SECTION 6

Capability Assessment..... SECTION 7

Mitigation Strategy..... SECTION 8

Mitigation Action Plan.....SECTION 9

Plan Maintenance.....SECTION 10

Plan Adoption.....APPENDIX A

Planning Tools..... APPENDIX B

Local Mitigation Plan Review Tool .....APPENDIX C

Planning Process Documentation..... APPENDIX D

Completed Mitigation Actions .....APPENDIX E

Flood Hazard Maps .....APPENDIX F

NCEI Events..... APPENDIX G

# SECTION 1

## INTRODUCTION

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

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

### 1.1 BACKGROUND

Natural hazards, such as thunderstorms, winter storms, floods, and tornadoes, 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 Cabarrus Stanly Union Region is located in the western Piedmont of North Carolina and includes the counties of Cabarrus, Stanly, and Union and the municipal governments within those counties. This area is vulnerable to a wide range of natural hazards, most notably: tornadoes and thunderstorms, flooding, and severe winter weather. It is also vulnerable to human-caused hazards, such as hazardous substance releases and cyber-attacks. These hazards threaten the life and safety of residents in the region and have the potential to damage or destroy both public and private property, disrupt the local economy, and impact the overall quality of life of individuals who live, work, and vacation in the region.

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



#### **FEMA Definition of Hazard Mitigation:**

*"Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards."*

Hazard mitigation techniques include both structural measures (such as strengthening or protecting buildings and infrastructure from the destructive forces of potential hazards) and non-structural measures (such as the adoption of sound land use policies and the creation of public awareness programs). It is widely accepted that the most effective mitigation measures are implemented at the

local government level, where decisions on the regulation and control of development are ultimately made. A comprehensive mitigation approach addresses hazard vulnerabilities that exist today and in the foreseeable future. Therefore, it is essential that projected patterns of future development are evaluated and considered in terms of how that growth will increase or decrease a community's overall hazard vulnerability.

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

The three counties participating in the development of the Cabarrus Stanly Union Regional Hazard Mitigation Plan first joined together in 2014 to develop the initial version of this regional plan. Prior to that, each County was operating under individual County-level hazard mitigation plans. The plan development process for the 2020 update of the plan is detailed in Section 2: Planning Process.

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

### **1.1.1 The Disaster Mitigation Act and the Flood Insurance Reform Acts**

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

Major federal flood insurance legislation was passed in 2012 under the Biggert-Waters Flood Insurance Reform Act (P.L. 112-141) and the subsequent Homeowner Flood Insurance Affordability Act (HFIAA) in 2014 which revised Biggert-Waters. HFIAA established the requirement that a FEMA-approved Hazard Mitigation Plan is now required if communities wish to be eligible for any of the FEMA mitigation programs. These acts made several changes to the way the National Flood Insurance Program is to be run, including raises in rates to reflect true flood risk and changes in how Flood Insurance Rate Map (FIRM) updates impact policyholders. These acts further emphasize Congress' focus on mitigating vulnerable structures.

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

It is important to note that this plan was developed over a period of time that started in October of 2018 and was essentially completed with delivery of the draft plan to NCEM in October of 2019. Thus, the plan was not developed in accordance with updated FEMA Region IV Review Standards that were provided in February of 2020.

## 1.2 PURPOSE

The purpose of the Cabarrus Stanly Union Regional Hazard Mitigation Plan is to:

- ◆ Completely update the existing Cabarrus Stanly Union Regional Hazard Mitigation Plan to demonstrate progress and reflect current conditions;
- ◆ Increase public awareness and education;
- ◆ Maintain grant eligibility for participating jurisdictions; and
- ◆ Update the plan in accordance with Community Rating System (CRS) requirements; and
- ◆ Maintain compliance with state and federal legislative requirements for local hazard mitigation plans.

## 1.3 SCOPE

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

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

**TABLE 1.1: PARTICIPATING JURISDICTIONS IN THE CABARRUS STANLY UNION REGIONAL HAZARD MITIGATION PLAN**

<b>Cabarrus County</b>	
Concord	Midland
Harrisburg	Mount Pleasant
Kannapolis	
<b>Stanly County</b>	
Albemarle	Norwood
Badin	Oakboro
Locust	Red Cross
Misenheimer	Richfield
New London	Stanfield
<b>Union County</b>	
Fairview	Monroe
Hemby Bridge	Stallings
Indian Trail	Unionville
Lake Park	Waxhaw
Marshville	Weddington
Marvin	Wesley Chapel
Mineral Springs	Wingate

## 1.4 AUTHORITY

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

- ◆ Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390);
- ◆ FEMA's Final Rule published in the Federal Register, at 44 CFR Part 201 (201.6 for local mitigation planning requirements);
- ◆ Flood Insurance Reform Act of 2004 (P.L. 108-264) and Biggert-Waters Flood Insurance Reform Act of 2012 (P.L. 112-141) and the Homeowner Flood Insurance Affordability Act of 2014.

## 1.5 SUMMARY OF PLAN CONTENTS

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

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

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

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

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

The **Capability Assessment**, found in Section 7, provides a comprehensive examination of the Cabarrus Stanly Union Region's capacity to implement meaningful mitigation strategies and identifies opportunities to increase and enhance that capacity. Specific capabilities addressed in this section include planning and regulatory capability, staff and organizational (administrative) capability, technical capability, fiscal capability, and political capability. Information was obtained through the use of a detailed survey questionnaire and an inventory and analysis of existing plans, ordinances, and relevant documents. The purpose of this assessment is to identify any existing gaps, weaknesses, or conflicts in programs or activities that may hinder mitigation efforts and to identify those activities that should be built upon in establishing a successful and sustainable local hazard mitigation program.

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

The **Mitigation Strategy**, found in Section 8, consists of broad goal statements as well as an analysis of hazard mitigation techniques for the jurisdictions participating in the Cabarrus Stanly Union Regional Hazard Mitigation Plan to consider in reducing hazard vulnerabilities. The strategy provides the foundation for a detailed **Mitigation Action Plan**, found in Section 9, which links specific mitigation

actions for each county and municipal department or agency to locally-assigned implementation mechanisms and target completion dates. Together, these sections are designed to make the Plan both strategic, through the identification of long-term goals, and functional, through the identification of immediate and short-term actions that will guide day-to-day decision-making and project implementation.

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

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

# SECTION 2

## PLANNING PROCESS

This section describes the planning process undertaken to develop the 2020 update of the Cabarrus Stanly Union Regional Hazard Mitigation Plan. Information about the development of the 2014 (and first) version of this plan can be found in that plan. Copies of the 2014 plan can be obtained by contacting each County’s Emergency Management office or NCEM’s Hazard Mitigation Planning Section.

- ◆ 2.1 Overview of Hazard Mitigation Planning
- ◆ 2.2 History of Hazard Mitigation Planning in the Cabarrus Stanly Union Region
- ◆ 2.3 Updating the Plan in 2020
- ◆ 2.4 The Cabarrus Stanly Union Regional Hazard Mitigation Planning Committee
- ◆ 2.5 Community Meetings and Workshops
- ◆ 2.6 Involving the Public
- ◆ 2.7 Involving the Stakeholders
- ◆ 2.8 Documentation of Plan Progress
- ◆ 2.9 Cabarrus County and City of Concord CRS Planning Process Documentation

### 44 CFR Requirement

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

## 2.1 OVERVIEW OF HAZARD MITIGATION PLANNING

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

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

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

- ◆ saving lives and property,

- ◆ saving money,
- ◆ speeding recovery following disasters,
- ◆ reducing future vulnerability through wise development and post-disaster recovery and reconstruction,
- ◆ expediting the receipt of pre-disaster and post-disaster grant funding, and
- ◆ demonstrating a firm commitment to improving community health and safety.

Typically, 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 the investments made before a hazard event will significantly reduce the demand for post-disaster assistance by lessening the need for emergency response, repair, recovery, and reconstruction. Furthermore, mitigation practices will enable local residents, businesses, and industries to re-establish themselves in the wake of a disaster, getting the community economy back on track sooner and with less interruption.

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

## 2.2 HISTORY OF HAZARD MITIGATION PLANNING IN THE CABARRUS STANLY UNION REGION

Prior to the development of the Cabarrus Stanly Union Regional Hazard Mitigation Plan in 2014, each of the three counties and jurisdictions participating in this Plan had previously adopted separate county-level hazard mitigation plans. The FEMA approval dates for each of these plans, along with a list of the participating municipalities for each plan, are listed below:

- ◆ *Cabarrus County Hazard Mitigation Plan (1/27/11)*
  - ◆ *Town of Harrisburg*
  - ◆ *Town of Midland*
  - ◆ *Town of Mount Pleasant*
- ◆ *City of Concord Hazard Mitigation Plan (12/15/11)*
- ◆ *City of Kannapolis Hazard Mitigation Plan (9/24/10)*
- ◆ *Stanly County Multi-Jurisdictional Hazard Mitigation Plan (5/5/11)*
  - ◆ *Town of Badin*
  - ◆ *City of Locust*
  - ◆ *Village of Misenhiemer*
  - ◆ *Town of New London*
  - ◆ *Town of Norwood*
  - ◆ *Town of Oakboro*
  - ◆ *Town of Red Cross*

- ◆ *Town of Richfield*
- ◆ *Town of Stanfield*
- ◆ *City of Albemarle Hazard Mitigation Plan (3/20/2012)*
- ◆ *Union County Multi-Jurisdictional Hazard Mitigation Plan (1/24/13)*
  - ◆ *Town of Fairview*
  - ◆ *Town of Hemby Bridge*
  - ◆ *Town of Indian Trail*
  - ◆ *Village of Lake Park*
  - ◆ *Town of Marshville*
  - ◆ *Village of Marvin*
  - ◆ *Town of Mineral Springs*
  - ◆ *City of Monroe*
  - ◆ *Town of Stallings*
  - ◆ *Town of Unionville*
  - ◆ *Town of Waxhaw*
  - ◆ *Town of Weddington*
  - ◆ *Village of Wesley Chapel*
  - ◆ *Town of Wingate*

Each of the existing county-level plans was developed using the multi-jurisdictional planning process recommended by the Federal Emergency Management Agency (FEMA).

For the development of the 2014 plan, all of the aforementioned jurisdictions joined to develop a regional plan. No new jurisdictions joined the process and all of the jurisdictions that participated in previous planning efforts participated in the development of the 2014 regional plan. The regional plan was developed in order to simplify planning efforts for the jurisdictions in the Cabarrus Stanly Union Region and allowed resources to be shared amongst the participating jurisdiction to ease the administrative duties of all of the participants by combining the three existing County-level plans into one multi-jurisdictional plan. The 2014 plan was important and successful first start for regional hazard mitigation planning efforts and that success has carried over into the 2020 update of the plan.

## **2.3 UPDATING THE PLAN IN 2020**

FEMA requires that hazard mitigation plans be updated every five years to remain eligible for federal mitigation and public assistance funding. To prepare the 2020 *Cabarrus Stanly Union Regional Hazard Mitigation Plan*, ESP Associates, Inc. was hired by North Carolina Emergency Management to provide professional mitigation planning services. Per the contractual scope of work, the consultant team followed the mitigation planning process recommended by FEMA (Publication Series 386 and Local Mitigation Plan Review Guide) and recommendations provided by North Carolina Emergency Management (NCEM) mitigation planning staff<sup>1</sup>. Additionally, for the 2020 update, FEMA Community Rating System (CRS) and Community Wildfire Protection Plan (CWPP) requirements were integrated into the plan update.

Tables 2.1 and 2.2 below provide an overview of how the Community Rating System and Community Wildfire Protection Plan requirements were integrated into this plan update.

---

<sup>1</sup> A copy of the negotiated contractual scope of work between NCEM and ESP is available through NCEM upon request.

**TABLE 2.1 FEMA HAZARD MITIGATION PLANNING REQUIREMENTS AND THE CRS 10-STEP PLANNING PROCESS REFERENCE TABLE**

FEMA Disaster Mitigation Act Requirement	CRS Activity 510 Planning Requirement
<b>Phase I – Planning Process</b>	
§201.6(c)(1)	Step 1: Organize to Prepare the Plan
§201.6(b)(1)	Step 2: Involve the Public
§201.6(b)(2) & (3)	Step 3: Coordinate
<b>Phase II – Risk Assessment</b>	
§201.6(c)(2)(i)	Step 4: Assess the Hazard
§201.6(c)(2)(ii) & (iii)	Step 5: Assess the Problem
<b>Phase III – Mitigation Strategy</b>	
§201.6(c)(3)(i)	Step 6: Set Goals
§201.6(c)(3)(ii)	Step 7: Review Possible Activities
§201.6(c)(3)(iii)	Step 8: Draft an Action Plan
<b>Phase IV – Plan Maintenance</b>	
§201.6(c)(5)	Step 9: Adopt the Plan
§201.6(c)(4)	Step 10: Implement, Evaluate and Revise the Plan

**TABLE 2.2 COMMUNITY WILDFIRE PROTECTION PLAN PROCESS INTEGRATION REFERENCE TABLE**

CWPP Process	Hazard Mitigation Plan Integration Reference
Step 1: Convene Decisionmakers	Section 2: Planning Process
Step 2: Involve Federal Agencies	Section 2: Involving Stakeholders
Step 3: Engage Interested Parties	Section 2: Planning Process
Step 4: Establish a Community Base Map	Section 3: Community Profile
Step 5: Develop a Community Risk Assessment	Sections 4, 5 and 6: Hazard Identification, Hazard Profiles and Vulnerability Assessment Section 7: Capability Assessment
Step 6: Establish Community Hazard Reduction Priorities and Recommendations to Reduce Structural Ignitability	Section 8: Mitigation Strategy
Step 7: Develop an Action Plan and Assessment Strategy	Section 9: Mitigation Action Plans Section 10: Plan Maintenance
Step 8: Finalize the CWPP	Appendix A: Plan Adoption

*Source: Preparing a Community Wildfire Protection Plan – A Handbook for Wildland-Urban Interface Communities*

The Local Mitigation Plan Review Tool, found in Appendix C, provides a detailed summary of FEMA’s current minimum standards of acceptability for compliance with DMA 2000 and notes the location where each requirement is met within this Plan. These standards are based upon FEMA’s Final Rule as published in the Federal Register in Part 201 of the Code of Federal Regulations (CFR). The planning team used FEMA’s Local Mitigation Plan Review Guide (October 2011) for reference as they completed the Plan.

For the development of the 2020 plan, all of the aforementioned jurisdictions that participated in the development of the 2014 plan participated in this plan’s development.

The process used to prepare this Plan included twelve major steps that were completed over the course of approximately nine months beginning in October 2018. Each of these planning steps (illustrated in **Figure 2.1**) resulted in critical work products and outcomes that collectively make up the Plan. Specific plan sections are further described in Section 1: *Introduction*.

**FIGURE 2.1: MITIGATION PLANNING PROCESS FOR THE CABARRUS STANLY UNION REGION**



## 2.4 THE CABARRUS STANLY UNION REGIONAL HAZARD MITIGATION PLANNING COMMITTEE

In order to guide the development of this Plan, the Cabarrus Stanly Union jurisdictions created the Cabarrus Stanly Union Regional Hazard Mitigation Planning Committee. The Regional Hazard Mitigation Planning Committee represents a community-based planning Committee made up of representatives from various county departments, municipalities, and other key stakeholders identified to serve as critical partners in the planning process.

Beginning in October 2018, the Regional Hazard Mitigation 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 e-mail distribution list.

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

- ◆ participate in Regional Hazard Mitigation Planning Committee meetings and workshops,
- ◆ provide best available data as required for the risk assessment portion of the plan,
- ◆ provide information that will help complete the Capability Assessment section of the plan,
- ◆ provide copies of any mitigation or hazard-related documents for review and incorporation into the plan,
- ◆ support the development and update of the Mitigation Strategy, including the design and adoption of regional goal statements,
- ◆ help design and propose appropriate mitigation actions for their department/agency for incorporation into the Mitigation Action Plan,
- ◆ review and provide timely comments on all study findings and draft plan deliverables, and
- ◆ support the adoption of the 2020 *Cabarrus Stanly Union Regional Hazard Mitigation Plan*.

**Table 2.3** lists the members of the Regional Hazard Mitigation Planning Committee who were responsible for participating in the development of the Plan.

**TABLE 2.3: MEMBERS OF THE CABARRUS STANLY UNION REGIONAL  
HAZARD MITIGATION PLANNING COMMITTEE**

<b>NAME</b>	<b>DEPARTMENT / AGENCY / TITLE</b>
Smith, Bobby	Cabarrus County EM
Simpson, Brian	Stanly County EM
Moye, Don	Union County EM
Whitley, Aloma	Town of Red Cross
Jones, Barbi	Cabarrus County Chamber of Commerce
Kindley, Brian	Monroe Fire Department
Clark, Cheri	Village of Lake Park, Administrator
Hinson, Dane	Stanly County GIS
Barham, Daniel	Stanly County EM
Jenkins, Dave	Stanly County
Gustafson, Dawn	Cabarrus County EM, Executive Assistant
Elkins, Don	Monroe Police Department
Britt, Doug	City of Monroe
Nichols, Erinn	Town of Stallings, Senior Administration Specialist
Hiers, Ernie	Kannapolis Fire Department
Herbert, Grace	Celgard
Harper, Heather	Atrium Health
LeMastre, Heather	American Red Cross
Crane, Ian	Concord Emergency Management, Assistant Coordinator
Sacks, Irene	City of Kannapolis, Director of Economic and Community Development
Burnett, Jason	Cabarrus County EM, Planner
Layton, Jennifer	Stanly County Health Department
Hilley, Jessica	Cabarrus County Transportation
Sells, Jim	Concord Emergency Management Coordinator
Marshall, Jonathan	Cabarrus County, Deputy County Manager
Sifford, Kelly	Cabarrus County Planning Department, Director
Burton, Kristin	Cabarrus County Outreach Coordinator
Weslow, L J	Rider Transit
Roark, Michael	Albemarle Fire Department, Fire Marshall / EM Coordinator
Smith, Michael	Stanly County EM
Reynolds, Paul	Stanly County GIS
Allen, Ray	Concord Fire Department
Gillelard, Ray	Cabarrus County Sheriff's Office
Lewis, Richard	American Red Cross
Bushey, Robert	Cabarrus County Transportation, Manager
McGhee, Ryan	Cabarrus Health Alliance, Executive Management
Skinner, Steven	Corning Inc
Ferrington, Susan	Cabarrus County Finance Director
Morris, Susie	Cabarrus County Planning Department, Planning and Zoning Manager

NAME	DEPARTMENT / AGENCY / TITLE
Clanton, Terry	Kannapolis Police Department, Deputy Chief
Foxx, Terry	NCEM Risk Management
Spry, Terry	Kannapolis Police Department, Captain
Ferguson, Chris	NCEM Risk Management
Hamby, Karen	NCEM Area Coordinator

**Table 2.4** lists points of contact for several of the jurisdictions who elected to designate their respective county officials to represent their jurisdiction on the planning team, generally because they did not have the time or staff to be able to attend on their own. Although these members designated county officials to represent them at in-person meetings, each was still contacted throughout the planning process and participated by providing suggestions and comments on the Plan, updates to mitigation actions and the Capability Assessment via email and phone conversations. These members are listed below by municipality.

**TABLE 2.4: MEMBERS DESIGNATING REPRESENTATIVES TO CABARRUS STANLY UNION REGIONAL HAZARD MITIGATION PLANNING COMMITTEE**

NAME	DEPARTMENT / AGENCY / TITLE	JURISDICTION
Dunn, Bryan	Fire Chief	Harrisburg
Paris, Doug	Town Manager	Midland
Holloway, Randy	Administrator	Mount Pleasant
Almond, Jay	Town Manager	Badin
Correa, Cesar	City Administrator	Locust
Blair, Anita	Village Clerk	Misenheimer
Daniels, Tate	Mayor	New London
Allen, Ray	Interim Town Administrator	Norwood
Efird, Patti	Town Clerk/Finance Officer	Oakboro
Whitley, Aloma	Town Clerk	Red Cross
Capps, Carolyn	Town Administrator	Richfield
Helms, Bridgette	Town Administrator	Stanfield
Humphries, Ed	Planning	Fairview
Richard Jensen, Richard	Planning, Zoning	Hemby Bridge
Deese, Brandi	Planning Director	Indian Trail
Isreal, Blair	Planning	Marshville
Ammanamanchi, Rohit	Planner	Marvin
Brooks, Vicky	Town Clerk	Mineral Spring
Gaddy, Sonya	Town Clerk/Land Use Administrator	Unionville
Currie, Kelley	Assistant Town Manager/Deputy Clerk	Waxhaw
Thompson, Lisa	Town Administrator/Planner	Weddington
Byers, Robyn	Planning & Zoning Administrator	Wesley Chapel

Rorie, Adrienne

Assistant Town Clerk/Land Use  
Administrator

Wingate

Additional participation and input from other identified stakeholders and the general public was sought by the participating counties during the planning process through phone calls and the distribution of emails, advertisements and public notices aimed at informing people on the status of the Hazard Mitigation Plan (public and stakeholder involvement is further discussed later in this section).

### 2.4.1 Multi-Jurisdictional Participation

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

- ◆ Participate in mitigation planning workshops,
- ◆ Provide implementation status updates on previously identified mitigation actions,
- ◆ Identify completed mitigation projects, if applicable; and,
- ◆ Develop and adopt (or update) their local Mitigation Action Plan.

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

## 2.5 COMMUNITY MEETINGS AND WORKSHOPS

The preparation of this Plan required a series of meetings and workshops for facilitating discussion, gaining consensus and initiating data collection efforts with local government staff, community officials, and other identified stakeholders. More importantly, the meetings and workshops prompted continuous input and feedback from relevant participants throughout the drafting stages of the Plan.

The following is a summary of the key meetings and community workshops held during the development of the plan update<sup>2</sup>. In many cases, routine discussions and additional meetings were held by local staff to accomplish planning tasks specific to their department or agency, such as the approval of specific mitigation actions for their department or agency to undertake and include in the Mitigation Action Plan.

### 2.5.1 Meeting Minutes

#### **Meeting Minutes from Internal Kickoff Conference Call/Skype Meeting with County Leads and NCEM Representatives**

**October 10, 2018**

#### **Phone Call/Skype Meeting**

Following issuance of a notice to proceed from NCEM, on October 2, 2018 ESP Associates reached out by email to County Emergency Management and Planning Department leads from Cabarrus, Stanly, and

---

<sup>2</sup> Copies of agendas, sign-in sheets, minutes, and handout materials for all meetings and workshops can be found in Appendix D.

Union Counties, NCEM Area 11 and 13 Coordinators and the Western Branch Manager to introduce themselves, explain the plan update process in general and schedule a time to hold an informal internal kickoff conference call/Skype meeting.

On October 10, 2018, Nathan Slaughter, Hazard Mitigation Department Manager from ESP Associates, Inc. and Project Manager for the update of the CSU Regional Hazard Mitigation Plan conducted a conference call/Skype meeting with the internal lead stakeholders previously mentioned above. He presented important project information about the plan update, gave a brief refresher on hazard mitigation and a reminder about the importance of the plan, provided a project overview to include key objectives, project tasks, schedule and staff, and then defined roles and responsibilities of the project consultant and the participating jurisdictions.

Following the presentation, he discussed with these stakeholders the need to set up a date, time and location for the official project kickoff meeting with the regional hazard mitigation planning committee. The lead internal stakeholders discussed potential meeting dates and locations and decided that November 29, 2018 would be the date of the meeting at a location to be determined later. The details of the official kickoff meeting were then determined through later conversations with Cabarrus County Planning staff.

### **Meeting Minutes from Cabarrus Stanly Union Regional Hazard Mitigation Planning Committee Kickoff Meeting**

**November 29, 2018**

#### **Cabarrus County Governmental Center**

Bobby Smith, Cabarrus County Director of Emergency Management, opened the meeting by welcoming everyone to the Governmental Center and introducing Nathan Slaughter and Jamie DeRose.

Nathan Slaughter, Department Manager from ESP Associates, Inc. and Project Manager for the update of the CSU Regional Hazard Mitigation Plan, began the meeting by welcoming the attendees and giving a brief overview of the project and the purpose of the meeting.

Mr. Slaughter led the meeting of the Regional Hazard Mitigation Planning Team and began by having attendees introduce themselves. The 44 attendees included representatives from various departments and local jurisdictions within each of the three counties participating in the plan update. All three counties were represented. Mr. Slaughter then provided an overview of the items to be discussed at the meeting and briefly reviewed the agenda and presentation slide handouts. He then defined mitigation and gave a review of the Disaster Mitigation Act of 2000 and NC Senate Bill 300.

To continue, Mr. Slaughter provided detailed information about the project. He mentioned that the project is funded by a FEMA PDM grant, and that NCEM provided the contractor for the update. For this update, there was no local match requirement.

Mr. Slaughter then explained some of the basic concepts of mitigation. He explained how we should think about mitigation: we want to mitigate hazard impacts of existing development in the community (houses, businesses, critical facilities, etc.), and ensure that future development is conducted in a way

that doesn't increase vulnerability. This can be achieved by having good plans, policies, and procedures in place.

Following the overview, Mr. Slaughter led the group in an "icebreaker" exercise to refamiliarize meeting participants to various mitigation techniques. He briefly recapped the six different categories of mitigation techniques: emergency services, prevention, natural resource protection, structural projects, public education and awareness, and property protection. Each attendee was then given \$20 in mock currency and asked to "spend" their mitigation money as they personally deemed appropriate among the six mitigation categories. Money was "spent" by placing it in cups labeled with each of the mitigation techniques. Upon completion of the exercise, Jamie DeRose, Lead Planner from ESP, tabulated and shared the results with the group. The most mock money was spent on emergency services, followed by prevention techniques. These results were compared against those from the previous plan development's ice breaker exercise. This helped demonstrate how priorities in mitigation actions have changed since the previous update.

After the icebreaker exercise, Mr. Slaughter reviewed the key objectives of the project, which are to:

- ◆ Coordinate between the three participating counties to update the regional plan,
- ◆ Update the plan to demonstrate progress and reflect current conditions,
- ◆ Complete the update before the existing plan expires on June 18, 2020,
- ◆ Increase public awareness and education,
- ◆ Maintain grant eligibility for participating jurisdictions,
- ◆ Update the plan in accordance with Community Rating System (CRS) requirements, and
- ◆ Maintain compliance with State and Federal requirements.

Next, he explained new elements to this update, which include the NCEM's RMT, Activity 510 compliance for CRS communities, Risk MAP, Community Wildfire Protection Plans, the NC Resilience Assessment, and EMAP compliance.

Mr. Slaughter reviewed the list of participating jurisdictions with the group, which all agreed to participate again. He also explained the planning process and specific tasks to be accomplished for the project, which include the planning process, risk assessment, capability assessment, mitigation strategy, mitigation action plan, and plain maintenance procedures. For the risk assessment portion of the process, Mr. Slaughter asked each county to designate a point of contact to coordinate the gathering of GIS data required for the analysis. He also reviewed the list of identified hazards and the committee agreed to maintain the previous list of hazards for the three counties.

The project schedule was presented and Mr. Slaughter noted that the twelve-month schedule provided ample time to produce a quality plan and meet state and federal deadlines.

Mr. Slaughter discussed what data would need to be collected to complete the project. This includes GIS Data, Capability Assessment Revisions, a Public Participation Survey, and updates to existing Mitigation Actions.

Mr. Slaughter then reviewed the roles and responsibilities of ESP Associates, Inc, the County leads, and the participating jurisdictions. The presentation concluded with a discussion of the next steps to be

taken in the project development. He encouraged meeting participants to distribute the Public Participation Survey. The next HMPT meeting was scheduled for some time in February 2019 to discuss the findings of the risk and capability assessments and to begin updating existing mitigation actions and identify new goals.

**FIGURE 2.2: Cabarrus Stanly Union Kickoff Meeting**



**Meeting Minutes from Mitigation Strategy Meeting**

**January 24, 2019**

**Cabarrus County Governmental Center**

**10:00 AM – Noon**

Nathan Slaughter, Project Manager from ESP Associates, began the meeting by welcoming the attendees and reviewing the meeting handouts, which included an agenda, existing plan goals for the regional plan, and a hard copy of the meeting presentation. Mr. Slaughter asked meeting attendees to introduce themselves and gave a refresher on mitigation, why we plan, and the key objectives of the project. He reviewed the participating jurisdictions, project tasks and project schedule. He stated that a draft of the updated Regional Hazard Mitigation Plan would be presented in May.

Jamie DeRose, Lead Planner from ESP Associates, then presented the findings of the risk assessment. She shared the list of all hazards that are addressed in the regional plan, and reviewed the list of hazards addressed in the North Carolina State Hazard Mitigation Plan. She discussed a couple of caveats for the risk assessment and indicated that best available data was used. While that information is helpful, events are often under-reported, so it is important to keep the end goal in sight. The purpose of the risk assessment was shared: to compare hazards and determine which should be the focus of the mitigation actions. Finally, she mentioned to the stakeholders that it ultimately is their risk assessment, so their recommendations for adjustment are welcomed and encouraged.

Ms. DeRose stated that since the last plan was updated, there have been two Presidential disaster declarations that have impacted the region, which helped emphasize the need to continue updating the mitigation plan.

The following Hazard Profiles and summaries of each hazard were then shared:

- ◆ DROUGHT: There were 19 regional drought events between 2010 and 2018, and future occurrences are likely.
- ◆ HAILSTORM: There have been 283 recorded events since 1959. Future occurrences are likely.
- ◆ HURRICANE AND COASTAL STORM: 59 storm tracks have come within 75 miles of the region since 1854. 4 of those were classified as a hurricane or tropical storm. Future occurrences are likely.
- ◆ LIGHTNING: Since 1996, there have been 31 reported occurrences, which resulted in 8 injuries and \$2.2 million dollars in property damage. Future occurrences are highly likely.
- ◆ TORNADOES: There have been 43 recorded events since 1989, causing one death, 30 injuries, and \$144,556,583 in property damage. Future occurrences are likely.
- ◆ SEVERE THUNDERSTORMS AND HIGH WIND: 585 severe thunderstorm events have been recorded since 1957. These events resulted in 7 injuries and \$2.19 million in property damages. Future occurrences are highly likely.
- ◆ WINTER STORM AND FREEZE: 135 winter weather events that resulted in over \$19 million in property damage have been recorded since 1993. Future occurrences are highly likely.
- ◆ DAM AND LEVEE FAILURE: Of the 242 dams in the region, 58 are considered high hazard dams. No serious breaches have been reported, and future occurrences are unlikely.
- ◆ EROSION: Although little information could be obtained on erosion occurrences in the region, erosion was addressed in the previous Stanly County plan. Future occurrences are possible.
- ◆ FLOOD: 197 flood events have occurred since 1883, resulting in over \$19.2 million in property damage, 6 deaths, and 4 injuries. There have also been 266 reported NFIP losses since 1978 and approximately \$4.8 million in claims. There are 24 repetitive loss properties, and future occurrences are highly likely.
- ◆ EARTHQUAKE: No significant earthquake events have taken place in the region, but future occurrences are possible.
- ◆ LANDSLIDE: No records of severe landslides were reported, and future occurrences are possible.
- ◆ HAZARDOUS MATERIALS INCIDENTS: 8 serious HAZMAT events have been reported through the PHMSA. There are 11 TRI Facilities in the region. Future occurrences are possible.
- ◆ TERROR THREAT: There have not been any terror threats in the region, but terrorism is still important to cover as a hazard. Future occurrences are unlikely.
- ◆ WILDFIRE: FEMA reports that 188 acres in the region are burned every year on average. Future occurrences are likely.

## SECTION 2: PLANNING PROCESS

---

In concluding the review of Hazard Profiles, Ms. DeRose stated if anyone had additional information for the hazard profiles, or disagreed with any of the data presented, they should call or email her with their concerns.

The results of the hazard identification process were used to generate a Priority Risk Index (PRI), which categorizes and prioritizes potential hazards as high, moderate or low risk based on probability, impact, spatial extent, warning time, and duration. The highest PRI was assigned to Winter Storms and Freeze, followed by Severe Thunderstorm and Flood. The committee reviewed most recent hazard profile data and discussed moving wildfire down and HAZMAT up in rankings.

Ms. DeRose then displayed maps that presented each county's social vulnerability, as documented by the Center for Disease Control. The maps present how socially vulnerable areas in each county are as compared to the rest of North Carolina. Many indicators were used to determine the social vulnerability, and the factors were grouped into four themes that were based on census-tract levels.

After a brief break, Mr. Slaughter then presented the Capability Assessment Findings. ESP Associates used a scoring system that was used to rank the participating jurisdictions in terms of capability in four major areas (Planning and Regulatory; Administrative and Technical; Fiscal; Political). Important capability indicators include National Flood Insurance Program (NFIP) participation, Building Code Effective Grading Schedule (BCEGS) score, Community Rating System (CRS) participation, and the Local Capability Assessment Survey conducted by ESP Associates.

Mr. Slaughter reviewed the Relevant Plans and Ordinances, Relevant Staff/Personnel Resources, and Relevant Fiscal Resources. All of these categories were used to rate the overall capability of the participating counties and jurisdictions. Most jurisdictions are in the moderate to high range for Planning and Regulatory Capability and in the low to moderate range for Fiscal Capability. There is variation between the jurisdictions for Administrative and Technical Capability, mainly with respect to availability of planners and grant writers. Based upon the scoring methodology, it was determined that all of the participating jurisdictions have moderate or high capabilities to implement hazard mitigation programs and activities.

Mr. Slaughter then transitioned to the Mitigation Strategy portion of the presentation. He began by reviewing some of the major concepts of mitigation and then gave the results of the icebreaker exercise from the first Regional Hazard Mitigation Planning Committee meeting, where attendees were given "money" to spend on various hazard mitigation techniques. The results were as follows:

◆ Emergency Services	\$107
◆ Prevention	\$93
◆ Public Education and Awareness	\$59
◆ Structural Projects	\$42
◆ Natural Resource Protection	\$28
◆ Property Protection	\$12

Mr. Slaughter gave an overview of the process for updating the Mitigation Strategy and presented the existing mitigation goals for the regional plan. He asked the Regional Hazard Mitigation Planning

Committee to review the goals to determine whether or not they still reflect current vulnerabilities and current mitigation priorities. The committee members agreed that the existing goals should remain unchanged.

Mr. Slaughter then indicated that each participating jurisdiction would need to provide a detailed status update for their existing mitigation actions by February 28, 2019. Mr. Slaughter also discussed the Mitigation Action Worksheets to be completed for any new mitigation actions and requested that all worksheets be returned by February 28, 2019. Mr. Slaughter then presented sample mitigation actions for the committee members to consider to include in their plan update.

During a working lunch, the attendees split into three groups by county. They were instructed to look at large maps of their counties that included major roads and floodplains and identify vulnerable areas that could be considered for potential new mitigation actions.

Mr. Slaughter and Ms. DeRose then discussed the results of the public participation survey that was posted on several of the participating counties' and jurisdictions' websites. As of the meeting date, 160 responses had been received. Based on the preliminary results, respondents felt that winter storms, severe thunderstorms, and floods posed the greatest threats to their neighborhood. Most did not live in a floodplain or have flood insurance, but 70% of all respondents did not know who to contact regarding reducing their risks to hazards.

Finally, Mr. Slaughter discussed the next steps in the planning process. These included returning mitigation action updates and delivery of a draft plan in May 2019. He thanked the group for taking the time to attend and the meeting was adjourned.

**FIGURE 2.3: Cabarrus Stanly Union Mitigation Strategy Workshop**



## 2.6 INVOLVING THE PUBLIC

### 44 CFR Requirement

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

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

Public involvement in the development of the *Cabarrus Stanly Union Regional Hazard Mitigation Plan* was sought using three methods: (1) physical public meetings, (2) public survey instruments were made available in hard copy and online; and (3) copies of the draft Plan deliverables were made available for public review on county municipal websites and at government offices. Thus, the public was provided three opportunities to be involved in the development of the regional plan at three 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 and (3) just prior to plan adoption. Documentation of these efforts is provided in Appendix D.

In addition to the opportunities for public comments previously discussed, each of the participating jurisdictions will hold public meetings before the final plan is officially adopted by the local governing bodies. These meetings will occur at different times once FEMA has granted conditional approval of the Plan. Adoption resolutions will be included in Appendix A.

**Meeting Minutes from Public Meeting #1  
November 29, 2018  
Cabarrus County Governmental Center**

Nathan Slaughter, Department Manager from ESP Associates, Inc. and Project Manager for the update of the CGL Regional Hazard Mitigation Plan, began the meeting by meeting individually with each attendee. He gave a brief overview of the project and the purpose of the meeting.

He explained that the project is funded by a FEMA PDM grant and is conducted to comply with the Disaster Mitigation Act of 2000 and NC Senate Bill 300. He then discussed the region's high, moderate, and low risk hazards that the Regional Hazard Mitigation Planning Team had elected.

Next, Mr. Slaughter identified the six hazard mitigation planning techniques: prevention, property protection, natural resource protection, structural projects, emergency services, and public education and awareness. He followed by providing the list of all participating counties and their respective jurisdictions.

Mr. Slaughter then showed an example of the previous Mitigation Action Plan and asked the following questions:

- ◆ Where are trouble spots in your neighborhood?
- ◆ How can mitigation be improved in your community?
- ◆ Which mitigation techniques need improvement?

The meeting concluded after the attendees gave their personal opinions and filled out the public survey.

The final opportunity for public input on the plan came at each participating jurisdictions' County or City Council meeting where the plan was presented for formal adoption. Each of those meetings are open to the public and therefore provided the public an opportunity to provide any final input or comments on the plan.

### **2.6.1 Public Participation Survey**

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

Copies of the *Public Participation Survey* were distributed to the Regional Hazard Mitigation Planning Committee be made available for residents to complete at local public offices. A link to an electronic version of the survey was also posted on each county's and many municipalities' website. Additionally,

media coverage about the project, and the public survey, was provided during the development of the plan.

A total of 169 survey responses were received, which provided valuable input for the Regional Hazard Mitigation Planning Committee to consider in the development of the plan update. Selected survey results are presented below.

- ◆ 49.1 percent of survey respondents have been impacted by a disaster, mainly hurricanes (Hugo—1989), flooding, and severe winter weather.
- ◆ Respondents ranked severe thunderstorm/high wind as the highest threat to their neighborhood (43.1 percent), followed by severe winter weather (25.6 percent).
- ◆ Approximately 53.3 percent of respondents have taken actions to make their homes more resistant to hazards and 83.4 percent are interested in making their homes more resistant to hazards.
- ◆ 70 percent of respondents do not know what office to contact regarding reducing their risks to hazards.
- ◆ Emergency Services and Public Education were ranked as the most important activities for communities to pursue in reducing risks.

Full results from the public survey can be found by contacting North Carolina Emergency Management’s Hazard Mitigation Planning section.

## 2.7 INVOLVING THE STAKEHOLDERS

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

At the beginning of the planning process for the development of this plan, the project consultant worked with each of the three County Emergency Management leads to initiate outreach to stakeholders to be involved in the planning process. The project consultant sent out a list of recommended stakeholders provided from FEMA Publication 386-1 titled **Getting Started: Building Support for Mitigation Planning**, which demonstrated the wide range of stakeholders that were considered to participate in the development of this plan. Each of the County Emergency Management leads used that list for reference as they invited stakeholders from their counties to participate in the planning process.

In addition to participation from a wide variety of County-level departments, additional stakeholders that were involved in the process of developing this plan included: North Carolina Division of Emergency Management (NCEM), Stanly Regional Medical Center, Wingate University, American Red Cross, Cabarrus Health Alliance, Carolinas Health Care, Cabarrus County Schools and others (see Section 2.9 and 2.10 below and Appendix D).

The Regional Hazard Mitigation Committee encouraged more open and widespread participation in the mitigation planning process. The region also went above and beyond in its local outreach efforts through the design and distribution of the *Public Participation Survey*. This opportunity was provided for local officials, residents, businesses, academia, and other private interests in the Cabarrus Stanly Union Region to be involved and offer input throughout the local mitigation planning process.

## 2.8 DOCUMENTATION OF PLAN PROGRESS

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

Further documentation of plan implementation progress can be found in the Capability Assessment. Community capability continues to improve for each participating jurisdiction with the implementation of new plans, policies and programs that help to promote hazard mitigation at the local level. The current state of local capabilities for the participating jurisdictions is captured in Section 7: *Capability Assessment*. The participating jurisdictions continue to demonstrate their commitment to hazard mitigation and hazard mitigation planning and have proven this by reconvening the Regional Hazard Mitigation Committee to update the Plan and by continuing to involve the public in the hazard mitigation planning process.

## 2.9 CABARRUS COUNTY CRS PLANNING PROCESS DOCUMENTATION

As a participant in the NFIP's CRS program, Cabarrus County has taken additional steps during the 2020 update of this plan to meet the CRS requirements of Activity 510: Floodplain Management Planning and attempt to maximize the number of points the County receives for this activity for this plan. Specific to the planning process, the County ensured the following activities took place:

- ◆ Assigned Cabarrus County staff to serve on the Regional Hazard Mitigation Planning Committee. The staff members assigned to the committee actively participated in the plan update process and represent a wide range of staff expertise in the areas of mitigation techniques. The Cabarrus County staff and their associated area of expertise are listed in Table 2.5.

**TABLE 2.5: CABARRUS COUNTY STAFF MEMBERS OF THE CABARRUS STANLY UNION REGIONAL HAZARD MITIGATION PLANNING TEAM AND THEIR AREA OF EXPERTISE**

**SECTION 2: PLANNING PROCESS**

NAME	DEPARTMENT / AGENCY / TITLE	MITIGATION TECHNIQUE					
		PREVENTION MEASURES	PROPERTY PROTECTION	NATURAL RESOURCE PROTECTION	EMERGENCY SERVICES	STRUCTURAL PROJECTS	PUBLIC INFORMATION
Smith, Bobby	Cabarrus County EM	X	X	X	X	X	X
Jones, Barbi	Cabarrus County Chamber of Commerce						X
Gustafson, Dawn	Cabarrus County EM, Executive Assistant	X	X	X	X	X	X
Burnett, Jason	Cabarrus County EM, Planner	X	X	X	X	X	X
Hilley, Jessica	Cabarrus County Transportation					X	X
Marshall, Jonathan	Cabarrus County, Deputy County Manager	X	X	X	X	X	X
Sifford, Kelly	Cabarrus County Planning Department, Director	X	X	X		X	X
Burton, Kristin	Cabarrus County Outreach Coordinator						X
Weslow, L J	Rider Transit					X	X
Gillelard, Ray	Cabarrus County Sheriff's Office				X		
Bushey, Robert	Cabarrus County Transportation, Manager					X	X
McGhee, Ryan	Cabarrus Health Alliance, Executive Management	X					X

**SECTION 2: PLANNING PROCESS**

NAME	DEPARTMENT / AGENCY / TITLE	MITIGATION TECHNIQUE					
		PREVENTION MEASURES	PROPERTY PROTECTION	NATURAL RESOURCE PROTECTION	EMERGENCY SERVICES	STRUCTURAL PROJECTS	PUBLIC INFORMATION
Fearrington, Susan	Cabarrus County Finance Director					X	X
Morris, Susie	Cabarrus County Planning Department, Planning and Zoning Manager	X	X	X	X	X	X

- ◆ Ensured that the first public meeting held during the plan update process was conducted within the first two months of the planning process. As previously documented, the first meeting in the plan update process (Internal Kickoff Conference Call) was held on October 10. The first public meeting was held in the evening of November 29 following the official Kickoff Meeting with the Regional Hazard Mitigation Planning Committee and just over a month from the beginning of the plan update process.
- ◆ Invited multiple outside stakeholders to participate in the plan update process. An email was sent to the following stakeholders to invited them to attend the public meeting. The email invitation is included in Appendix D.

- ◆ **Atrium Health**
- ◆ **Carolinas Health Care**
- ◆ **American Red Cross**
- ◆ Kannapolis City Schools
- ◆ Cabarrus County Schools
- ◆ **Celgard**
- ◆ **Corning Inc**

Bold font indicates the organizations that attended the meeting and filled out public surveys.

- ◆ Cabarrus County initially wanted to hold one final public meeting at least two weeks before submittal of the final plan to Cabarrus County’s Board of County Commissioners for adoption. The meeting was scheduled for April 1, 2020; however, this effort was cancelled as the County was dealing with the COVID-19 pandemic during this time and public meetings were not possible.

## 2.10 CITY OF CONCORD CRS PLANNING PROCESS DOCUMENTATION

The City of Concord also participates in the CRS and has taken the following additional steps during the planning process for this update to ensure points will be earned for Activity 510:

- ◆ Assigned City of Concord staff to serve on the Regional Hazard Mitigation Planning Committee. The staff members assigned to the committee actively participated in the plan update process and represent a wide range of staff expertise in the areas of mitigation techniques. The City of Concord staff and their associated area of expertise are listed in Table 2.6.

**TABLE 2.6: CITY OF CONCORD MEMBERS OF THE CABARRUS STANLY UNION REGIONAL HAZARD MITIGATION PLANNING TEAM AND THEIR AREA OF EXPERTISE**

NAME	DEPARTMENT / AGENCY / TITLE	MITIGATION TECHNIQUE					
		PREVENTION MEASURES	PROPERTY PROTECTION	NATURAL RESOURCE PROTECTION	EMERGENCY SERVICES	STRUCTURAL PROJECTS	PUBLIC INFORMATION
Crane, Ian	Concord Emergency Management, Assistant Coordinator	X	X	X	X	X	X
Sells, Jim	Concord Emergency Management Coordinator	X	X	X	X	X	X
Allen, Ray	Concord Fire Department				X		X

- ◆ Ensured that the first public meeting held during the plan update process was conducted within the first two months of the planning process. As previously documented, the first meeting in the plan update process (Internal Kickoff Conference Call) was held on October 10. The first public meeting was held in the evening of November 29 following the official Kickoff Meeting with the Regional Hazard Mitigation Planning Committee and just over a month from the beginning of the plan update process.
- ◆ Invited multiple outside stakeholders to participate in the plan update process. An email was sent to the following stakeholders to invited them to attend the public meeting. The email invitation is included in Appendix D.

- ◆ **Atrium Health**
- ◆ **Carolinas Health Care**
- ◆ **American Red Cross**
- ◆ Kannapolis City Schools
- ◆ Cabarrus County Schools

- ◆ **Celgard**
- ◆ **Corning Inc**

Bold font indicates the organizations that attended the meeting and filled out public surveys.

- ◆ The City of Concord initially wanted to hold one final public meeting at least two weeks before submittal of the final plan to City Council for adoption. The meeting was scheduled for April 1, 2020; however, this effort was cancelled as the City was dealing with the COVID-19 pandemic during this time and public meetings were not possible.

# SECTION 3

## COMMUNITY PROFILE

This section of the Plan provides a general overview of the Cabarrus Stanly Union Region. It consists of the following four subsections:

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

### 3.1 GEOGRAPHY AND THE ENVIRONMENT

The Cabarrus Stanly Union Region is located in the south-central portion of North Carolina, east of Charlotte. An orientation map is provided as **Figure 3.1**.

The Cabarrus Stanly Union Region’s location provides easy access to the major metropolitan area of Charlotte while maintaining a small town, rural environment. The region is one of the fastest growing areas in the state of North Carolina with flourishing suburban and industrial growth amid large natural areas untouched by development. Numerous parks and recreational activities are available throughout the region. Tourism is maintained through various events such as the Queen’s Cup Steeplechase and NASCAR Monster Energy Cup Series at the Charlotte Motor Speedway along with significant historic sites including the Reed Gold Mine, which is a designated National Historic Landmark.

The Cabarrus Stanly Union Region is located in the Carolina Piedmont consisting of rolling countryside with no significant peaks or points. The region is along the Uwharrie Lakes section of the North Carolina Piedmont. The Uwharrie Mountains do span across the northeastern part of the region in Stanly County and the range’s foothills stretch into Cabarrus and Union County. Lake Lynn is a small 18-acre natural lake located in Cabarrus County offering multiple recreational activities and habitats for numerous species and Badin Lake is a large recreational lake that forms much of the eastern border of Stanly County.

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

**TABLE 3.1: TOTAL LAND AREAS OF PARTICIPATING COUNTIES**

County	Total Land Area
Cabarrus County	362 square miles
Stanly County	395 square miles
Union County	632 square miles

*Source: United States Census Bureau*

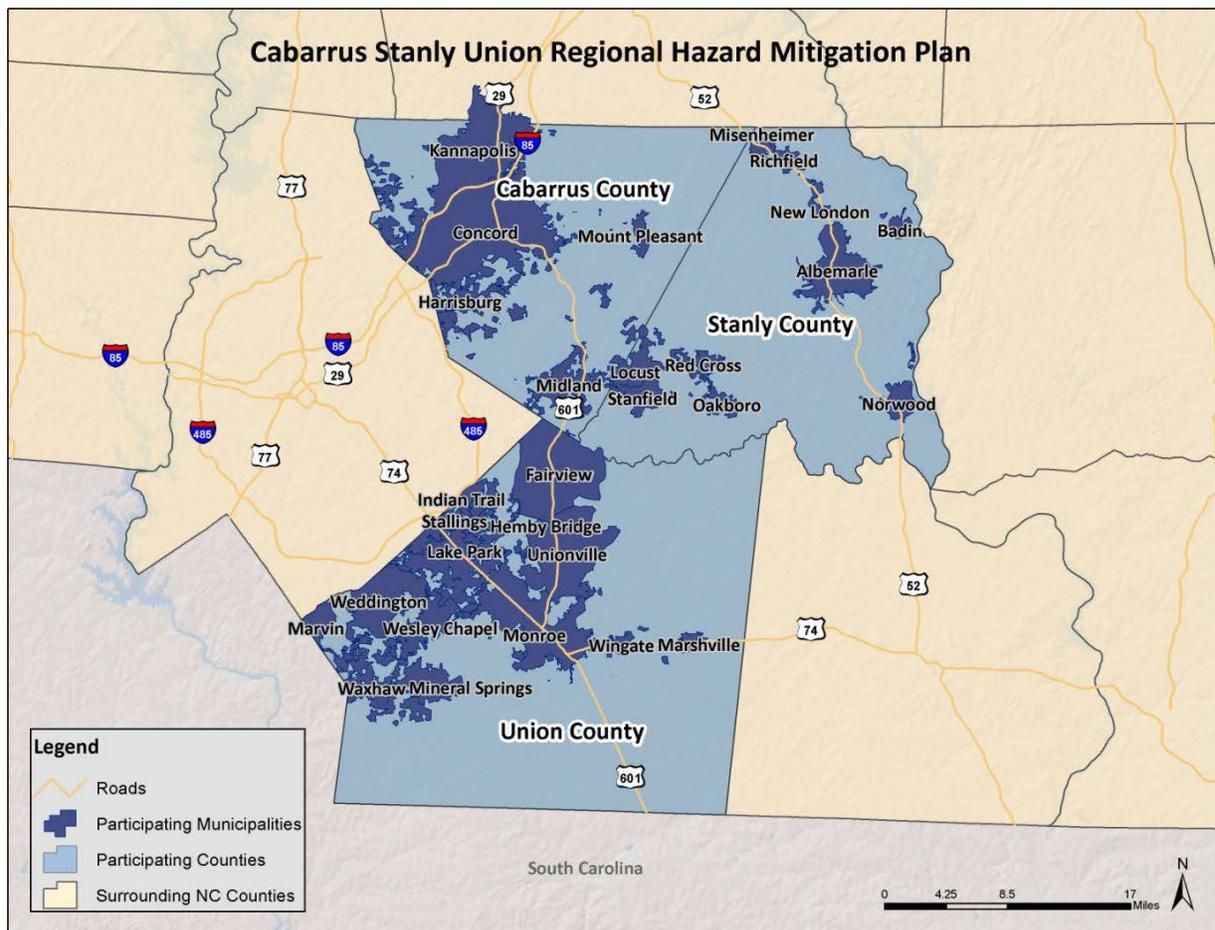
The Cabarrus Stanly Union Region enjoys a moderate climate that is characterized by cool winters and

warm summers. From March through May, temperatures have an average of 61°F ranging from an average high of 89°F in July and an average low of 52°F in January. Typically, the weather is milder by mid-April and warm in May. The highest recorded temperature in the region is 110°F in 1983 and the lowest -16°F in 1899.

Summers are long and described as warm and humid. Afternoon temperatures are often in the low 90°F; however, temperatures reaching up to 100°F can occur. Summer months temperatures have an average high of 85.7°F and a low of 62.6°F. Rainfall is generally evenly distributed throughout the year, with the driest weather usually in the fall. Summer rain is usually provided by thunderstorms and occasional dry periods can range from one to three weeks. Annual average precipitation is around four inches per month.

Generally, temperatures reach the freezing point slightly more than half of the winter days. Winter weather can be described as changeable with occasional cold periods, but extreme cold periods tend to be rare. Winter months' temperatures have an average high of 57.5°F and a low of 32.8°F. Snow is infrequent but can occur as early as November or December. Heavy snowfall can also occur, but historically accumulation does not stay on the ground for more than a day or two. Annual snowfall average is around six inches per year. On the average, temperatures have reached freezing in early April in the spring and early November in the fall.

**FIGURE 3.1: CABARRUS STANLY UNION REGION ORIENTATION MAP**



## 3.2 POPULATION AND DEMOGRAPHICS

Union County is the largest participating county by area and it also has the largest population. Between 2010 and 2018, all of the participating jurisdictions experienced population growth. Union County had the highest county growth rate at 14.9%. Population counts from the US Census Bureau for 1990, 2000, 2010, and 2018 for each of the participating counties are presented in **Table 3.2**.

**TABLE 3.2: POPULATION COUNTS FOR PARTICIPATING COUNTIES**

Jurisdiction	1990 Census Population	2000 Census Population	2010 Census Population	2018 Population Estimates	% Change 2010-2018
<b>Cabarrus County</b>	98,935	131,063	178,011	211,342	18.7%
<b>Stanly County</b>	51,765	58,100	60,585	62,075	2.5%
<b>Union County</b>	84,211	123,677	201,292	235,908	17.2%

Source: United States Census Bureau

Based on US Census Bureau estimates, in 2018 the median age of residents of the participating counties ranges from 38 to 42 years. The racial characteristics of the participating counties are presented in Table 3.3. Generally, whites make up the majority of the population in the region accounting for over 74 percent of the population in Cabarrus, Stanly, and Union Counties. Cabarrus County has the most diverse population within the region.

**TABLE 3.3: DEMOGRAPHICS OF PARTICIPATING COUNTIES**

Jurisdiction	White, Percent (2017)	Black or African American, Percent (2017)	American Indian or Alaska Native, Percent (2017)	Asian, Percent (2017)	Native Hawaiian or Other Pacific Islander, Percent (2010)	Persons of Hispanic Origin, Percent (2017) *	Two or More Races, Percent (2017)
<b>Cabarrus County</b>	74.4%	18.5%	0.7%	4.1%	0.1%	10.4%	2.3%
<b>Stanly County</b>	84.1%	11.6%	0.4%	2.1%	0.3%	4.3%	1.4%
<b>Union County</b>	82.0%	12.3%	0.6%	3.1%	0.1%	11.3%	2.0%

\*Hispanics may be of any race, so also are included in applicable race categories

Source: United States Census Bureau

## 3.3 HOUSING, INFRASTRUCTURE, AND LAND USE

### 3.3.1 Housing

According to the US Census Bureau, in 2017 there were 188,377 housing units in the Cabarrus Stanly Union Region, the majority of which are single family homes or mobile homes. Housing information for the three participating counties is presented in **Table 3.4**. As shown in the table, Cabarrus and Union Counties have housing stocks with less than one percent made up of seasonal housing units.

**TABLE 3.4: HOUSING CHARACTERISTICS OF PARTICIPATING COUNTIES**

Jurisdiction	Housing Units (2010)	Housing Units (2018)	Seasonal Units, Percent (2018)	Median Home Value (2013-2017)
<b>Cabarrus County</b>	71,937	80,873	0.9%	\$180,300
<b>Stanly County</b>	27,110	27,988	3.4%	\$133,000
<b>Union County</b>	72,870	82,557	0.9%	\$215,200

Source: United States Census Bureau

### 3.3.2 Infrastructure

#### **Transportation**

There are several major highways that cross the Cabarrus Stanly Union Region. Interstate 85 runs from South Carolina to Virginia through the state of North Carolina and the Cabarrus Stanly Union Region. US 29 and US 52 are two north-south highways connecting South Carolina with Virginia through North Carolina. I-85, US 29, and US 52 provide access to Charlotte. Highway 74 is a major highway that runs through the region. It runs east to west from Chattanooga, Tennessee to Wrightsville Beach, North Carolina and connects the region to the North Carolina Coastline.

Highway expansion projects are currently underway in the region allowing increased access. Future road segments of I-74 are to be constructed within the region to increase access throughout North Carolina. A proposed Highway 74 by-pass will enable Union County to continue to grow and attract new businesses and residents to the area. Interstate 73 is partially complete and runs north to south through Stanly County. Expansions on Highway 485 will place southwestern Stanly County within 14 miles of Charlotte's interstate system. The major north-south connector within the region is NC Highway 52 and the major east-west roads include NC Highway 24/27 and NC Highway 73. Other important state highways include NC 49, NC 3, NC 601, NC 8, NC 200, NC 205, and NC 740.

Public transportation is offered throughout the Cabarrus Stanly Union Region. Cabarrus County offers public transportation through the Cabarrus County Transportation Services (CCTS). This agency provides transportation services to eligible residents to access necessary medical care and other resources that can improve and enhance their quality of life through transportation routes connecting Mount Pleasant, Midland, and Harrisburg municipalities. Concord and Kannapolis also provide full bus service routes through CK Rider, linking many parts of the community and local government with 10 buses and 7 routes. Stanly County provides community transportation service for its residents. Various schedules are available and vehicle request routes can be utilized. Union County also offers transportation services to residents by request.

The Charlotte/Douglas International Airport is the closest airport serving the Cabarrus Stanly Union Region. The airport currently offers non-stop commercial flights on nine airlines to numerous destinations across the eastern US and Midwest as well as to several international destinations. This airport is approximately 32 miles from Locust, which is roughly located in the center of the region. Other major nearby airports include the Hartsfield-Jackson Atlanta International Airport in Georgia and the Nashville Metropolitan Airport in Tennessee.

Passenger rail service is also provided in Cabarrus County, connecting the region to South Carolina, Central and Eastern North Carolina, and Virginia. Commercial rail service is also provided by three major transportation companies, as well as various shortlines across the three-county region.

#### **Utilities**

Electrical power in the Cabarrus Stanly Union Region is provided by three public utilities. Duke Energy Progress provides service to Cabarrus, Stanly, and Union Counties while Energy United also services Stanley County and Union Energy serves Union County. Electric cooperatives are functioning in the region with Duke Energy serving the City of Kannapolis, the City of Monroe, and Town of Oakboro.

Water and sewer service is provided by many of the counties and towns in the Cabarrus Stanly Union Region. Cabarrus County provides water and sewer service to its residents through the Water and Sewer

Authority of Cabarrus County and additional retail sewer service providers servicing the municipalities of Concord, Kannapolis, Harrisburg, and Mount Pleasant. The Water and Sewer Authority of Cabarrus County operates the Rocky River Regional and Muddy Creek Wastewater Treatment Plants and provides reservoir management for some, or all, of its jurisdictions. Within Stanly County, the Albemarle Wastewater Treatment Plant and Great Badin Wastewater Treatment Plant service the county and municipalities. The City of Albemarle Public Utility Department maintains all the easements of sanitary sewer outfall lines. Union County supplies sewer and water services throughout the county and fourteen municipalities. There are six wastewater facilities within the county and additional facilities are contracted through the City of Monroe and Charlotte-Mecklenburg Utilities. Underground waterlines exist throughout the county and are monitored by the Union County Public Works. Within the City of Concord, two large refined petroleum product interstate pipelines pass through the city limits. Plantation Pipe Line Company and Colonial Pipe Line are part of the system which originates in Louisiana and delivers over 600,000 barrels of petroleum products daily.

**Community Facilities**

There are a number of public buildings and community facilities located throughout the Cabarrus Stanly Union Region. According to the data collected for the vulnerability assessment (Section 6.4.1), there are 86 fire/EMS stations, 29 police stations, and 136 public schools located within the study area. Three hospitals are located in the Cabarrus Stanly Union Region. Carolinas Medical Center has locations in both Union and Cabarrus Counties, the largest of which is CMC-North East, a 447-bed center with an associated rehabilitation facility with 40 beds located in the City of Concord. Stanly Regional Medical Center in Stanly County contains 97 beds in the City of Albemarle.

Cabarrus Stanly Union Region contains numerous local, state, and national parks and recreation areas. Cabarrus County contains 3 county-wide parks, 2 senior centers, and 45 school parks. Camp T.N. Spencer Park is a 50-acre park open to the public and it operates a summer camp in conjunction with the Boy and Girls Club. The park has a community building available for rent in addition to picnic shelters, trails, a playground, a volleyball court, cabins, tent sites, fishing ponds, and other recreational activities. Frank Liske Park is a 238-acre park which was formerly a working farm for the Stonewall Jackson Training School with relics of the Stonewall Jackson Training School still available for public use. A barn can be rented out for gatherings and there are four additional rental areas available. There is also a 10-acre lake for fishing and paddle boating picnic shelters, picnic sites playgrounds, tennis courts, and other additional recreational amenities. A softball complex, walking and fitness trails, nature trail, 18-hole miniature golf course, and a wildlife and nature preserve are available. North Cabarrus Park is a 90-acre park currently undergoing a six phase development process by renewing playgrounds, picnic shelters, picnic sites, volleyball court, basketball courts, walking trails, and various other recreational activities. Additional phases of the park are proposed to create additional recreational facilities and trails. Senior Centers are located in the Cities of Concord and Mount Pleasant which provide services and programs for older adults, adults with disabilities, and their caregivers.

Within Stanly County, there are 22 parks. Morrow Mountain Park offers camping facilities, cabins, hiking trails, fishing, canoe rental, swimming, equestrian trails, and picnic shelters. Locust City Park and Officer Jeff Shelton Memorial Park have a complete sports complex composing of four baseball/softball fields, football field, tennis court, two soccer fields, playground, basketball court, walking trail, and additional recreational facilities.

Union County contains one very large park and two recreational complexes. Cane Creek Park is a 1,050-acre park surrounding a 350-acre lake with a variety of outdoor activities such as fishing, miniature golf,

and other recreational facilities. Jesse Helms Soccer Complex and Fred Kirby Park Athletic Fields are two facilities devoted to recreational activities including soccer fields, baseball fields, a playground, and a trail.

The Carolina Thread trail also winds its way through the Cabarrus Stanly Union Region as part of a regional trail and greenway network that will link 15 counties. The Carolina Thread Trail creates a permanent legacy of conservation by linking communities and attractions across North and South Carolina and also serves as a great place for walking, biking, commuting, and simply enjoying.

### **3.3.3 Land Use**

The Cabarrus Stanly Union Region has experienced growth because of its proximity to the City of Charlotte. As shown in **Figure 3.1** above, there are several incorporated municipalities located throughout the region, and these areas are where the region's population is generally concentrated. The incorporated areas are also where many businesses, commercial uses, and institutional uses are located. Growth occurring in populated areas is coincident with utility service areas. Sustainability is a key element of land use guidance by focusing development to areas where physical conditions of the land can naturally support the development. Maintaining the land use challenges that comes as communities transition from small towns to growing bedroom communities will continue to be important in the region. Local land use (and associated regulations) is further discussed in *Section 7: Capability Assessment*.

## **3.4 EMPLOYMENT AND INDUSTRY**

The Cabarrus Stanly Union Region's population is expanding, which is resulting in an increase of economic development to support the growing population. The region has a diverse economy with employment in various industries. Agriculture, business, and industry contribute to the economic growth of the region. Significant employers are prevalent throughout the Cabarrus Stanly Union Region.

According to the North Carolina Department of Commerce, Labor and Economic Analysis Division, in 2018, Cabarrus County had a labor force of 109,139. As of 2018, the top five employers in Cabarrus County were Amazon, Cabarrus County Schools, Atrium Health, Wal-Mart Associates and Cabarrus County. The average unemployment rate was 3.2 compared to the State rate of 3.7.

As of 2018, Stanly County had a labor force of 30,153 and the top five employers in Stanly County were Stanly County Schools, Atrium Health, Stanly County, Wal-Mart Associates and Michelin Tire Center. The average unemployment rate was 3.3 compared to the State rate of 3.7.

And as of 2018, Union County had a labor force of 124,074 and the top five employers in Union County were Union County Public Schools, Tyson Farms, TDY Industries, Union County and Harris Teeter. The average unemployment rate was 3.1 compared to the State rate of 3.7.

# SECTION 4

## HAZARD IDENTIFICATION

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

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

### 44 CFR Requirement

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

## 4.1 OVERVIEW

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

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the participating counties in the Cabarrus Stanly Union Region have identified a number of hazards that are to be addressed in its Regional Hazard Mitigation Plan. These hazards were identified through an extensive process that utilized input from the Cabarrus Stanly Union Regional Hazard Mitigation Planning Committee members, research of past disaster declarations in the participating counties<sup>1</sup>, and review of the North Carolina State Hazard Mitigation Plan (2018). To maintain consistency, the Cabarrus Stanly Union Planning Committee voted to assess the same hazards that were identified in the most recent update of the North Carolina State Hazard Mitigation Plan. A list of all previous hazards covered in the 2014 Cabarrus Stanly Union Regional Hazard Mitigation Plan is viewable in **Table 4.1**, along with a summary of the hazards assessed in this update. Readily available information from reputable sources (such as federal and state agencies) was also evaluated to supplement information from these key sources.

<sup>1</sup> A complete list of disaster declarations for the Cabarrus Stanly Union Region can be found below in Section 4.3.

**TABLE 4.1: 2020 CABARRUS STANLY UNION HAZARDS UPDATE**

2014 Cabarrus Stanly Union Identified Hazards		2020 Cabarrus Stanly Union Identified Hazards		Sub hazards covered in 2020 Plan and Explanations
<b>Atmospheric Hazards</b>	Drought	Drought	<b>Natural Hazards</b>	Agricultural Drought, Hydrological Drought
	Hailstorm			Assessed under "Tornadoes/Thunderstorms"
	Heat Wave	Excessive Heat		
	Hurricane and Tropical Storm	Hurricane and Coastal Hazards		Storm Surge associated with Hurricanes and Nor'easters, High Wind associated with Hurricanes and Nor'easters, Torrential Rain, Tornadoes Associates with Hurricanes, Severe Winter Weather associated with Nor'easters
	Lightning			Assessed under "Tornadoes/Thunderstorms"
	Tornado	Tornadoes/Thunderstorms		Hailstorm, Torrential Rain associated with Severe Thunderstorms, Thunderstorm Wind, Lightning, Waterspout, High Wind
	Severe Thunderstorm			Assessed under "Tornadoes/Thunderstorms"
	Winter Storm and Freeze	Severe Winter Weather		Freezing Rain, Snowstorms, Blizzards, Wind Chill, Extreme Cold
<b>Hydrologic Hazards</b>	Dam and Levee Failure	Dam Failures	<b>Other Hazards</b>	
	Erosion			Assessed under "Geological"
	Flood	Flooding		
<b>Geologic Hazards</b>	Earthquake	Earthquakes		
	Landslide	Geological		Landslides, Sinkholes, Erosion
<b>Other Hazards</b>	Wildfire	Wildfires		
		Infectious Disease		
<b>Other Hazards</b>	Hazardous Materials Incident	Hazardous Substances	<b>Technological Hazards</b>	Hazardous Materials, Hazardous Chemicals, Oil Spill
	Nuclear Accident	Radiological Emergency – Fixed Nuclear Facilities		
		Terrorism		Chemical, Biological, Radiological, Nuclear, Explosive
		Cyber		
		Electromagnetic Pulse		

**Table 4.2** lists the full range of natural hazards initially identified for inclusion in the Plan and provides a

brief description for each. This table includes 24 individual hazards. Some of these hazards are considered to be interrelated or cascading, but for preliminary hazard identification purposes these individual hazards are broken out separately.

Next, **Table 4.3** lists the disaster declarations in the Cabarrus Stanly Union Region.

**Table 4.4** documents the evaluation process used for determining which of the initially identified hazards are considered significant enough to warrant further evaluation in the risk assessment. For each hazard considered, the table indicates whether or not the hazard was identified as a significant hazard to be further assessed, how this determination was made, and why this determination was made. The table works to summarize not only those hazards that *were* identified (and why) but also those that *were not* identified (and why not). Hazard events not identified for inclusion at this time may be addressed during future evaluations and updates of the risk assessment if deemed necessary by the Regional Hazard Mitigation Planning Committee during the plan update process.

Lastly, **Table 4.5** provides a summary of the hazard identification and evaluation process noting that 15 of the 23 initially identified hazards are considered significant enough for further evaluation through this Plan’s risk assessment (marked with a “☑”).

## 4.2 DESCRIPTION OF FULL RANGE OF HAZARDS

**TABLE 4.2: DESCRIPTIONS OF THE FULL RANGE OF INITIALLY IDENTIFIED HAZARDS**

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

<b>Hazard</b>	<b>Description</b>
	<p>provoke dust storms and low visibility. An extreme heat event combined with a drought can be very dangerous and have severe economic consequences on a community.</p>
<b>Hurricane and Tropical Storm</b>	<p>Hurricanes and tropical storms are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and with a diameter averaging 10 to 30 miles across. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves and tidal flooding which can be more destructive than cyclone wind. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea and Gulf of Mexico during the official Atlantic hurricane season, which extends from June through November.</p>
<b>Lightning</b>	<p>Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a “bolt” when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 73 people are killed each year by lightning strikes in the United States.</p>
<b>Nor’easter</b>	<p>Similar to hurricanes, nor’easters are ocean storms capable of causing substantial damage to coastal areas in the Eastern United States due to their associated strong winds and heavy surf. Nor'easters are named for the winds that blow in from the northeast and drive the storm up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful. Nor’easters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating</p>

Hazard	Description
<b>Tornado</b>	<p>high surf that causes severe beach erosion and coastal flooding.</p> <p>A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. Tornadoes are most often generated by thunderstorm activity when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The destruction caused by tornadoes ranges from light to catastrophic depending on the intensity, size and duration of the storm.</p>
<b>Severe Thunderstorm</b>	<p>Thunderstorms are caused by air masses of varying temperatures meeting in the atmosphere. Rapidly rising warm moist air fuels the formation of thunderstorms. Thunderstorms may occur singularly, in lines, or in clusters. They can move through an area very quickly or linger for several hours. Thunderstorms may result in hail, tornadoes, or straight-line winds. Windstorms pose a threat to lives, property, and vital utilities primarily due to the effects of flying debris and can down trees and power lines.</p>
<b>Winter Storm and Freeze</b>	<p>Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 miles per hour, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, power lines, communication towers, structures, roads and other hard surfaces. Winter storms and ice storms can down trees, cause widespread power outages, damage property, and cause fatalities and injuries to human life.</p>
<b>GEOLOGIC HAZARDS</b>	
<b>Earthquake</b>	<p>A sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the surface. This movement forces the gradual building and accumulation of energy. Eventually, strain becomes so great that the energy is abruptly released, causing the shaking at the earth's surface which we know as an earthquake. Roughly 90 percent of all earthquakes occur at the boundaries where plates meet, although it is possible for earthquakes to occur entirely within plates. Earthquakes can affect hundreds of thousands of square miles; cause damage to property measured in the tens of billions of dollars; result in loss of life and injury to</p>

Hazard	Description
	hundreds of thousands of persons; and disrupt the social and economic functioning of the affected area.
<b>Expansive Soils</b>	Soils that will exhibit some degree of volume change with variations in moisture conditions. The most important properties affecting degree of volume change in a soil are clay mineralogy and the aqueous environment. Expansive soils will exhibit expansion caused by the intake of water and, conversely, will exhibit contraction when moisture is removed by drying. Generally speaking, they often appear sticky when wet, and are characterized by surface cracks when dry. Expansive soils become a problem when structures are built upon them without taking proper design precautions into account with regard to soil type. Cracking in walls and floors can be minor, or can be severe enough for the home to be structurally unsafe.
<b>Landslide</b>	The movements of a mass of rock, debris, or earth down a slope when the force of gravity pulling down the slope exceeds the strength of the earth materials that comprise to hold it in place. Slopes greater than 10 degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high.
<b>Land Subsidence</b>	The gradual settling or sudden sinking of the Earth’s surface due to the subsurface movement of earth materials. Causes of land subsidence include groundwater pumping, aquifer system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost.
<b>Tsunami</b>	A series of waves generated by an undersea disturbance such as an earthquake. The speed of a tsunami traveling away from its source can range from up to 500 miles per hour in deep water to approximately 20 to 30 miles per hour in shallower areas near coastlines. Tsunamis differ from regular ocean waves in that their currents travel from the water surface all the way down to the sea floor. Wave amplitudes in deep water are typically less than one meter; they are often barely detectable to the human eye. However, as they approach shore, they slow in shallower water, basically causing the waves from behind to effectively “pile up”, and wave heights to increase dramatically. As opposed to typical waves which crash at the shoreline, tsunamis bring with them a continuously flowing ‘wall of water’ with the

Hazard	Description
<p><b>Volcano</b></p>	<p>potential to cause devastating damage in coastal areas located immediately along the shore.</p> <p>A mountain that opens downward to a reservoir of molten rock below the surface of the earth. While most mountains are created by forces pushing up the earth from below, volcanoes are different in that they are built up over time by an accumulation of their own eruptive products: lava, ash flows, and airborne ash and dust. Volcanoes erupt when pressure from gases and the molten rock beneath becomes strong enough to cause an explosion.</p>
<p><b>HYDROLOGIC HAZARDS</b></p>	
<p><b>Dam and Levee Failure</b></p>	<p>Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam. Dam failure can result from natural events, human-induced events, or a combination of the two. The most common cause of dam failure is prolonged rainfall that produces flooding. Failures due to other natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning.</p>
<p><b>Erosion</b></p>	<p>Erosion is the gradual breakdown and movement of land due to both physical and chemical processes of water, wind, and general meteorological conditions. Natural, or geologic, erosion has occurred since the Earth’s formation and continues at a very slow and uniform rate each year.</p>
<p><b>Flood</b></p>	<p>The accumulation of water within a water body which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream ocean, lake or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, or shallow flooding (where shallow flooding refers to sheet flow, ponding and urban drainage).</p>
<p><b>Storm Surge</b></p>	<p>A storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane up to more than 30 feet in a Category 5 storm. Storm surge heights and associated waves are also dependent upon the shape of the offshore continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge</p>

Hazard	Description
	<p>but higher and more powerful storm waves. Storm surge arrives ahead of a storm’s actual landfall and the more intense the hurricane is, the sooner the surge arrives. Storm surge can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast. Further, water rise caused by storm surge can be very rapid, posing a serious threat to those who have not yet evacuated flood-prone areas.</p>
<p><b>OTHER HAZARDS</b></p>	
<p><b>Hazardous Materials Incident</b></p>	<p>Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the nation’s highways and on the water. HAZMAT incidents consist of solid, liquid and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind and possibly wildlife as well.</p>
<p><b>Terror Threat</b></p>	<p>Terrorism is defined by FEMA as, “the use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom.” Terrorist acts may include assassinations, kidnappings, hijackings, bomb scares and bombings, cyber attacks (computer based), and the use of chemical, biological, nuclear and radiological weapons.</p>
<p><b>Wildfire</b></p>	<p>An uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors. Over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning.</p>
<p><b>Nuclear Accident</b></p>	<p>The International Atomic Energy Agency (IAEA) classifies a nuclear incident or accident as an event that leads to significant consequences for people, the</p>

Hazard	Description
	environment, or the facility. Typically, the effects of an incident are the release of radioactive substances that can cause damaging impacts. The IAEA uses a scale known as the International Nuclear and Radiological Event Scale (INES) to classify the level of impact that an event has on people and the environment.

### 4.3 DISASTER DECLARATIONS

Disaster declarations provide initial insight into the hazards that may impact the Cabarrus Stanly Union Regional planning area. Since 1973, ten presidential disaster declarations have been reported in the Cabarrus Stanly Union Region, which can be seen in **Table 4.3** below. This includes five storms related to hurricanes and coastal hazards, three storms related to severe winter weather, and one storm related to tornadoes.

**TABLE 4.3: CABARRUS STANLY UNION REGION DISASTER DECLARATIONS**

Year	Disaster Number	Description	Cabarrus County	Stanly County	Union County
1989	827	Tornadoes			X
1989	844	Hurricane Hugo	X	X	X
1996	1087	Blizzard of 96	X	X	X
1996	1134	Hurricane Fran		X	
1999	1292	Hurricane Floyd		X	X
2000	1312	Severe Winter Storm	X	X	X
2002	1448	Severe Ice Storm	X	X	X
2004	1546	Tropical Storm Frances	X		X
2005	3222	Hurricane Katrina	X	X	X
2018	4393	Hurricane Florence			X

Appendix G includes detailed information about all previous historical hazard occurrence events that have occurred in the region as reported to the National Centers for Environmental Information. Some more detailed information about previous historical hazards events can be found in Section 5: Hazard Profiles under each separate hazard profile.

## 4.4 HAZARD EVALUATION

**TABLE 4.4: DOCUMENTATION OF THE HAZARD EVALUATION PROCESS**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
<b>NATURAL HAZARDS</b>			
Avalanche	NO	<ul style="list-style-type: none"> <li>• Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>• Review of the NC State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>• Review of US Forest Service National Avalanche Center website</li> </ul>	<ul style="list-style-type: none"> <li>• The United States avalanche hazard is limited to mountainous western states including Alaska as well as some areas of low risk in New England.</li> <li>• Avalanche hazard was removed from the North Carolina State Hazard Mitigation Plan after determining the mountain elevation in Western North Carolina did have enough snow not to produce this hazard.</li> <li>• Avalanche is not included in any of the previous Cabarrus Stanly Union hazard mitigation plans.</li> </ul>
Drought	YES	<ul style="list-style-type: none"> <li>• Review of the NC State Hazard Mitigation Plan</li> <li>• Review of the North Carolina Drought Monitor website</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> </ul>	<ul style="list-style-type: none"> <li>• There are reports of drought conditions in nineteen out of the last nineteen years in the Cabarrus Stanly Union Region, according to the North Carolina Drought Monitor.</li> <li>• Droughts are discussed in NC State Hazard Mitigation Plan as a lesser hazard.</li> <li>• The NC State Hazard Mitigation Plan lists drought as a top hazard</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
			<p>for the Piedmont 5 Region which includes the Cabarrus Stanly Union counties.</p> <ul style="list-style-type: none"> <li>• Drought is included in the previous Cabarrus Stanly Union regional hazard mitigation plan.</li> </ul>
Hailstorm	YES (Assessed under Tornadoes/Thunderstorms)	<ul style="list-style-type: none"> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>• Review of NOAA NCEI Storm Events Database</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Hailstorm events are discussed in the state plan under the Severe Thunderstorm hazard.</li> <li>• NCEI reports 283 hailstorm events (0.75 inch size hail to 4.5 inches) for the Cabarrus Stanly Union Region between 1959 and 2018. For these events there was over \$274,000 (2018 dollars) in property damages.</li> <li>• Although hail is not addressed as an individual hazard in any of the previous hazard mitigation plans, it is addressed as a sub-item under tornadoes/thunderstorms. Given the frequency of the event, individual analysis is warranted.</li> </ul>
Excessive Heat	YES	<ul style="list-style-type: none"> <li>• Review of NOAA NCEI Storm Events Database</li> <li>• Review of the North Carolina State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union</li> </ul>	<ul style="list-style-type: none"> <li>• NCEI reports at least one extreme heat event for the Cabarrus Stanly Union counties.</li> <li>• The NC State Hazard Mitigation Plan does not include Extreme Heat as a moderate hazard for the Piedmont 5</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
		Regional Hazard Mitigation Plan	Region which includes the Cabarrus Stanly Union counties. <ul style="list-style-type: none"> <li>• The NC State Hazard Mitigation Plan reports the west-central portion of the state as having a moderate vulnerability in the state.</li> <li>• Extreme Heat was addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> </ul>
Hurricane and Coastal Hazards	YES	<ul style="list-style-type: none"> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Analysis of NOAA historical tropical cyclone tracks and National Hurricane Center Website</li> <li>• Review of NOAA NCEI Storm Events Database</li> <li>• Review of historical presidential disaster declarations</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Hurricane and coastal hazard events are discussed in the state plan and are listed as a top hazard in the Piedmont 5 Region which includes the Cabarrus Stanly Union counties.</li> <li>• NOAA historical records indicate 59 hurricane/coastal hazards have come within 75 miles of the Cabarrus Stanly Union Region since 1850.</li> <li>• Five out of ten disaster declarations in the Cabarrus Stanly Union Region are directly related to hurricane and costal hazard events.</li> <li>• The 50-year return period peak gust for hurricane and tropical storm events in the Cabarrus Stanly Union Region is between 63-68 mph.</li> <li>• Hurricane and coastal hazards were addressed in</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
			the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.
Lightning	YES (Assessed under Tornadoes/Thunderstorms)	<ul style="list-style-type: none"> <li>• Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of NOAA NCEI Storm Events Database, NOAA lightning statistics</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Lightning events are discussed in the state plan as part of the severe thunderstorm hazard.</li> <li>• NCEI reports 31 lightning events for the Cabarrus Stanly Union Region since 1996. These events have resulted in a recorded 8 injuries and nearly \$2.2 million (2018 dollars) in property damage.</li> <li>• Given the damage and reported death and injuries, individual analysis is warranted.</li> </ul>
Nor’easter	NO	<ul style="list-style-type: none"> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>• Review of NOAA NCEI Storm Events Database</li> </ul>	<ul style="list-style-type: none"> <li>• Nor’easters are discussed in the state plan. The Piedmont 5 Region, which includes the Cabarrus Stanly Union Region, has the second lowest vulnerability in the state.</li> <li>• NCEI does not report any nor’easter activity for the Cabarrus Stanly Union Region. However, nor’easters may have affected the region as severe winter storms. In this case, the activity would be reported under winter storm events.</li> <li>• Nor’easters were not addressed in the previous Cabarrus Stanly Union</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
			Regional Hazard Mitigation Plan.
Tornadoes/Thunderstorm	YES	<ul style="list-style-type: none"> <li>• Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>• Review of NOAA NCEI Storm Events Database</li> <li>• Review of historical presidential disaster declarations.</li> </ul>	<ul style="list-style-type: none"> <li>• Tornado events are discussed in the NC State Hazard Mitigation Plan.</li> <li>• NCEI reports 43 tornado events in Cabarrus Stanly Union Region counties since 1989. These events have resulted in no recorded deaths and have caused 30 injuries and over \$144 million (2018 dollars) in property damage with the most severe being an F4.</li> <li>• Tornado events were addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> </ul>
Severe Thunderstorm	YES (Assessed under Tornadoes/Thunderstorms)	<ul style="list-style-type: none"> <li>• Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>• Review of NOAA NCEI Storm Events Database</li> <li>• Review of historical presidential disaster</li> </ul>	<ul style="list-style-type: none"> <li>• Severe thunderstorm events are discussed in the NC State Hazard Mitigation Plan. The Piedmont 5 Region, including the Cabarrus Stanly Union counties, has a moderate vulnerability in the state.</li> <li>• According to the NC State Hazard Mitigation Plan, severe thunderstorm is a significant hazard the Piedmont 5 Region which includes the Cabarrus Stanly Union counties.</li> <li>• NCEI reports 585 thunderstorm wind events in the Cabarrus Stanly Union Region</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
		declarations.	<p>counties since 1957. These events have resulted in 7 injuries and \$2.19 million (2018 dollars) in property damage.</p> <ul style="list-style-type: none"> <li>• Severe thunderstorm events were addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> </ul>
Severe Winter Weather	YES	<ul style="list-style-type: none"> <li>• Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>• Review of NOAA NCEI Storm Events Database</li> <li>• Review of historical presidential disaster declarations.</li> </ul>	<ul style="list-style-type: none"> <li>• Severe winter weather events, including snow storms and ice storms, are discussed in the state plan. They are listed as a top hazard in the Piedmont 5 Region which includes the Cabarrus Stanly Union Region counties.</li> <li>• NCEI reports that the Cabarrus Stanly Union counties have been affected by 135 snow and ice events since 1993. These events resulted in over \$19 million (2018 dollars) in damages.</li> <li>• Three of the region’s ten disaster declarations were directly related to winter storm events.</li> <li>• Winter storm events were addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> </ul>
Earthquakes	YES	<ul style="list-style-type: none"> <li>• Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> </ul>	<ul style="list-style-type: none"> <li>• Earthquake events are discussed in the state plan and all of the participating</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
		<ul style="list-style-type: none"> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>• Review of the National Geophysical Data Center</li> <li>• USGS Earthquake Hazards Program website</li> </ul>	<p>counties in the Cabarrus Stanly Union Region are considered to be at moderate risk to an earthquake event (no counties are high risk).</p> <ul style="list-style-type: none"> <li>• Earthquakes were addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> <li>• Earthquakes have occurred in and around the State of North Carolina in the past. The state is affected by the Charleston and the New Madrid (near Tennessee) Fault lines which have generated a magnitude 8.0 earthquake in the last 200 years.</li> <li>• 15 events are known to have occurred in the region according to the National Geophysical Data Center. The greatest MMI reported was a 7.</li> <li>• According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for the Cabarrus Stanly Union Region is approximately 4%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more.</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Expansive Soils	NO	<ul style="list-style-type: none"> <li>• Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>• Review of USDA Soil Conservation Service’s Soil Survey</li> </ul>	<ul style="list-style-type: none"> <li>• Expansive soils are identified in the state plan and are a significant hazard in the Piedmont 5 Region, but no local reports of expansive soils exist according to local investigation.</li> <li>• According to FEMA and USDA sources, the Cabarrus Stanly Union Region is located in an area that has a “little to no” clay swelling potential.</li> <li>• The previous Cabarrus Stanly Union Regional Hazard Mitigation Plan did not identify expansive soils as a potential hazard.</li> </ul>
Geological (Landslides, Sinkholes, Erosion)	YES	<ul style="list-style-type: none"> <li>• Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>• Review of USGS Landslide Incidence and Susceptibility Hazard Map</li> <li>• Review of the North Carolina Geological</li> </ul>	<ul style="list-style-type: none"> <li>• Landslide/debris flow events are discussed in the state plan, and ranked a moderate hazard in the Piedmont 5 Region which includes the Cabarrus Stanly Union counties.</li> <li>• USGS landslide hazard maps indicate “high landslide incidence” (more than 15% of the area is involved in landsliding) is found in two of the three counties. All counties also have areas of moderate susceptibility.</li> <li>• Data provided by NCGS indicate only 1 recorded landslide event in the Cabarrus Stanly Union Region, but the high incidence areas in</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
		Survey database of historic landslides	Cabarrus and Stanly Counties warrant further consideration. <ul style="list-style-type: none"> <li>Geological hazards were addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> </ul>
Land Subsidence	NO	<ul style="list-style-type: none"> <li>Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>Review of NC State Hazard Mitigation Plan</li> <li>Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> </ul>	<ul style="list-style-type: none"> <li>The state plan delineates certain areas that are susceptible to land subsidence hazards in North Carolina; however none of these areas are located in Cabarrus Stanly Union counties.</li> <li>The plan identifies the Cabarrus Stanly Union counties as having scored very low for the land subsidence hazard.</li> <li>Land Subsidence was not addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> </ul>
Tsunami	NO	<ul style="list-style-type: none"> <li>Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>Review of NC State Hazard Mitigation Plan</li> <li>Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>Review of FEMA “How-to” mitigation planning guidance</li> </ul>	<ul style="list-style-type: none"> <li>Tsunamis are discussed in the state plan and described as a “greater” hazard for the state. However, the Piedmont 5 Region scored a zero for tsunami hazard risk.</li> <li>Tsunamis were not addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> <li>No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States.</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
		(Publication 386-2, "Understanding Your Risks – Identifying Hazards and Estimating Losses).	<ul style="list-style-type: none"> <li>• Tsunami inundation zone maps are not available for communities located along the U.S. East Coast.</li> <li>• FEMA mitigation planning guidance suggests that locations along the U.S. East Coast have a relatively low tsunami risk and need not conduct a tsunami risk assessment at this time.</li> </ul>
Volcano	NO	<ul style="list-style-type: none"> <li>• Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of USGS Volcano Hazards Program website</li> </ul>	<ul style="list-style-type: none"> <li>• There are no active volcanoes in North Carolina.</li> <li>• There has not been a volcanic eruption in North Carolina in over 1 million years.</li> <li>• No volcanoes are located near the Cabarrus Stanly Union Region.</li> </ul>
Dam Failure	YES	<ul style="list-style-type: none"> <li>• Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>• Review of North Carolina Dam Safety Program’s NC Dam Inventory as of 11/20/19</li> </ul>	<ul style="list-style-type: none"> <li>• Dam failure is discussed in the state plan as a top hazard of concern for the Cabarrus Stanly Union Region.</li> <li>• Per the NC Dam Inventory, there are 63 high hazard dams in the planning region. (High hazard is defined as “where failure will likely cause loss of life or serious damage to homes, industrial and commercial buildings, important public utilities, primary highways, or major railroads.”)</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
			<ul style="list-style-type: none"> <li>• Dam failure was addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> </ul>
Erosion	YES (Referenced in Geological Hazards)	<ul style="list-style-type: none"> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Riverine erosion is addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> <li>• Coastal erosion is discussed in the state plan but only for coastal areas (there is no discussion of riverine erosion).</li> </ul>
Flooding	YES	<ul style="list-style-type: none"> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of historical disaster declarations</li> <li>• Review of NOAA NCEI Storm Events Database</li> <li>• Review of FEMA's NFIP Community Status Book and Community Rating System (CRS)</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> </ul>	<ul style="list-style-type: none"> <li>• The flood hazard is thoroughly discussed in the state plan.</li> <li>• Although none of the eight Presidential Disaster Declarations were directly called flooding events, the four hurricane/tropical storm events likely caused severe flooding</li> <li>• NCEI reports that Cabarrus Stanly Union Region counties have been affected by 197 flood events since 1993. These events in total caused 6 reported deaths and an estimated \$19.2 million (2018 dollars) in property damages.</li> <li>• Nearly 6.8% of the Cabarrus Stanly Union Region is located in an identified floodplain (100 or 500 year).</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
			<ul style="list-style-type: none"> <li>• All counties participate in the NFIP.</li> <li>• Flooding was addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> </ul>
Storm Surge	NO	<ul style="list-style-type: none"> <li>• Review of FEMA’s Multi-Hazard Identification and Risk Assessment</li> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>• Review of NOAA NCEI Storm Events Database</li> </ul>	<ul style="list-style-type: none"> <li>• Storm surge is discussed in the state plan under the hurricane hazard and indicates that the Piedmont 5 Region has zero vulnerability to storm surge.</li> <li>• Storm surge was not addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> <li>• No historical events were reported by NCEI</li> <li>• Given the inland location of the Cabarrus Stanly Union Region, storm surge would not affect the area.</li> </ul>
<b>OTHER HAZARDS</b>			
Wildfires	YES	<ul style="list-style-type: none"> <li>• Review of NC State Hazard Mitigation Plan</li> <li>• Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>• Review of Southern Wildfire Risk Assessment (SWRA) Data</li> <li>• Review of the NC Division of Forest Resources website</li> </ul>	<ul style="list-style-type: none"> <li>• Wildfires were identified as a hazard that impacts the State in the NC State Hazard Mitigation Plan</li> <li>• Wildfires were addressed in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan.</li> <li>• Review of Southern Wildfire Risk Assessment (SWRA) Data</li> <li>• Review of the NC Division of Forest Resources website</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Hazardous Substances	YES	<ul style="list-style-type: none"> <li>Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> </ul>	<ul style="list-style-type: none"> <li>All counties identify hazardous substances as a potential concern.</li> <li>This update assesses hazardous materials, hazardous chemicals, and oil spills under this hazard.</li> </ul>
Infectious Disease	YES	<ul style="list-style-type: none"> <li>Review of the NC State Hazard Mitigation Plan.</li> </ul>	<ul style="list-style-type: none"> <li>Including infectious disease to be consistent with the State Plan.</li> </ul>
<b>TECHNOLOGICAL HAZARDS</b>			
Terrorism	YES	<ul style="list-style-type: none"> <li>Review of previous mitigation plans in the Cabarrus Stanly Union region</li> <li>Review of local official knowledge</li> </ul>	<ul style="list-style-type: none"> <li>Although none of the previous hazard mitigation plans for the region included terrorism threat as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan.</li> <li>There is a fixed nuclear facility in the state.</li> <li>This hazard will assess chemical, biological, radiological, nuclear, and explosive terrorism events.</li> </ul>
Radiological Emergency – Fixed Nuclear Facilities	YES	<ul style="list-style-type: none"> <li>Review of the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan</li> <li>Review of IAEA list of fixed nuclear power stations in the United States</li> <li>Discussion with local officials about location of nuclear power stations</li> </ul>	<ul style="list-style-type: none"> <li>The McGuire Nuclear Power Station is located on Lake Norman near the region.</li> <li>The Catawba Nuclear Power Stations is located across the state border in York, South Carolina, and could impact the region</li> <li>Although radiological emergencies are not identified in any previous plans, local officials expressed a desire to address them in this plan</li> </ul>

**SECTION 4: HAZARD IDENTIFICATION**

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
			<ul style="list-style-type: none"> <li>• Nuclear events can sometimes be caused by natural hazards and deserve some attention in this plan due to some areas of the region being located in the 10 mile evacuation zone for the McGuire and Catawba Nuclear Power Stations</li> </ul>
Cyber	YES	<ul style="list-style-type: none"> <li>• Review of NC State Hazard Mitigation Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Changing future conditions encourage the assessment of the possibility of a cyber attack with the increase in global technology</li> </ul>
Electromagnetic Pulse	YES	<ul style="list-style-type: none"> <li>• Review of NC State Hazard Mitigation Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Changing future conditions encourage the assessment of the possibility of an electromagnetic pulse with the increase in global technology</li> </ul>

## 4.5 HAZARD IDENTIFICATION RESULTS

**TABLE 4.5: SUMMARY RESULTS OF THE HAZARD IDENTIFICATION AND EVALUATION PROCESS**

NATURAL HAZARDS	TECHNOLOGICAL HAZARDS
<input type="checkbox"/> Avalanche	<input checked="" type="checkbox"/> Radiological Emergency – Fixed Nuclear Facilities
<input checked="" type="checkbox"/> Drought	<input checked="" type="checkbox"/> Terrorism
<input checked="" type="checkbox"/> Hailstorm**	<input checked="" type="checkbox"/> Cyber
<input checked="" type="checkbox"/> Excessive Heat	<input checked="" type="checkbox"/> Electromagnetic Pulse
<input checked="" type="checkbox"/> Hurricane and Coastal Hazards	OTHER HAZARDS
<input checked="" type="checkbox"/> Flooding	<input checked="" type="checkbox"/> Hazardous Substances
<input checked="" type="checkbox"/> Lightning**	<input checked="" type="checkbox"/> Wildfires
<input type="checkbox"/> Nor'easter	<input checked="" type="checkbox"/> Infectious Disease
<input checked="" type="checkbox"/> Tornadoes/Thunderstorms	
<input checked="" type="checkbox"/> Severe Winter Weather	
<input checked="" type="checkbox"/> Earthquakes	
<input checked="" type="checkbox"/> Dam Failures	
<input checked="" type="checkbox"/> Geological	
<input checked="" type="checkbox"/> Infectious Disease	
<input type="checkbox"/> Expansive Soils	
<input type="checkbox"/> Land Subsidence	
<input type="checkbox"/> Tsunami	
<input type="checkbox"/> Volcano	
<input type="checkbox"/> Storm Surge	
<input type="checkbox"/> Erosion	

= Hazard considered significant enough for further evaluation in the Cabarrus Stanly Union Region hazard risk assessment.

\*\* = Hazard is assessed as a sub hazard under the Tornadoes/Thunderstorms hazard.

# SECTION 5

## HAZARD PROFILES

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

- ◆ 5.1 Overview
- ◆ 5.2 Study Area
- ◆ 5.3 Drought
- ◆ 5.4 Excessive Heat
- ◆ 5.5 Hurricane and Coastal Hazards
- ◆ 5.6 Tornadoes/Thunderstorms
- ◆ 5.7 Severe Winter Weather
- ◆ 5.8 Earthquakes
- ◆ 5.9 Geological
- ◆ 5.10 Dam Failure
- ◆ 5.11 Flooding
- ◆ 5.12 Wildfires
- ◆ 5.13 Infectious Disease
- ◆ 5.14 Hazardous Substances
- ◆ 5.15 Radiological Emergency – Fixed Nuclear Facilities
- ◆ 5.16 Terrorism
- ◆ 5.17 Cyber
- ◆ 5.18 Electromagnetic Pulse
- ◆ 5.19 Conclusions on Hazard Risk
- ◆ 5.20 Final Determinations

### 44 CFR Requirement

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

## 5.1 OVERVIEW

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

After reviewing the list of assessed hazards from the previous update, the Cabarrus Stanly Union Regional Planning Team moved to amend the hazards in order to be consistent with the State of North Carolina Hazard Mitigation Plan. This required some of the hazard names to change and additional hazards were included in the assessment.

The following hazards were identified:

- ◆ **Natural**
  - Drought
  - Excessive Heat
  - Hurricane and Coastal Hazards
  - Tornadoes/Thunderstorms (including hailstorms and lightning)
  - Severe Winter Weather
  - Earthquakes
  - Geological (including landslides, sinkholes, and erosion)
  - Dam Failure
  - Flooding
- ◆ **Other**
  - Wildfires
  - Infectious Disease
- ◆ **Technological**
  - Hazardous Substances
  - Radiological Emergency – Fixed Nuclear Facilities
  - Terrorism
  - Cyber
  - Electromagnetic Pulse

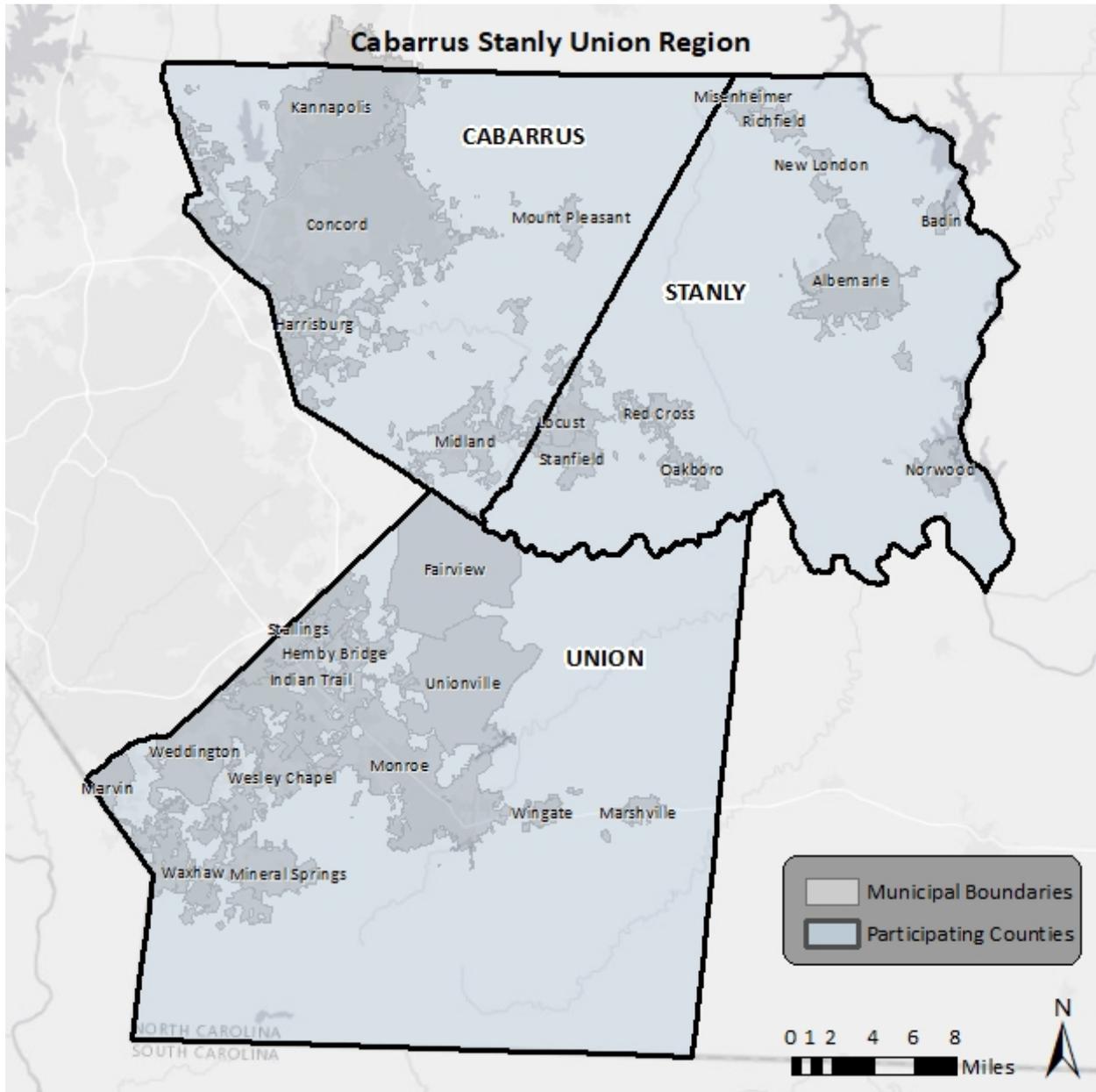
## 5.2 STUDY AREA

The Cabarrus Stanly Union Region includes three counties: Cabarrus, Stanly, and Union. **Table 5.1** provides a summary table of the participating jurisdictions within each county. In addition, **Figure 5.1** provides a base map, for reference, of the Cabarrus Stanly Union Region.

**TABLE 5.1: PARTICIPATING JURISDICTIONS IN THE CABARRUS STANLY UNION REGIONAL HAZARD MITIGATION PLAN**

Cabarrus County	
Concord	Midland
Harrisburg	Mount Pleasant
Kannapolis	Unincorporated Cabarrus County
Stanly County	
Albemarle	Norwood
Badin	Oakboro
Locust	Red Cross
Misenhiemer	Richfield
New London	Stanfield
Unincorporated Stanly County	
Union County	
Fairview	Monroe
Hemby Bridge	Stallings
Indian Trail	Unionville
Lake Park	Waxhaw
Marshville	Weddington
Marvin	Wesley Chapel
Mineral Springs	Wingate
Unincorporated Union County	

**FIGURE 5.1: CABARRUS STANLY UNION REGION BASE MAP**



**Table 5.2** lists each significant hazard for the Cabarrus Stanly Union Region and identifies whether or not it has been determined to be a specific hazard of concern for the twenty-nine municipal jurisdictions, each of the three county’s unincorporated areas. This is based on the best available data and information from the Cabarrus Stanly Union Regional Hazard Mitigation Planning Team. (● = hazard of concern)

TABLE 5.2 SUMMARY OF IDENTIFIED HAZARD EVENTS

Jurisdiction	NATURAL								OTHER		TECHNOLOGICAL					
	Drought	Excessive Heat	Hurricane and Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Geological	Dam Failure	Flooding	Wildfires	Infectious Disease	Hazardous Substances	Radiological Emergency	Terrorism	Cyber	Electromagnetic Pulse
<b>Cabarrus County</b>																
Concord	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Harrisburg	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Kannapolis	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Midland	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Mount Pleasant	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<b>Stanly County</b>																
Albemarle	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Badin	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Locust	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Misenhiemer	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
New London	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Norwood	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Oakboro	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Red Cross	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Richfield	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Stanfield	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<b>Union County</b>																
Fairview	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Hemby Bridge	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Indian Trail	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Lake Park	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Marshville	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Marvin	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Mineral Springs	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Monroe	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Stallings	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Unionville	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Waxhaw	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Weddington	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Wesley Chapel	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Wingate	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

# Natural Hazards

## 5.3 DROUGHT

### 5.3.1 Background and Description

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

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

**TABLE 5.3 DROUGHT CLASSIFICATION DEFINITIONS**

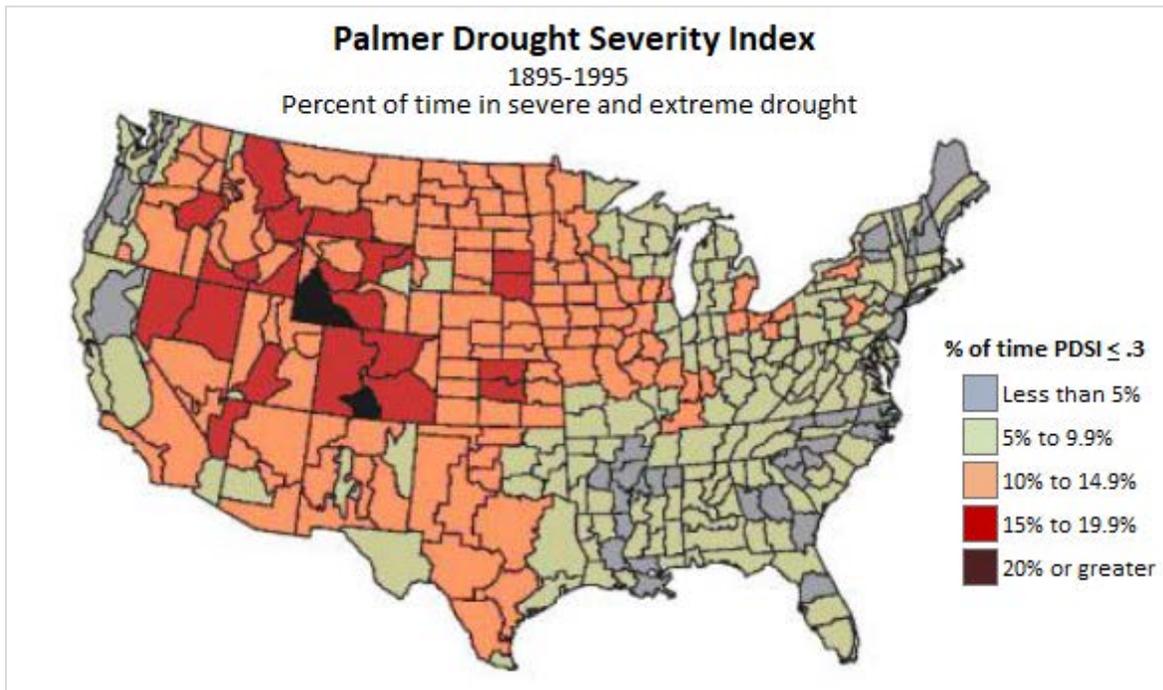
<b>Meteorological Drought</b>	The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
<b>Hydrologic Drought</b>	The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater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

*Source: Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, FEMA*

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

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

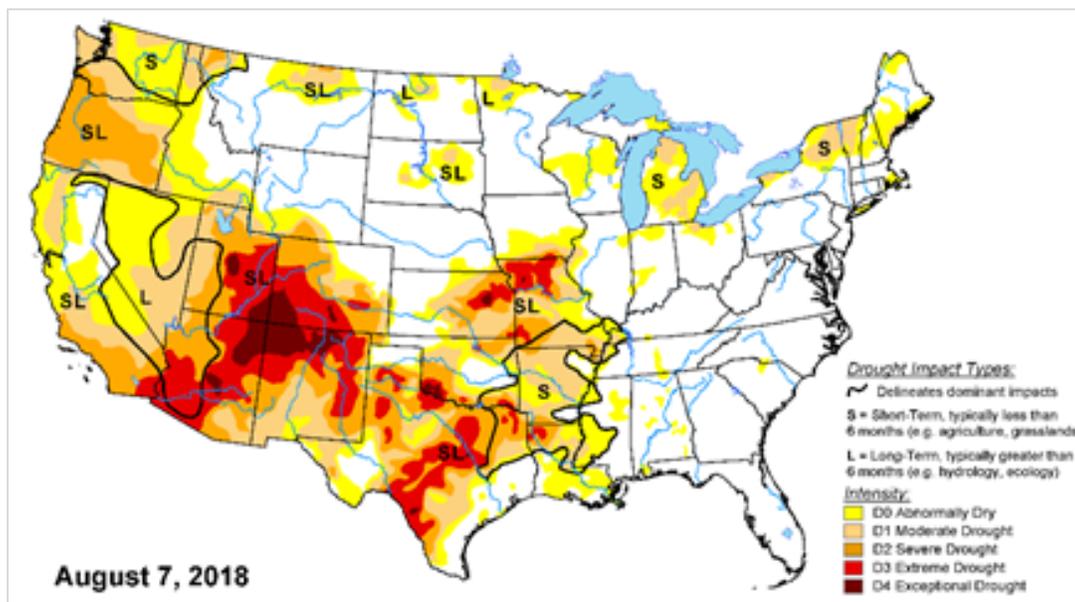
**FIGURE 5.2: PALMER DROUGHT SEVERITY INDEX SUMMARY MAP**



Source: National Drought Mitigation Center

The figure above is the most updated version of the Palmer Drought Severity Index; however, the US Drought Monitor is updated on a weekly basis. An archived map from the summer of 2018 can be seen below in **Figure 5.3** to reflect more current drought conditions in the US.

**FIGURE 5.3: US DROUGHT MONITOR**



### 5.3.2 Location and Spatial Extent

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

### 5.3.3 Historical Occurrences

The North Carolina Drought Management Advisory Council also reports data on North Carolina drought conditions from 2000 to 2018 through the North Carolina Drought Monitor. It classifies drought conditions using the scale set by the US Drought Monitor, which classifies conditions on a scale of D0 to D4. Each class is further explained in **Table 5.4**.

**TABLE 5.4: USDM DROUGHT CLASSIFICATIONS**

Scale	Description	Impacts
D0	Abnormally Dry	- Short-term dryness slowing planting, growth of crops - Some lingering water deficits - Pastures or crops not fully recovered
D1	Moderate Drought	- Some damage to crops, pastures - Some water shortages developing - Voluntary water-use restrictions requested
D2	Severe Drought	- Crop or pasture loss likely - Water shortages common - Water restrictions imposed
D3	Extreme Drought	- Major crop/pasture losses - Widespread water shortages or restrictions
D4	Exceptional Drought	- Exceptional and widespread crop/pasture losses - Shortages of water creating water emergencies

According to the North Carolina Drought Monitor, all of the counties in the Cabarrus Stanly Union Region has had drought occurrences in each of the last nineteen years (2000-2018) (**Table 5.4**). It should be noted that the North Carolina Drought Monitor also estimates what percentage of the county is in each classification of drought severity. For example, the most severe classification reported may be exceptional, but a majority of the county may actually be in a less severe condition.

**TABLE 5.4: SUMMARY OF DROUGHT OCCURRENCES**

Location	Number Years with Drought Occurrences	Number Years with Exceptional Drought Occurrences
<b>Cabarrus County</b>	19	3
<b>Stanly County</b>	19	3
<b>Union County</b>	19	3

Source: North Carolina Drought Monitor (through October 2018)

### 5.3.4 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of the Cabarrus Stanly Union Region has a probability level of likely (10 to 100 percent annual probability) for future drought events. This hazard may vary slightly by location but each area has an equal probability of experiencing a drought. While reports indicate that there is a much lower probability for extreme, long-lasting drought conditions, NOAA also predicts that central North Carolina to have areas of persistent drought and further drought development<sup>1</sup>.

---

<sup>1</sup> U.S. Seasonal Drought Outlook. National Weather Service Climate Prediction Center.  
[http://www.cpc.ncep.noaa.gov/products/expert\\_assessment/sdo\\_summary.php](http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php)

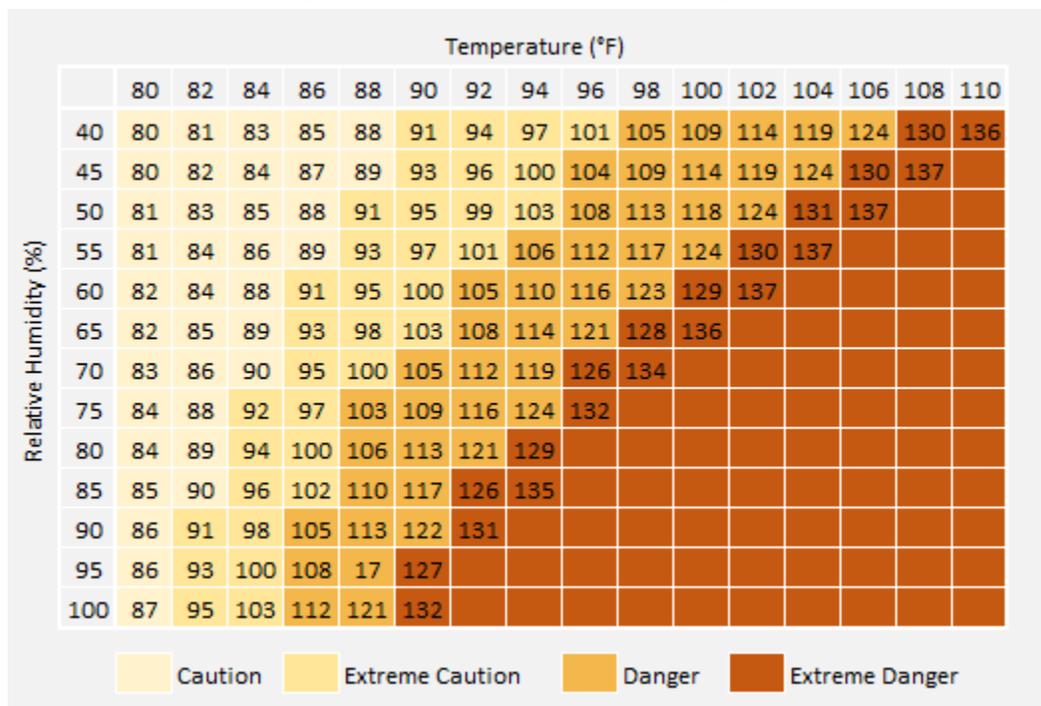
## 5.4 EXCESSIVE HEAT

### 5.4.1 Background and Description

Excessive heat, like drought, poses little risk to property. However, excessive heat can have devastating effects on health. Excessive heat can often be referred to as “extreme heat” or a “heat wave.” According to the National Weather Service, there is no universal definition for a heat wave, but the standard U.S. definition is any event lasting at least three days where temperatures reach ninety degrees Fahrenheit or higher. However, it may also be defined as an event at least three days long where temperatures are ten degrees greater than the normal temperature for the affected area. Heat waves are typically accompanied by humidity but may also be very dry. These conditions can pose serious health threats causing an average of 1,500 deaths each summer in the United States<sup>2</sup>.

According to the National Oceanic and Atmospheric Administration, heat is the number one weather-related killer among natural hazards, followed by frigid winter temperatures<sup>3</sup>. The National Weather Service devised the Heat Index as a mechanism to better inform the public of heat dangers. The Heat Index Chart, shown in **Figure 5.4**, uses air temperature and humidity to determine the heat index or apparent temperature. **Table 5.5** shows the dangers associated with different heat index temperatures. Some populations, such as the elderly and young, are more susceptible to heat danger than other segments of the population.

**FIGURE 5.4: NWS HEAT INDEX CHART**



Source: NOAA, National Weather Service

<sup>2</sup> <http://www.noaawatch.gov/themes/heat.php>

<sup>3</sup> <https://www.NCEI.noaa.gov/sotc/drought/201802#det-pdi>

**TABLE 5.5: HEAT DISORDERS ASSOCIATED WITH HEAT INDEX TEMPERATURE**

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

Source: National Weather Service, NOAA

In addition, NOAA has seventeen metropolitan areas participating in the Heat Health Watch/Warning System in order to better inform and warn the public of heat dangers. A Heat Health Watch is issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Heat Warning is issued when an excessive heat event is expected in the next 36 hours. Furthermore, a warning is issued when the conditions are occurring, imminent, or have a high likelihood of occurrence. Urban areas participate in the Heat Health Watch/Warning System because urban areas are at greater risk to heat affects. Stagnant atmospheric conditions trap pollutants, thus adding unhealthy air to excessively hot temperatures. In addition, the “urban heat island effect” can produce significantly higher nighttime temperatures because asphalt and concrete (which store heat longer) gradually release heat at night.

### 5.4.2 Location and Spatial Extent

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

### 5.4.3 Historical Occurrences

Data from the National Centers for Environmental Information was used to determine historical excessive heat and heat wave events in the Cabarrus Stanly Union Region. The results are reported in **Table 5.6** below.

**TABLE 5.6: EXCESSIVE HEAT OCCURRENCES**

County	Number of Events (1996-2018)	Deaths/Injuries	Property Damage (2018 dollars)
Cabarrus County	0	0/0	\$0
Stanly County	0	0/0	\$0
Union County	2	0/0	\$0
<b>Cabarrus Stanly Union Regional Total</b>	<b>2</b>	<b>0/0</b>	<b>\$0</b>

Source: NCEI

In addition, information from the State Climate Office of North Carolina was reviewed to obtain

historical temperatures in the region. Temperature information was reported since 1890. The recorded maximum for each county can be found below in **Table 5.7**.

**TABLE 5.6: HIGHEST RECORDED TEMPERATURE**

Location	Date	Temperature (°F)
Cabarrus County	8/22/1983	107
Stanly County	7/28/1940	109
Union County	8/21/1983	107
Cabarrus Stanly Union Regional Maximum	--	109

Source: State Climate Office of North Carolina

The State Climate Office also reports average maximum temperatures in various locations in the region. The most centralized location is in Concord (Cabarrus County). **Table 5.8** shows the average maximum temperatures from 2015 to 2018 at the Concord observation station which can be used as a general comparison for the region.

**TABLE 5.8: AVERAGE MAXIMUM TEMPERATURE IN CONCORD, CABARRUS COUNTY**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Avg. Max (°F)	51.2	60.6	63.5	72.5	80.0	87.8	90.1	88.3	84.6	74.8	62.8	53.6

Source: State Climate Office of North Carolina

#### 5.4.4 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of the Cabarrus Stanly Union Region has a probability level of possible (1 to 10 percent annual probability) for future extreme heat events to impact the region.

## 5.5 HURRICANE AND COASTAL HAZARDS

### 5.5.1 Background and Description

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

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

As an incipient hurricane develops, barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Scale (**Table 5.9**), which rates hurricane intensity on a scale of 1 to 5, with 5 being the most intense.

**TABLE 5.9: SAFFIR-SIMPSON SCALE**

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

Source: National Hurricane Center (2018)

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

**TABLE 5.10: HURRICANE DAMAGE CLASSIFICATIONS**

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

Source: National Hurricane Center; Federal Emergency Management Agency

### 5.5.2 Location and Spatial Extent

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

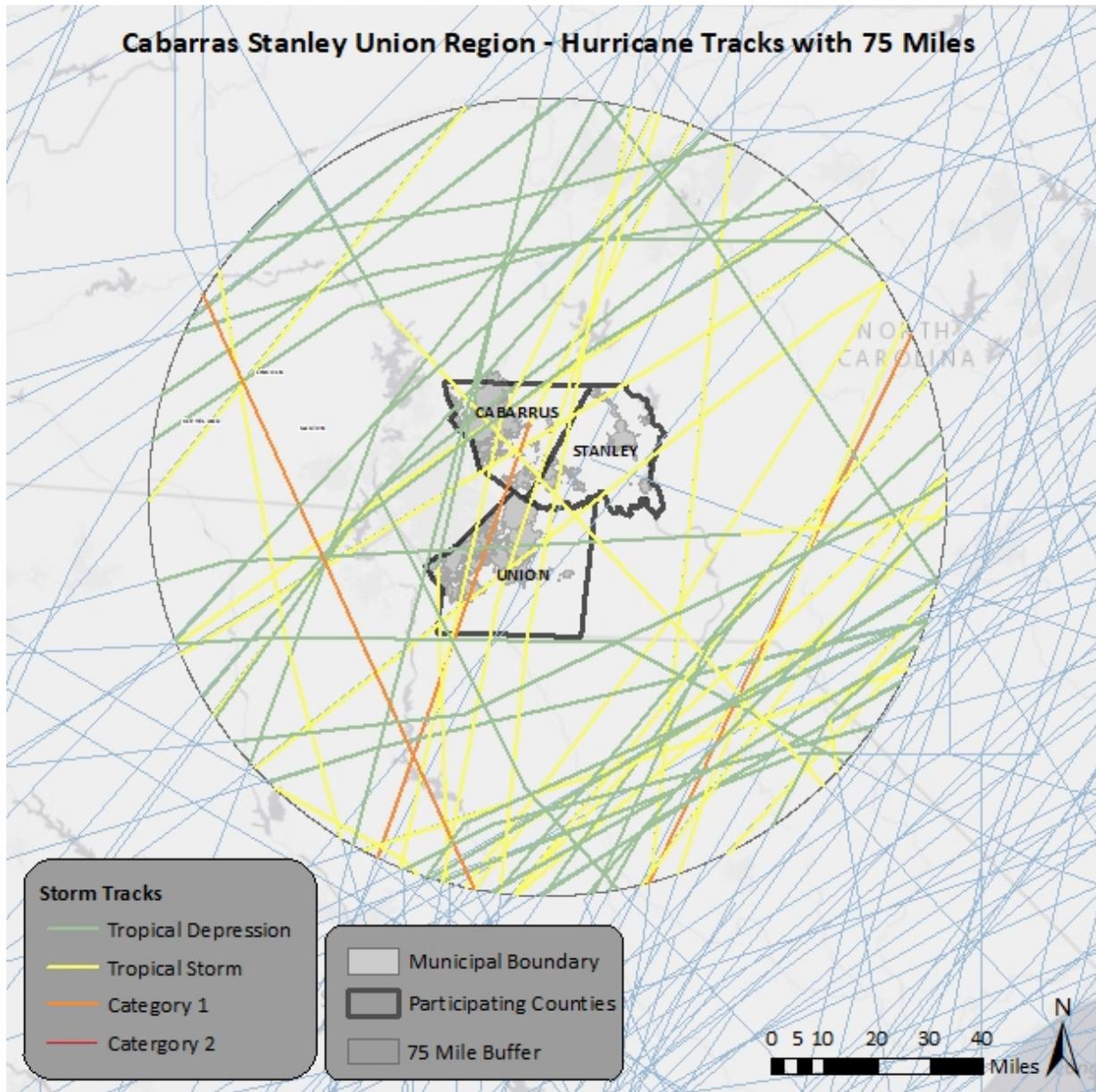
### 5.5.3 Historical Occurrences

According to the National Hurricane Center’s historical storm track records, 59 hurricane or tropical storm tracks have passed within 75 miles of the Cabarrus Stanly Union Region since 1850<sup>4</sup>. This includes twenty-three tropical storms and thirty-six tropical depressions.

Of the recorded storm events, thirteen have traversed directly through the Cabarrus Stanly Union Region as shown in **Figure 5.5**. Furthermore, **Table 5.11** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 75 miles of the Cabarrus Stanly Union Region) and Category of the storm based on the Saffir-Simpson Scale.

<sup>4</sup> These storm track statistics do not include extra-tropical storms. Though these related hazard events are less severe in intensity, they may cause significant local impact in terms of rainfall and high winds.

**FIGURE 5.5: HISTORICAL HURRICANE STORM TRACKS WITHIN 75 MILES**



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

**TABLE 5.11: HISTORICAL STORM TRACKS WITHIN 75 MILES OF THE CABARRUS STANLY UNION REGION (1850-2018)**

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
9/9/1854	NOT NAMED	44	Tropical Storm (TS)
9/17/1859	NOT NAMED	35	Tropical Storm (TS)
10/4/1877	NOT NAMED	44	Tropical Storm (TS)
1878	NOT NAMED	--	Tropical Depression (TD)
10/13/1885	NOT NAMED	35	Tropical Storm (TS)
6/22/1886	NOT NAMED	31	Tropical Depression (TD)

**SECTION 5: HAZARD PROFILES**

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
1886	NOT NAMED	--	Tropical Depression (TD)
10/20/1887	NOT NAMED	31	Tropical Depression (TD)
9/10/1888	NOT NAMED	31	Tropical Depression (TD)
9/24/1889	NOT NAMED	35	Tropical Storm (TS)
1891	NOT NAMED	35	Tropical Storm (TS)
10/4/1893	NOT NAMED	35	Tropical Storm (TS)
1896	NOT NAMED	--	Tropical Depression (TD)
7/13/1901	NOT NAMED	31	Tropical Depression (TD)
10/12/1902	NOT NAMED	31	Tropical Depression (TD)
6/16/1902	NOT NAMED	--	Tropical Depression (TD)
9/14/1904	NOT NAMED	53	Tropical Storm (TS)
9/23/1907	NOT NAMED	31	Tropical Depression (TD)
10/23/1908	NOT NAMED	26	Tropical Depression (TD)
8/31/1911	NOT NAMED	22	Tropical Depression (TD)
6/14/1912	NOT NAMED	31	Tropical Depression (TD)
10/10/1913	NOT NAMED	26	Tropical Depression (TD)
9/4/1913	NOT NAMED	31	Tropical Depression (TD)
8/3/1915	NOT NAMED	31	Tropical Depression (TD)
7/15/1916	NOT NAMED	44	Tropical Storm (TS)
9/23/1920	NOT NAMED	31	Tropical Depression (TD)
10/3/1927	NOT NAMED	31	Tropical Depression (TD)
8/11/1928	NOT NAMED	26	Tropical Depression (TD)
10/2/1929	NOT NAMED	35	Tropical Storm (TS)
1935	NOT NAMED	--	Tropical Depression (TD)
8/15/1940	NOT NAMED	31	Tropical Depression (TD)
9/18/1945	NOT NAMED	35	Tropical Storm (TS)
10/9/1946	NOT NAMED	26	Tropical Depression (TD)
1947	NOT NAMED	53	Tropical Storm (TS)
1949	NOT NAMED	--	Tropical Depression (TD)
8/31/1952	NOT NAMED	40	Tropical Storm (TS)
6/2/1959	ARLENE	22	Tropical Depression (TD)
7/10/1959	CINDY	31	Tropical Depression (TD)
9/30/1959	GRACIE	53	Tropical Storm (TS)
8/31/1964	CLEO	22	Tropical Depression (TD)
1965	UNNAMED	44	Tropical Storm (TS)
7/19/1968	CELESTE	26	Tropical Depression (TD)
5/26/1970	ALMA	22	Tropical Depression (TD)
9/15/1976	SUBTROP 3	53	Tropical Storm (TS)
9/9/1977	BABE	40	Tropical Storm (TS)
9/5/1979	DAVID	40	Tropical Storm (TS)
1985	ONE-C	22	Tropical Depression (TD)
7/25/1985	BOB	40	Tropical Storm (TS)
9/25/1989	HUGO	58	Tropical Storm (TS)
1990	NOT NAMED	35	Tropical Storm (TS)
7/21/1994	NOT NAMED	31	Tropical Depression (TD)
7/24/1997	DANNY	31	Tropical Depression (TD)
9/6/1999	DENNIS	22	Tropical Depression (TD)
9/23/2000	HELENE	22	Tropical Depression (TD)
9/28/2004	JEANNE	31	Tropical Depression (TD)
7/7/2005	CINDY	18	Tropical Depression (TD)
6/14/2006	ALBERTO	35	Tropical Storm (TS)

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
9/14/2007	HUMBERTO	31	Tropical Depression (TD)
10/31/2012	SANDY	42	Tropical Depression (TD)
10/8/2016	MATTHEW	51	Tropical Storm (TS)
10/11/2018	MICHAEL	40	Tropical Storm (TS)

Source: National Hurricane Center

The National Centers for Environmental Information reported four events associated with a hurricane or tropical storm in the Cabarrus Stanly Union Region between 1950 and 2018. These storms were all classified as hurricanes, with two occurring in both 1996 and 1999. The storms resulted in over \$145 million (2018 dollars) of property damage and numerous trees and power lines were reported down across the region. Federal records also indicate that four disaster declarations were made in 1989 (Hurricane Hugo), 1996 (Hurricane Fran), 1999 (Hurricane Floyd), and 2004 (Tropical Storm Frances) for the region<sup>5</sup>.

Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in the Cabarrus Stanly Union Region. However, winds can also be a concern in cases where a hurricane makes landfall in South Carolina, as was the case with Hurricane Hugo in 1989. Some anecdotal information is available for the major storms that have impacted that area as found below:

#### **Hurricane Hugo** – September 22-24, 1989

Hurricane Hugo was one of the largest storms on record in the Atlantic Basin that produced high winds and dumped heavy rains over much of North Carolina and South Carolina. Hugo reached a peak level of Category 5 on the Saffir-Simpson scale and made landfall near Isle of Palms in South Carolina as a Category 4, eventually passing over Charlotte and much of the surrounding area as a Category 1 storm. Although the storm caused its greatest damage in South Carolina, over 1,000 structures were destroyed or severely damaged in North Carolina, causing over \$1 billion dollars in damages. Wind gusts reached over 40 mph and numerous trees were downed throughout much of south and western North Carolina.

#### **Tropical Storm Frances** – September 7-8, 2004

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

### **5.5.4 Probability of Future Occurrences**

Given the inland location of the region, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. However, as Hurricane Hugo demonstrated, the region is not immune to a major hurricane strike. The probability of being impacted is less than coastal areas, but still remains a real threat to the Cabarrus Stanly Union Region due to induced events like flooding and landsliding. Based on historical evidence,

<sup>5</sup> Not all of the participating counties were declared disaster areas for these storms. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Identification*.

## SECTION 5: HAZARD PROFILES

---

the probability level of future occurrence is possible (between 1 and 10 percent annual probability). Given the regional nature of the hazard, all areas are equally exposed to this hazard. However, when the region is impacted, the damage could be catastrophic, threatening lives and property throughout the planning area.

## 5.6 TORNADOES/THUNDERSTORMS

For the purposes of maintaining consistency with the State of North Carolina Hazard Mitigation Plan, this section will assess tornadoes and thunderstorms, which also include high winds, hailstorms and lightning.

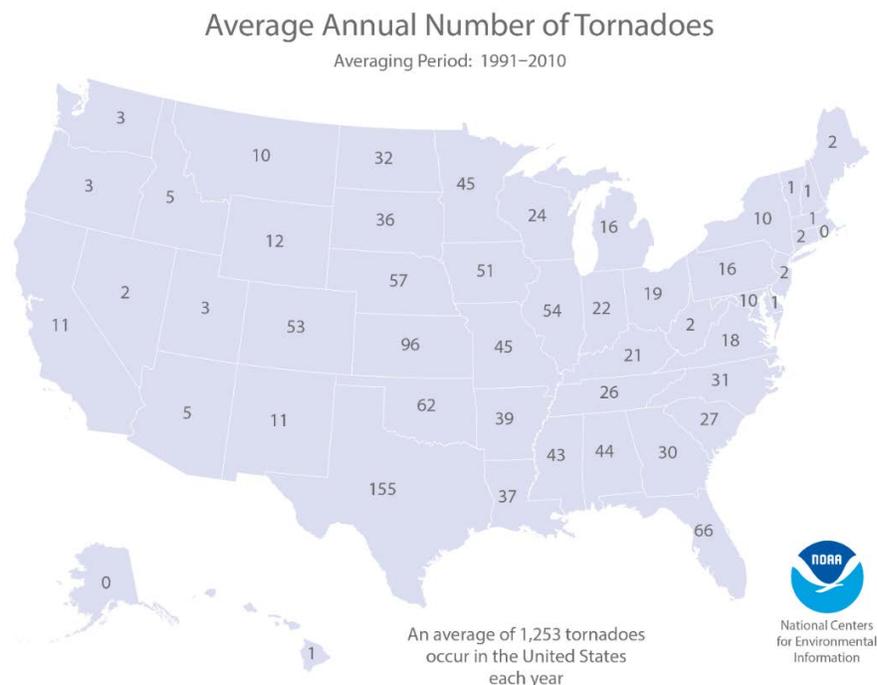
### 5.6.1 Background and Description

#### Tornadoes

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

Each year, an average of over 1,200 tornadoes is reported nationwide, resulting in an average of 56 deaths and 1,500 injuries<sup>6</sup>. According to the NOAA Storm Prediction Center (SPC), the highest concentration of tornadoes in the United States has been in Oklahoma, Texas, Kansas, and Florida respectively. Although the Great Plains region of the Central United States does favor the development of the largest and most dangerous tornadoes (earning the designation of “tornado alley”), Florida experiences the greatest number of tornadoes per square mile of all U.S. states (SPC, 2002). **Figure 5.6** shows tornado activity in the United States based on the number of recorded tornadoes per 10,000 square miles.

### FIGURE 5.6: TORNADO ACTIVITY IN THE UNITED STATES



Tornadoes are more likely to occur during the months of March through May and are most likely to form

<sup>6</sup> NOAA, 2013.

in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touch down briefly, but even small short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes may carve out a path over a mile wide and several miles long.

The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, including residential dwellings (particularly mobile homes). Tornadic magnitude is reported according to the Fujita and Enhanced Fujita Scales. Tornado magnitudes prior to 2005 were determined using the traditional version of the Fujita Scale (**Table 5.12**). Tornado magnitudes that were determined in 2005 and later were determined using the Enhanced Fujita Scale (**Table 5.13**).

**TABLE 5.12: THE FUJITA SCALE (EFFECTIVE PRIOR TO 2005)**

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

Source: National Weather Service

**TABLE 5.13 THE ENHANCED FUJITA SCALE (EFFECTIVE 2005 AND LATER)**

EF-Scale Number	Intensity Phrase	3 Second Gust (MPH)	Type of Damage Done
0	Gale	65-85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
1	Moderate	86-110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
2	Significant	111-135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.

## SECTION 5: HAZARD PROFILES

---

EF-Scale Number	Intensity Phrase	3 Second Gust (MPH)	Type of Damage Done
3	Severe	136-165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
4	Devastating	166-200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
5	Incredible	Over 200	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.

Source: National Weather Service

### Thunderstorms

Thunderstorms can produce a variety of accompanying hazards including wind, hailstorms, and lightning<sup>7</sup>, which are all discussed here. Although thunderstorms generally affect a small area, they are very dangerous and may cause substantial property damage.

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

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

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

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

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

---

<sup>7</sup> Lightning and hail hazards are discussed as separate hazards in this section.

than 2.5 miles at the surface and longer than 5 minutes with winds up to 130 miles per hour are referred to as “macrobursts.”

**Hailstorms**

Hailstorms are a potentially damaging outgrowth of severe thunderstorms (thunderstorms are discussed separately in Section 5.8). Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until they develop to a sufficient weight and fall as precipitation. Hail typically takes the form of spheres or irregularly-shaped masses greater than 0.75 inches in diameter. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth’s surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size. **Table 5.14** shows the TORRO Hailstorm Intensity Scale which is a way of measuring hail severity.

**TABLE 5.14: TORRO HAILSTORM INTENSITY SCALE**

	Intensity Category	Typical Hail Diameter (mm)*	Probable Kinetic Energy, J-m <sup>2</sup>	mm to inch conversion (inches)	Typical Damage Impacts
<b>H0</b>	Hard Hail	5	0-20	0 – 0.2	No damage
<b>H1</b>	Potentially Damaging	5-15	>20	0.2 – 0.6	Slight general damage to plants, crops
<b>H2</b>	Significant	10-20	>100	0.4 – 0.8	Significant damage to fruit, crops, vegetation
<b>H3</b>	Severe	20-30	>300	0.8 – 1.2	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
<b>H4</b>	Severe	25-40	>500	1.0 – 1.6	Widespread glass damage, vehicle bodywork damage
<b>H5</b>	Destructive	30-50	>800	1.2 – 2.0	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
<b>H6</b>	Destructive	40-60		1.6 – 2.4	Bodywork of grounded aircraft dented, brick walls pitted
<b>H7</b>	Destructive	50-75		2.0 – 3.0	Severe roof damage, risk of serious injuries
<b>H8</b>	Destructive	60-90		1.6 – 3.5	(Severest recorded in the British Isles) Severe damage to aircraft bodywork
<b>H9</b>	Super Hailstorms	75-100		3.0 – 3.9	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
<b>H10</b>	Super Hailstorms	>100			Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Source: <http://www.torro.org.uk/site/hyscale.php>

**Lightning**

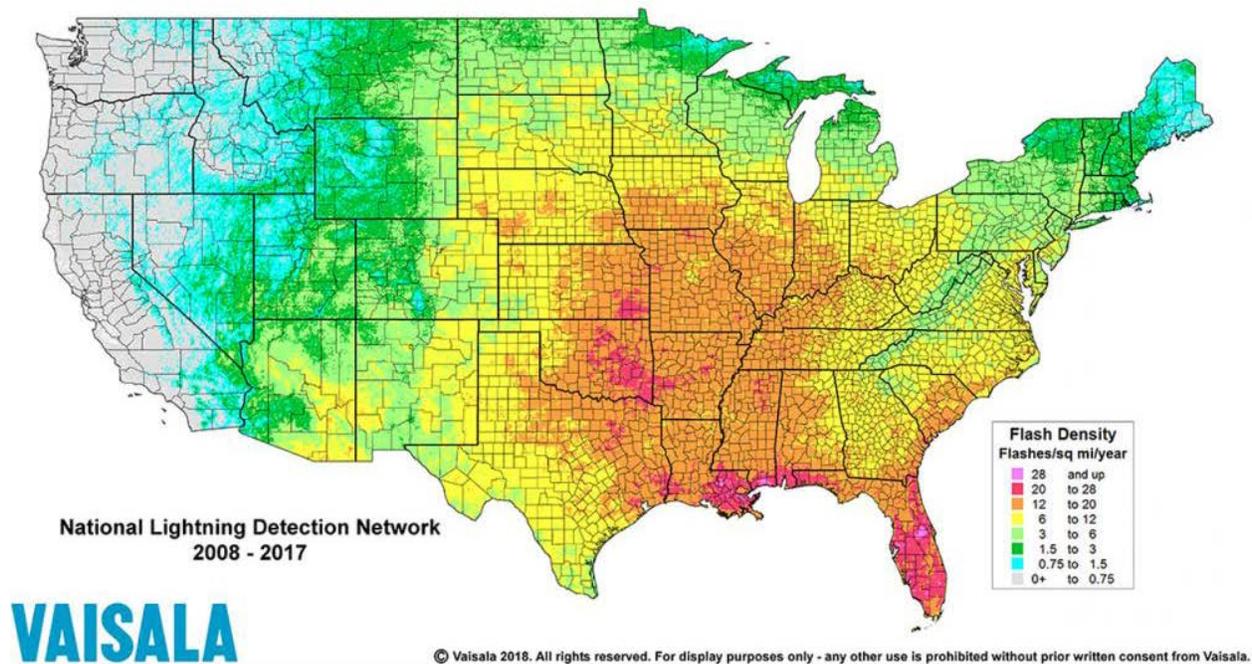
Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a “bolt” when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes the thunder which often accompanies lightning strikes. While most often

affiliated with severe thunderstorms, lightning may also strike outside of heavy rain and might occur as far as 10 miles away from any rainfall.

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

Figure 5.7 shows a lightning flash density map for the years 2008-2017 based upon data provided by Vaisala’s U.S. National Lightning Detection Network (NLDN®).

**FIGURE 5.7: LIGHTNING FLASH DENSITY IN THE UNITED STATES**



Source: Vaisala U.S. National Lightning Detection Network

### 5.6.2 Location and Spatial Extent

#### Tornadoes

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

#### Thunderstorms

A thunderstorm/wind event is an atmospheric hazard, and thus has no geographic boundaries. It is typically a widespread event that can occur in all regions of the United States. However, thunderstorms are most common in the central and southern states because atmospheric conditions in those regions are favorable for generating these powerful storms. Also, the Cabarrus Stanly Union Region typically

experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that the Cabarrus Stanly Union Region has uniform exposure to a thunderstorm/wind event and the spatial extent of an impact could be large.

### Hailstorms

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

### Lightning

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

## 5.6.3. Historical Occurrences

### Tornadoes

Tornadoes are a somewhat rare occurrence, however, they have and do occur in the Cabarrus Stanly Union Region. Tornadoes resulted in one disaster declaration in the Cabarrus Stanly Union Region in 1989<sup>8</sup>. According to the National Centers for Environmental Information, there have been a total of 43 recorded tornado events in the Cabarrus Stanly Union Region since 1950 (**Table 5.15**), resulting in over \$144 million (2018 dollars) in property damages<sup>9</sup>. In addition, 1 death and 30 injuries were reported. The magnitude of these tornadoes ranges from F0 to F4 in intensity, although an F5 event is possible. It is important to note that only tornadoes that have been reported are factored into this risk assessment. It is likely that a high number of occurrences have gone unreported over the past 69 years.

**TABLE 5.15: SUMMARY OF TORNADO OCCURRENCES**

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2018)
<b>Cabarrus County</b>	<b>12</b>	<b>0/3</b>	<b>\$65,820,846</b>
Concord	2	0/0	\$6,260
Harrisburg	1	0/0	\$1,649,252
Kannapolis	0	0/0	\$0
Midland	0	0/0	\$0
Mount Pleasant	0	0/0	\$0
Unincorporated Area	9	0/3	\$64,165,334
<b>Stanly County</b>	<b>11</b>	<b>0/1</b>	<b>\$15,253,527</b>
Albemarle	1	0/0	\$4,545,720
Badin	0	0/0	\$0
Locust	1	0/0	\$37,881
Misenhiemer	0	0/0	\$0
New London	0	0/0	\$0
Norwood	0	0/0	\$0
Oakboro	0	0/0	\$0
Red Cross	0	0/0	\$0

<sup>8</sup> A complete listing of historical disaster declarations can be found in Section 4: *Hazard Profiles*.

<sup>9</sup> These tornado events are only inclusive of those reported by the National Centers for Environmental Information (NCEI). It is likely that additional tornadoes have occurred in the Cabarrus Stanly Union Region. As additional local data becomes available, this hazard profile will be amended.

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2018)
Richfield	0	0/0	\$0
Stanfield	0	0/0	\$0
Unincorporated Area	9	0/1	\$10,669,926
<b>Union County</b>	<b>20</b>	<b>1/26</b>	<b>\$63,482,210</b>
Fairview	0	0/0	\$0
Hemby Bridge	0	0/0	\$0
Indian Trail	0	0/0	\$0
Lake Park	0	0/0	\$0
Marshville	0	0/0	\$0
Marvin	0	0/0	\$0
Mineral Springs	0	0/0	\$0
Monroe	2	0/0	\$344,602
Stallings	1	0/1	\$82,821
Unionville	1	0/0	\$0
Waxhaw	0	0/0	\$0
Weddington	0	0/0	\$0
Wesley Chapel	0	0/0	\$0
Wingate	0	0/0	\$0
Unincorporated Area	16	1/25	\$63,054,787
<b>Cabarrus Stanly Union Regional Total</b>	<b>43</b>	<b>1/30</b>	<b>\$144,556,583</b>

Source: National Centers for Environmental Information

### Thunderstorms

Severe storms have not resulted in any disaster declarations in the Cabarrus Stanly Union Region in and of themselves; however, several declared disaster events such as the tornadoes of 1989 were likely accompanied by severe storms<sup>10</sup>. According to NCEI, there have been 585 reported thunderstorm and high wind events since 1957 in the Cabarrus Stanly Union<sup>11</sup>. These events caused over \$6.4 million (2018 dollars) in damages. There were reports of three injuries. **Table 5.16** summarizes this information.

**TABLE 5.16: SUMMARY OF THUNDERSTORM / HIGH WIND OCCURRENCES**

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2018)
<b>Cabarrus County</b>	<b>195</b>	<b>0/0</b>	<b>\$1,556,559</b>
Concord	47	0/0	\$303,283
Harrisburg	18	0/0	\$151,109
Kannapolis	20	0/0	\$79,260
Midland	10	0/0	\$76,790
Mount Pleasant	11	0/0	\$45,457
Unincorporated Area	89	0/0	\$900,660
<b>Stanly County</b>	<b>162</b>	<b>0/3</b>	<b>\$2,932,863</b>
Albemarle	40	0/3	\$2,831,837
Badin	5	0/0	\$23,533

<sup>10</sup> Not all of the participating counties were declared disaster areas for these events. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Identification*.

<sup>11</sup> These thunderstorm events are only inclusive of those reported by the National Centers for Environmental Information (NCEI). It is likely that additional thunderstorm events have occurred in the Cabarrus Stanly Union Region. As additional local data becomes available, this hazard profile will be amended.

**SECTION 5: HAZARD PROFILES**

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2018)
Locust	7	0/0	\$5,788
Misenhiemer	0	0/0	\$0
New London	9	0/0	\$2,500
Norwood	11	0/0	\$2,132
Oakboro	5	0/0	\$13,796
Red Cross	2	0/0	\$0
Richfield	3	0/0	\$578
Stanfield	9	0/0	\$28,597
Unincorporated Area	71	0/0	\$24,102
<b>Union County</b>	<b>228</b>	<b>0/1</b>	<b>\$1,940,540</b>
Fairview	10	0/0	\$1,371
Hemby Bridge	0	0/0	\$0
Indian Trail	10	0/0	\$55,049
Lake Park	0	0/0	\$0
Marshville	16	0/0	\$54,840
Marvin	2	0/0	\$0
Mineral Springs	7	0/0	\$22,019
Monroe	47	0/0	\$409,693
Stallings	4	0/0	\$1,548
Unionville	7	0/0	\$348,542
Waxhaw	23	0/0	\$929,223
Weddington	8	0/0	\$24,846
Wesley Chapel	2	0/0	\$0
Wingate	8	0/0	\$6,859
Unincorporated Area	84	0/1	\$86,550
<b>Cabarrus Stanly Union Regional Total</b>	<b>585</b>	<b>0/4</b>	<b>\$6,429,962</b>

Source: National Centers for Environmental Information

**Hailstorms**

According to the National Centers for Environmental Information, 263 recorded hailstorm events have affected the Cabarrus Stanly Union Region since 1959<sup>12</sup>. **Table 5.17** is a summary of the hail events in the Cabarrus Stanly Union Region. In all, hail occurrences resulted in over \$274,000 (2018 dollars) in property damages, most of which were reported in Stanly County. Hail ranged in diameter from 0.75 inches to 4.5 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Centers for Environmental Information. Furthermore, high losses in Stanly County indicate that neighboring counties may also be subject to additional, unreported losses. Therefore, it is likely that damages are greater than the reported value. Additionally, a single storm event may have affected multiple counties.

<sup>12</sup> These hail events are only inclusive of those reported by the National Centers for Environmental Information (NCEI). It is likely that additional hail events have affected the Cabarrus Stanly Union Region. In addition to NCEI, the North Carolina Department of Insurance office was contacted for information. As additional local data becomes available, this hazard profile will be amended.

TABLE 5.17: SUMMARY OF HAIL OCCURRENCES

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2018)
<b>Cabarrus County</b>	<b>103</b>	<b>0/0</b>	<b>\$0</b>
Concord	38	0/0	\$0
Harrisburg	8	0/0	\$0
Kannapolis	9	0/0	\$0
Midland	2	0/0	\$0
Mount Pleasant	7	0/0	\$0
Unincorporated Area	39	0/0	\$0
<b>Stanly County</b>	<b>64</b>	<b>0/0</b>	<b>\$274,071</b>
Albemarle	14	0/0	\$0
Badin	2	0/0	\$0
Locust	5	0/0	\$0
Misenhiemer	0	0/0	\$0
New London	3	0/0	\$0
Norwood	3	0/0	\$0
Oakboro	4	0/0	\$0
Red Cross	0	0/0	\$0
Richfield	3	0/0	\$0
Stanfield	1	0/0	\$0
Unincorporated Area	29	0/0	\$274,071
<b>Union County</b>	<b>116</b>	<b>0/0</b>	<b>\$0</b>
Fairview	3	0/0	\$0
Hemby Bridge	0	0/0	\$0
Indian Trail	9	0/0	\$0
Lake Park	0	0/0	\$0
Marshville	3	0/0	\$0
Marvin	1	0/0	\$0
Mineral Springs	8	0/0	\$0
Monroe	16	0/0	\$0
Stallings	6	0/0	\$0
Unionville	4	0/0	\$0
Waxhaw	19	0/0	\$0
Weddington	4	0/0	\$0
Wesley Chapel	1	0/0	\$0
Wingate	4	0/0	\$0
Unincorporated Area	38	0/0	\$0
<b>Cabarrus Stanly Union Regional Total</b>	<b>283</b>	<b>0/0</b>	<b>\$274,071</b>

Source: National Centers for Environmental Information

### Lightning

According to the National Centers for Environmental Information, there have been a total of 30 recorded lightning events in the Cabarrus Stanly Union Region since 1994<sup>13</sup>. These events resulted in

<sup>13</sup> These lightning events are only inclusive of those reported by the National Centers for Environmental Information (NCEI). It is certain that additional lightning events have occurred in the Cabarrus Stanly Union Region. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

nearly \$2.2 million (2018 dollars) in damages, as listed in summary **Table 5.18**. Furthermore, lightning caused eight injuries throughout the Cabarrus Stanly Union Region.

It is certain that more than 32 events have impacted the Region. Many of the reported events are those that caused damage. Therefore, it should be expected that damages are likely much higher for this hazard than what is reported.

**TABLE 5.18: SUMMARY OF LIGHTNING OCCURRENCES**

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2018)
<b>Cabarrus County</b>	<b>9</b>	<b>0/1</b>	<b>\$733,946</b>
Concord	0	0/0	\$0
Harrisburg	3	0/1	\$64,179
Kannapolis	2	0/0	\$54,975
Midland	0	0/0	\$0
Mount Pleasant	0	0/0	\$0
Unincorporated Area	4	0/0	\$614,792
<b>Stanly County</b>	<b>4</b>	<b>0/3</b>	<b>\$128,732</b>
Albemarle	2	0/0	\$105,140
Badin	0	0/0	\$0
Locust	0	0/0	\$0
Misenhiemer	0	0/0	\$0
New London	0	0/0	\$0
Norwood	1	0/3	\$0
Oakboro	0	0/0	\$0
Red Cross	0	0/0	\$0
Richfield	0	0/0	\$0
Stanfield	0	0/0	\$0
Unincorporated Area	1	0/0	\$23,592
<b>Union County</b>	<b>17</b>	<b>0/3</b>	<b>\$1,326,874</b>
Fairview	0	0/0	\$0
Hemby Bridge	0	0/0	\$0
Indian Trail	1	0/2	\$0
Lake Park	0	0/0	\$0
Marshville	1	0/0	\$60,609
Marvin	0	0/0	\$0
Mineral Springs	2	0/0	\$347,558
Monroe	9	0/0	\$5,497
Stallings	0	0/0	\$639,379
Unionville	0	0/0	\$0
Waxhaw	0	0/0	\$0
Weddington	3	0/1	\$249,052
Wesley Chapel	0	0/0	\$0
Wingate	1	0/0	\$24,779
Unincorporated Area	0	0/0	\$0
<b>Cabarrus Stanly Union Regional Total</b>	<b>30</b>	<b>0/7</b>	<b>\$2,189,552</b>

Source: National Centers for Environmental Information

## 5.6.4 Probability of Future Occurrences

### **Tornadoes**

According to historical information, tornado events are not an annual occurrence for the region. However, in recent years, the southeastern United States, including North Carolina, has experienced a number of tornado events. While the majority of the reported tornado events are small in terms of size, intensity, and duration, they do pose a significant threat should the Cabarrus Stanly Union Region experience a direct tornado strike. The probability of future tornado occurrences affecting the Cabarrus Stanly Union Region is likely (10 to 100 percent annual probability).

### **Thunderstorms**

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

### **Hailstorms**

Based on historical occurrence information, it is assumed that the probability of future hail occurrences is likely (10 to 100 percent annual probability). Since hail is an atmospheric hazard (coinciding with thunderstorms), it is assumed that the entire Cabarrus Stanly Union Region has equal exposure to this hazard. It can be expected that future hail events will continue to cause minor damage to property and vehicles throughout the region.

### **Lightning**

Since there were a moderate number of historical lightning events reported throughout the Cabarrus Stanly Union Region via NCEI data, it is considered a fairly regular occurrence that often accompanies thunderstorms. In fact, lightning events will assuredly happen on an annual basis, though not all events will cause damage. According to Vaisala's U.S. National Lightning Detection Network (NLDN), the Cabarrus Stanly Union Region is located in an area of the country that experienced an average of 4 to 5 lightning flashes per square kilometer per year between 2010 and 2018. Therefore, the probability of future events is highly likely (100 percent annual probability). It can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the region.

## 5.7 SEVERE WINTER WEATHER

### 5.7.1 Background and Description

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

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

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

### 5.7.2 Location and Spatial Extent

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

### 5.7.3 Historical Occurrences

Winter weather has resulted in three disaster declarations in the Cabarrus Stanly Union Region. This includes the Blizzard of 1996, one subsequent 2000 winter storm, and an ice storm in 2002<sup>14</sup>. According to the National Centers for Environmental Information, there have been a total of 96 recorded winter

---

<sup>14</sup> All of the participating counties were declared disaster areas for these events. A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Profiles*.

storm events in the Cabarrus Stanly Union Region since 1993 (**Table 5.19**)<sup>15</sup>. These events resulted in over \$46 million (2018 dollars) in damages.

**TABLE 5.19: SUMMARY OF WINTER STORM EVENTS**

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2018)
Cabarrus County	51	0/0	\$18,056,121
Stanly County	40	0/0	\$0
Union County	44	0/0	\$1,276,931
<b>Cabarrus Stanly Union Regional Total</b>	<b>135</b>	<b>2/10</b>	<b>\$19,333,052</b>

Source: National Centers for Environmental Information

There have been several severe winter weather events in the Cabarrus Stanly Union Region. The text below describes three of the major events and associated impacts on the Region. Similar impacts can be expected with severe winter weather.

#### 1996 Winter Storm

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

#### 2002 Ice Storm – December 4-5, 2002

An ice storm produced up to an inch of freezing rain in central North Carolina impacting 40 counties. A total of 24 people were killed, and as many as 1.8 million people were left without electricity. Additionally, property damage was estimated at almost \$100 million. New records were also set for traffic accidents and school closing durations. The scale of destruction was comparable to that of hurricanes that have impacted the state, such as Hurricane Fran in 1996. The storm cost the state \$97.2 million in response and recovery.

#### 2018 Winter Storm

This storm developed shortly after midnight on December 9, 2018 and continued into the afternoon. Snowfall was moderate to heavy and both sleet and rain were incorporated. Driving conditions were heavily disrupted and snowfall amounts reached up to 8 inches.

Winter storms throughout the planning area have several negative externalities including hypothermia for those individuals having to remain outdoors for a certain length of time and likely increased impact for the need of medical services, cost of snow and debris cleanup, business and government service interruption, traffic accidents, and power outages. Furthermore, citizens may resort to using inappropriate heating devices that could lead to fire or an accumulation of toxic fumes.

### 5.7.4 Probability of Future Occurrences

Winter storm events will remain a regular occurrence in the Cabarrus Stanly Union Region due to its location in the western part of the state. According to historical information the Cabarrus Stanly Union Region often experiences several winter storms events each year. Therefore, the annual probability is likely (10 to 100 percent).

<sup>15</sup> These ice and winter storm events are only inclusive of those reported by the National Climatic Data Center (NCDC). It is likely that additional winter storm conditions have affected the Cabarrus Stanly Union Region. In addition, the 96 are reported by county, so many of these storms likely affected all of the counties.

## 5.8 EARTHQUAKES

### 5.8.1 Background and Description

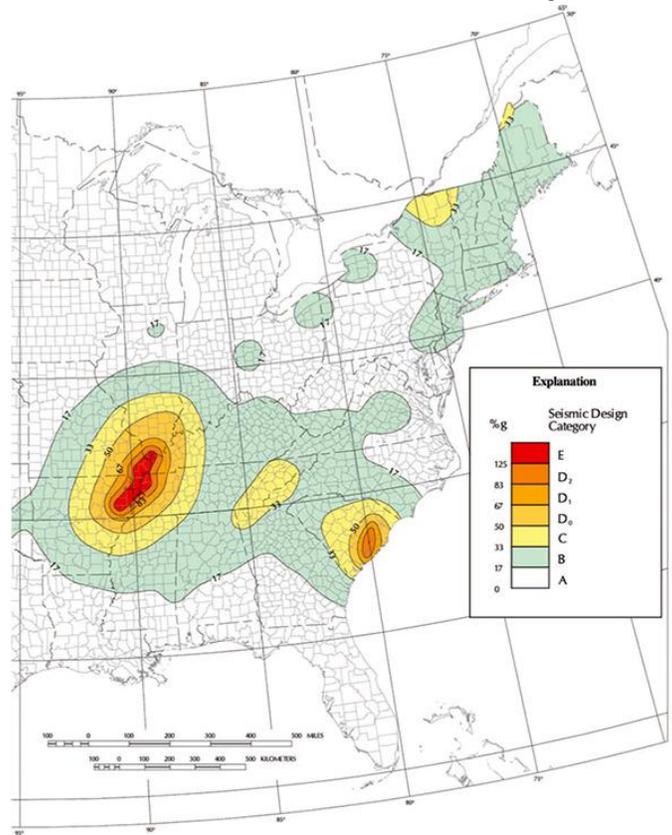
An earthquake is movement or trembling of the ground produced by sudden displacement of rock in the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of caverns. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured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

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

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

The greatest earthquake threat in the United States is along tectonic plate boundaries and seismic fault lines located in the central and western states; however, the Eastern United State does face moderate risk to less frequent, less intense earthquake events. **Figure 5.8** shows relative seismic risk for the United States.

**FIGURE 5.8: EASTERN UNITED STATES EARTHQUAKE HAZARD MAP**



Source: United States Geological Survey

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude (**Table 5.20**). Each unit increase in magnitude on the Richter Scale corresponds to a 10-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using roman numerals, ranging from “I” corresponding to imperceptible (instrumental) events to “XII” for catastrophic (total destruction). A detailed description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter Scale is given in **Table 5.21**.

**TABLE 5.20: RICHTER SCALE**

Richter Magnitudes	Earthquake Effects
< 3.5	Generally not felt, but recorded.
3.5 – 5.3	Often felt, but rarely causes damage.
5.4 – 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 – 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 – 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: Federal Emergency Management Agency

**TABLE 5.21: MODIFIED MERCALLI INTENSITY SCALE FOR EARTHQUAKES**

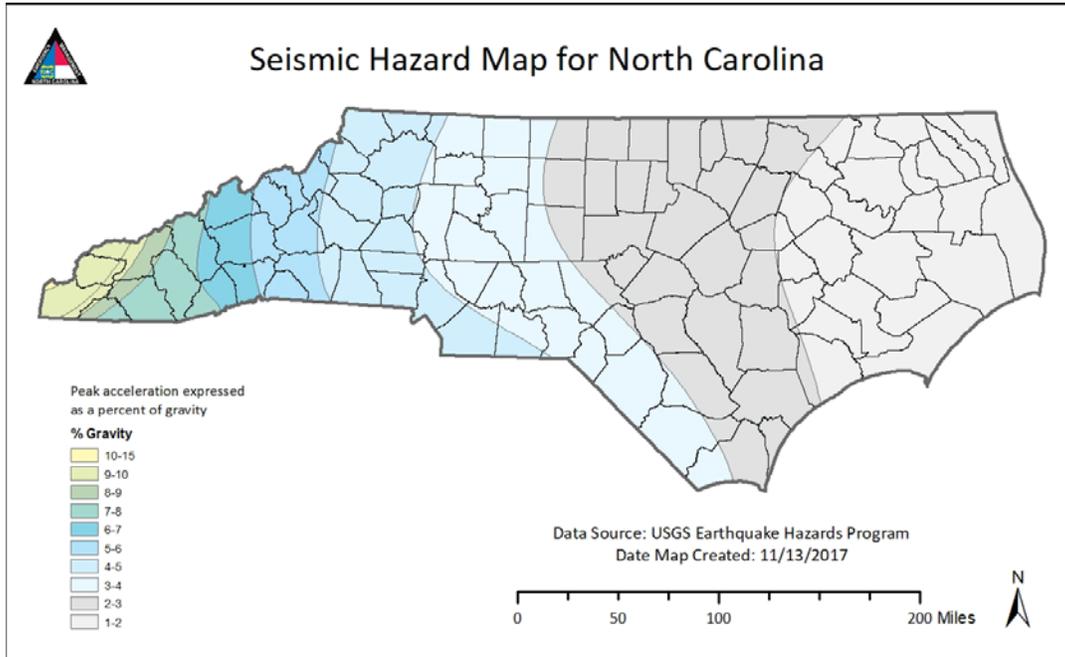
Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Not felt	Not felt except by a very few under especially favorable conditions.	
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.	< 4.2
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.	
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.	
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.	< 4.8
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.	< 5.4
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.	< 6.1
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.	
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.	< 6.9
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.	< 7.3
I	Not felt	Not felt except by a very few under especially favorable conditions.	< 8.1
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.	> 8.1

Source: Federal Emergency Management Agency

## 5.8.2 Location and Spatial Extent

Approximately two-thirds of North Carolina is subject to earthquakes, with the western and southeast region most vulnerable to a very damaging earthquake. The state is affected by both the Charleston Fault in South Carolina and New Madrid Fault in Tennessee. Both of these faults have generated earthquakes measuring greater than 8 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines throughout North Carolina. **Figure 5.9** is a map showing geological and seismic information for North Carolina.

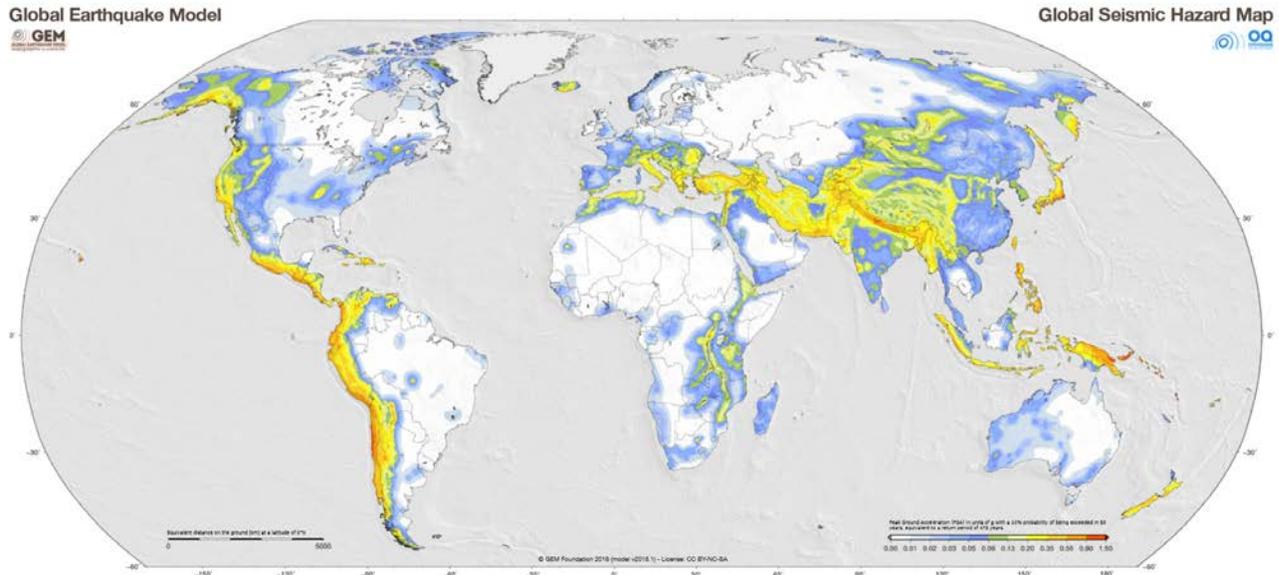
**FIGURE 5.9: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA**



Source: North Carolina Geological Survey

**Figure 5.10** shows the intensity level associated with the world and the Cabarrus Stanly Union Region, based on the national USGS and Global Earthquake Model (GEM). The Global Earthquake Model Global Seismic Hazard Map depicts the geographic distribution of the Peak Ground Acceleration (PGA) with a 10% probability of being exceeded in 50 years. The data represents the probability that the ground motion will reach a certain level during an earthquake. The map was created by collating maps computed using national and regional probabilistic seismic hazard models developed by various institutions and projects, and by GEM Foundation scientists. This indicates that the region as a whole exists within an area of low to moderate seismic risk.

**FIGURE 5.10: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS**



Source: Global Earthquake Model, 2018

### 5.8.3 Historical Occurrences

At least 15 earthquakes are known to have affected the Cabarrus Stanly Union Region since 1886. The strongest of these measured a VI on the Modified Mercalli Intensity (MMI) scale. **Table 5.22** provides a summary of earthquake events reported by the National Geophysical Data Center between 1638 and 2018.

**TABLE 5.22: SUMMARY OF SEISMIC ACTIVITY**

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
<b>Cabarrus County</b>	<b>8</b>	<b>VI</b>	<b>7</b>
Concord	3	VI	7
Harrisburg	1	III	4
Kannapolis	2	IV	4
Midland	0	--	--
Mount Pleasant	1	II	3
Unincorporated Area	1	VI	7
<b>Stanly County</b>	<b>4</b>	<b>V</b>	<b>5</b>
Albemarle	1	V	5
Badin	0	--	--
Locust	0	--	--
Misenhiemer	0	--	--
New London	1	III	4
Norwood	0	--	--
Oakboro	1	III	4
Red Cross	0	--	--
Richfield	1	III	4
Stanfield	0	--	--

**SECTION 5: HAZARD PROFILES**

Location	Number of Occurrences	Greatest MMI Reported	Richter Scale Equivalent
Unincorporated Area	0	--	--
<b>Union County</b>	<b>3</b>	<b>VI</b>	<b>7</b>
Fairview	1	IV	3
Hemby Bridge	0	--	--
Indian Trail	0	--	--
Lake Park	0	--	--
Marshville	0	--	--
Marvin	0	--	--
Mineral Springs	0	--	--
Monroe	2	VI	7
Stallings	0	--	--
Unionville	0	--	--
Waxhaw	0	--	--
Weddington	0	--	--
Wesley Chapel	0	--	--
Wingate	0	--	--
Unincorporated Area	0	--	--
<b>Cabarrus Stanly Union Regional Total</b>	<b>15</b>	<b>VI</b>	<b>7</b>

In addition to those earthquakes specifically affecting the Cabarrus Stanly Union Region, a list of earthquakes that have caused damage throughout North Carolina is presented below in **Table 5.23**.

**TABLE 5.23: EARTHQUAKES WHICH HAVE CAUSED DAMAGE IN NORTH CAROLINA**

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

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

#### **5.11.4 Probability of Future Occurrences**

The probability of significant, damaging earthquake events affecting the Cabarrus Stanly Union Region is unlikely. However, it is possible that future earthquakes resulting in light to moderate perceived shaking and damages ranging from none to very light will affect the region. The annual probability level for the region is estimated between 1 and 10 percent (possible). The USGS also uses historical data to predict the probability of a major earthquake within the next 50 years by county. Those results follow: Cabarrus County – 0.68%; Stanly County – 0.64%; Union County – 1.04%

## 5.9 GEOLOGICAL

### 5.9.1 Background and Description

For the purposes of maintaining consistency with the State of North Carolina Hazard Mitigation Plan, this section will assess geological hazards which include landslides, sinkholes, and erosion.

#### Landslides

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

There are several types of landslides: rock falls, rock topple, slides, and flows. Rock falls are rapid movements of bedrock, which result in bouncing or rolling. A topple is a section or block of rock that rotates or tilts before falling to the slope below. Slides are movements of soil or rock along a distinct surface of rupture, which separates the slide material from the more stable underlying material.

Mudflows, sometimes referred to as mudslides, mudflows, lahars or debris avalanches, are fast-moving rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as heavy rainfall or rapid snowmelt, changing the soil into a flowing river of mud or “slurry.” Slurry can flow rapidly down slopes or through channels and can strike with little or no warning at avalanche speeds. Slurry can travel several miles from its source, growing in size as it picks up trees, cars, and other materials along the way. As the flows reach flatter ground, the mudflow spreads over a broad area where it can accumulate in thick deposits.

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

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

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

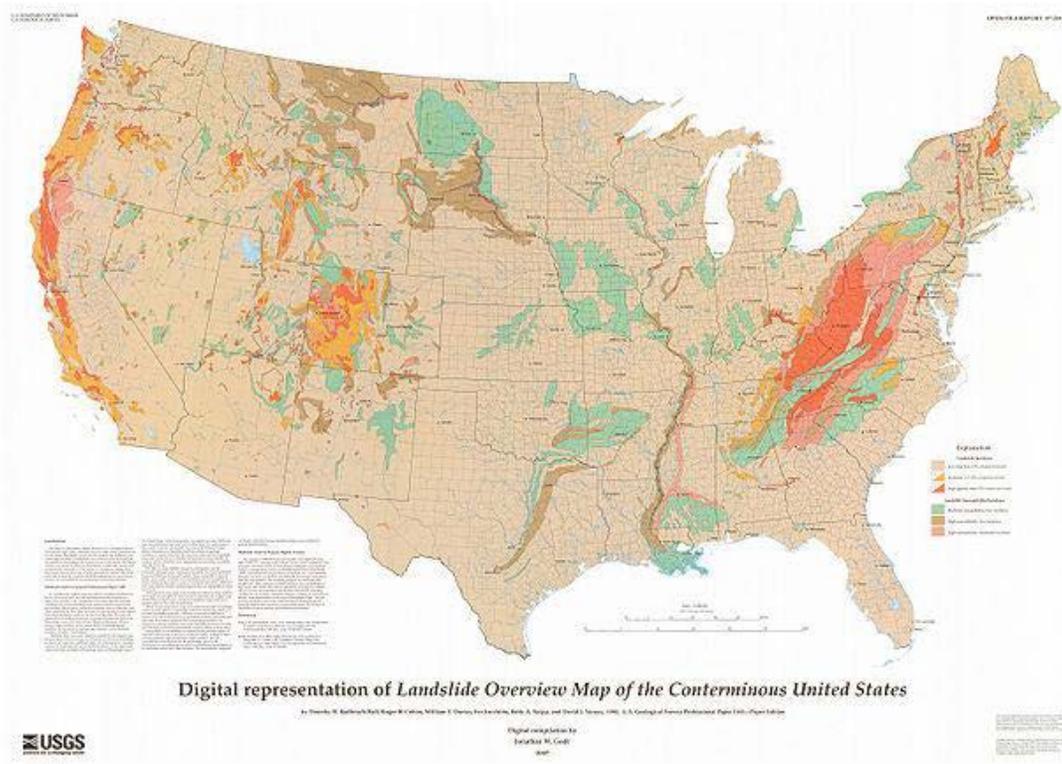
According to the United States Geological Survey, each year landslides cause \$5.1 billion (2018 dollars) in damage and between 25 and 50 deaths in the United States<sup>16</sup>. **Figure 5.11** delineates areas where

---

<sup>16</sup> United States Geological Survey (USGS). United States Department of the Interior. “Landslide Hazards – A National Threat.” 2005.

large numbers of landslides have occurred and areas that are susceptible to landsliding in the conterminous United States<sup>17</sup>.

**FIGURE 5.11: LANDSLIDE OVERVIEW MAP OF THE CONTERMINOUS UNITED STATES<sup>18</sup>**



Landslide Incidence		Landslide Susceptibility/Incidence	
	Low Incidence (less than 1.5% of area involved)		Moderate susceptibility/low incidence
	Moderate Incidence (1.5%-15% of area involved)		High susceptibility/low incidence
	High Incidence (greater than 15% of area involved)		High susceptibility/moderate incidence

Source: USGS

### Sinkholes

According to the United States Geological Survey, a sinkhole is an area of ground that has no natural external surface drainage--when it rains, all of the water stays inside the sinkhole and typically drains into the subsurface. Sinkholes can vary from a few feet to hundreds of acres and from less than 1 to

<sup>17</sup> This map layer is provided in the U.S. Geological Survey Professional Paper 1183, Landslide Overview Map of the Conterminous United States, available online at: [http://landslides.usgs.gov/html\\_files/landslides/nationalmap/national.html](http://landslides.usgs.gov/html_files/landslides/nationalmap/national.html).

<sup>18</sup> Susceptibility not indicated where same or lower than incidence. Susceptibility to landsliding was defined as the probable degree of response of [the areal] rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landsliding. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated.

more than 100 feet deep. Some are shaped like shallow bowls or saucers whereas others have vertical walls.

Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that can naturally be dissolved by groundwater circulating through them. As the rock dissolves, spaces and caverns develop underground. Sinkholes are dramatic because the land usually stays intact for a while until the underground spaces just get too big. If there is not enough support for the land above the spaces then a sudden collapse of the land surface can occur. These collapses can be small, or, as **Figure 5.12** below shows, they can be huge and can occur where a house or road is on top<sup>19</sup>.

**FIGURE 5.12: SINKHOLE IN NORTH CAROLINA**



Source: NCEM

**Erosion**

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

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

---

<sup>19</sup> Sinkholes. United States Geological Survey. Retrieved on December 14, 2017 from: <https://water.usgs.gov/edu/sinkholes.html>

An area's potential for erosion is determined by four factors: soil characteristics, vegetative cover, topography climate or rainfall, and topography. Soils composed of a large percentage of silt and fine sand are most susceptible to erosion. As the clay and organic content of these soils increases, the potential for erosion decreases. Well-drained and well-graded gravels and gravel-sand mixtures are the least likely to erode. Coarse gravel soils are highly permeable and have a good capacity for absorption, which can prevent or delay the amount of surface runoff. Vegetative cover can be very helpful in controlling erosion by shielding the soil surface from falling rain, absorbing water from the soil, and slowing the velocity of runoff. Runoff is also affected by the topography of the area including size, shape, and slope. The greater the slope length and gradient, the more potential an area has for erosion. Climate can affect the amount of runoff, especially the frequency, intensity, and duration of rainfall and storms. When rainstorms are frequent, intense, or of long duration, erosion risks are high. Seasonal changes in temperature and rainfall amounts define the period of highest erosion risk of the year.

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

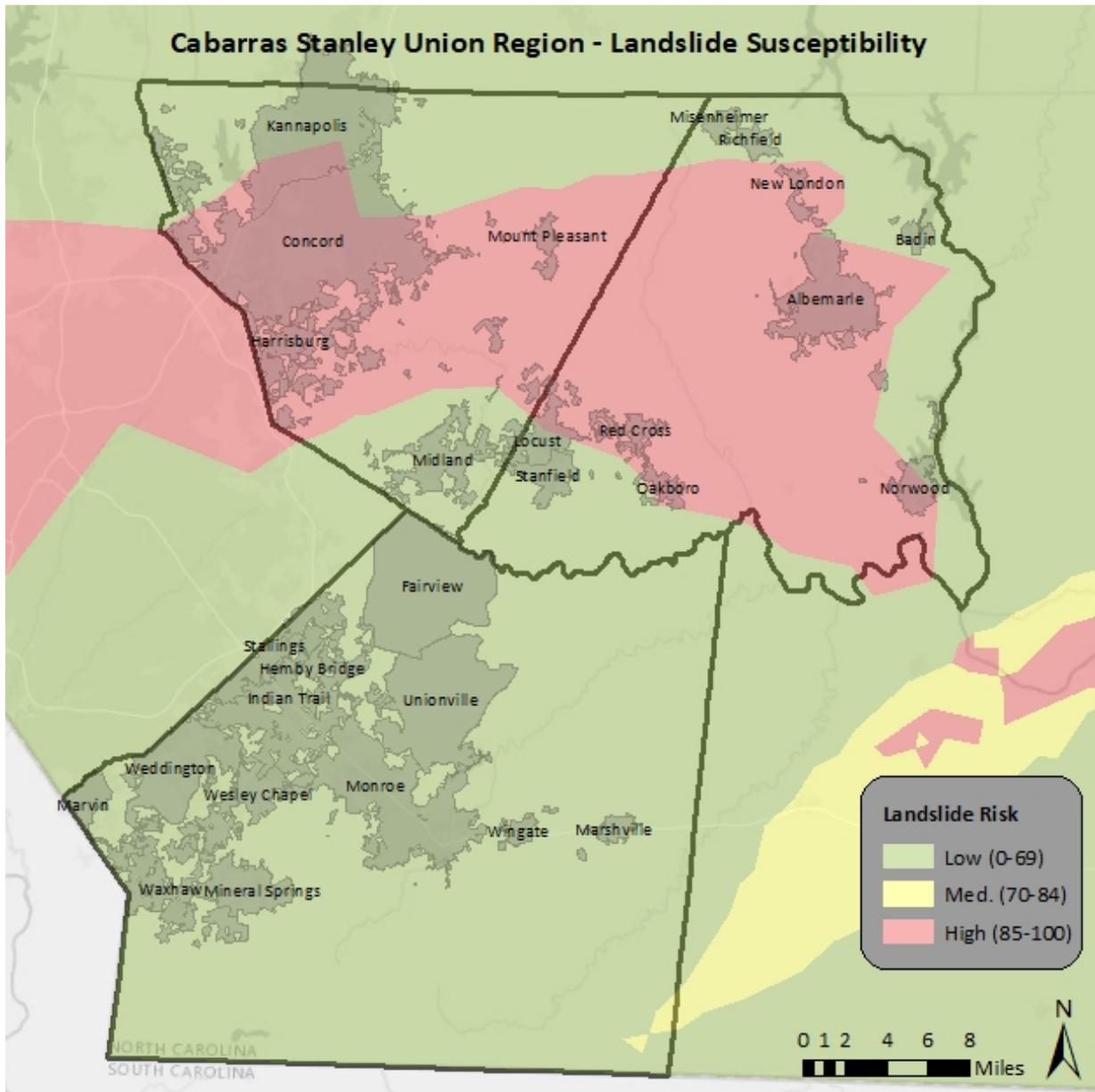
## **5.9.2 Location and Spatial Extent**

### **Landslides**

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

According to **Figure 5.13** below, much of the region, has high landslide activity, especially in Cabarrus and Stanly Counties. The remaining portion of the region, including all of Union County, has a moderate incidence occurrence rate. There is some susceptibility throughout the region.

**FIGURE 5.13: LANDSLIDE SUSCEPTIBILITY**

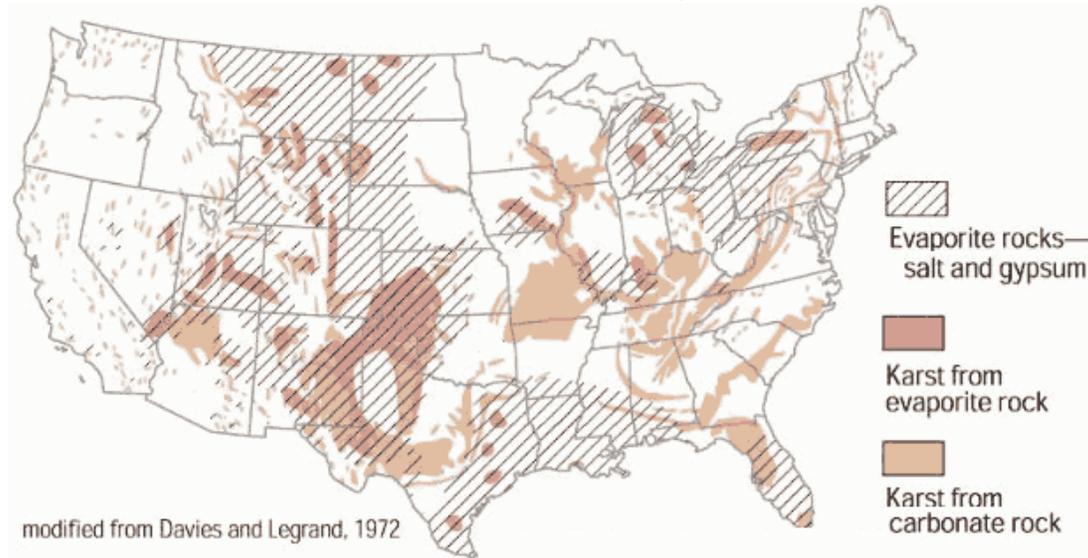


Source: United States Geological Survey

**Sinkholes**

Figure 5.14 below shows areas of the United States where certain rock types that are susceptible to dissolution in water occur. In these areas, the formation of underground cavities can form and catastrophic sinkholes can happen. These rock types are evaporites (salt, gypsum, and anhydrite) and carbonates (limestone and dolomite). Evaporite rocks underlie about 35 to 40 percent of the United States, though in many areas they are buried at great depths. In some cases, sinkholes in North Carolina have been measured at up to 20 to 25 feet in depth, with similar widths.

**FIGURE 5.14: UNITED STATES GEOLOGICAL SURVEY OF KARST MODIFIED FROM DAVIES AND LEGRAND, 1972**



### Erosion

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

## 5.9.3 Historical Occurrences

### Landslides

Steep topography in some areas of the Cabarrus Stanly Union Region makes the planning area susceptible to landslides. Most landslides are caused by heavy rainfall in the area. Building on steep slopes that was not previously possible also contributes to risk. The locations of landslide events as provided by the North Carolina Geological Survey are showed that there were no reported incidents in the region<sup>20</sup>. Some incidence mapping has also been completed throughout the western portion of North Carolina though it is not complete. Therefore, it should be noted that many more incidents than what is reported are likely to have occurred in Cabarrus, Stanly, and Union Counties. Previous versions of all of the region's mitigation plans explain that there have been no recorded occurrences of significant landslides.

### Sinkholes

In North Carolina, most sinkholes occur in the southern coastal plain due to the high concentration of limestone; however, they are also common in the western part of the state and in the Cabarrus Stanly

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

Union region. According to a search of local media outlets across the state, the western area has experienced more than 40 sinkholes over the past 20 years. There are no historical occurrences of sinkholes in the region.

### **Erosion**

Most historical occurrences of erosion are seen near the coast of North Carolina, but the Cabarrus Stanly Union region is still susceptible to the hazard. Several sources were vetted to identify areas of erosion in the Cabarrus Stanly Union Region. This includes searching local newspapers, interviewing local officials, and reviewing previous hazard mitigation plans. Little information could be found beyond the hazard mitigation plans. Erosion was referenced in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan, but there was no recorded history of significant erosion events and it was found to be hazard with a negligible potential impact.

## **5.9.4 Probability of Future Occurrences**

### **Landslides**

Based on historical information and the USGS susceptibility index, the probability of future landslide events is possible (10 to 100 percent probability). Local conditions may become more favorable for landslides due to heavy rain, for example. This would increase the likelihood of occurrence. It should also be noted that some areas in the Cabarrus Stanly Union Region have greater risk than others given factors such as steepness on slope and modification of slopes.

### **Sinkholes**

Sinkholes have also affected parts of North Carolina in recent history, but most of those impacts have been in the southeastern region of the state, not the Cabarrus Stanly Union region. While many sinkholes have been relatively small, it is still unlikely (between 1 and 33.3 percent annual probability) that this region will continue to be affected in the future.

### **Erosion**

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

## 5.10 DAM FAILURE

### 5.10.1 Background and Description

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

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

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

### 5.10.2 Location and Spatial Extent

The North Carolina Division of Land Resources provides information on dams, including a hazard potential classification. There are three hazard classifications—high, intermediate, and low—that correspond to qualitative descriptions and quantitative guidelines. **Table 5.24** explains these classifications.

**TABLE 5.24: NORTH CAROLINA DAM HAZARD CLASSIFICATIONS**

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

Source: North Carolina Division of Energy, Mineral, and Land Resources

According to the North Carolina Division of Energy, Mineral, and Land Resources, there are 242 dams in the Cabarrus Stanly Union Region<sup>21</sup>. **Figure 5.16** shows the dam location and the corresponding hazard ranking for each. Of these dams, 58 are classified as high hazard potential. These high hazard dams are summarized by county in **Table 5.25**.

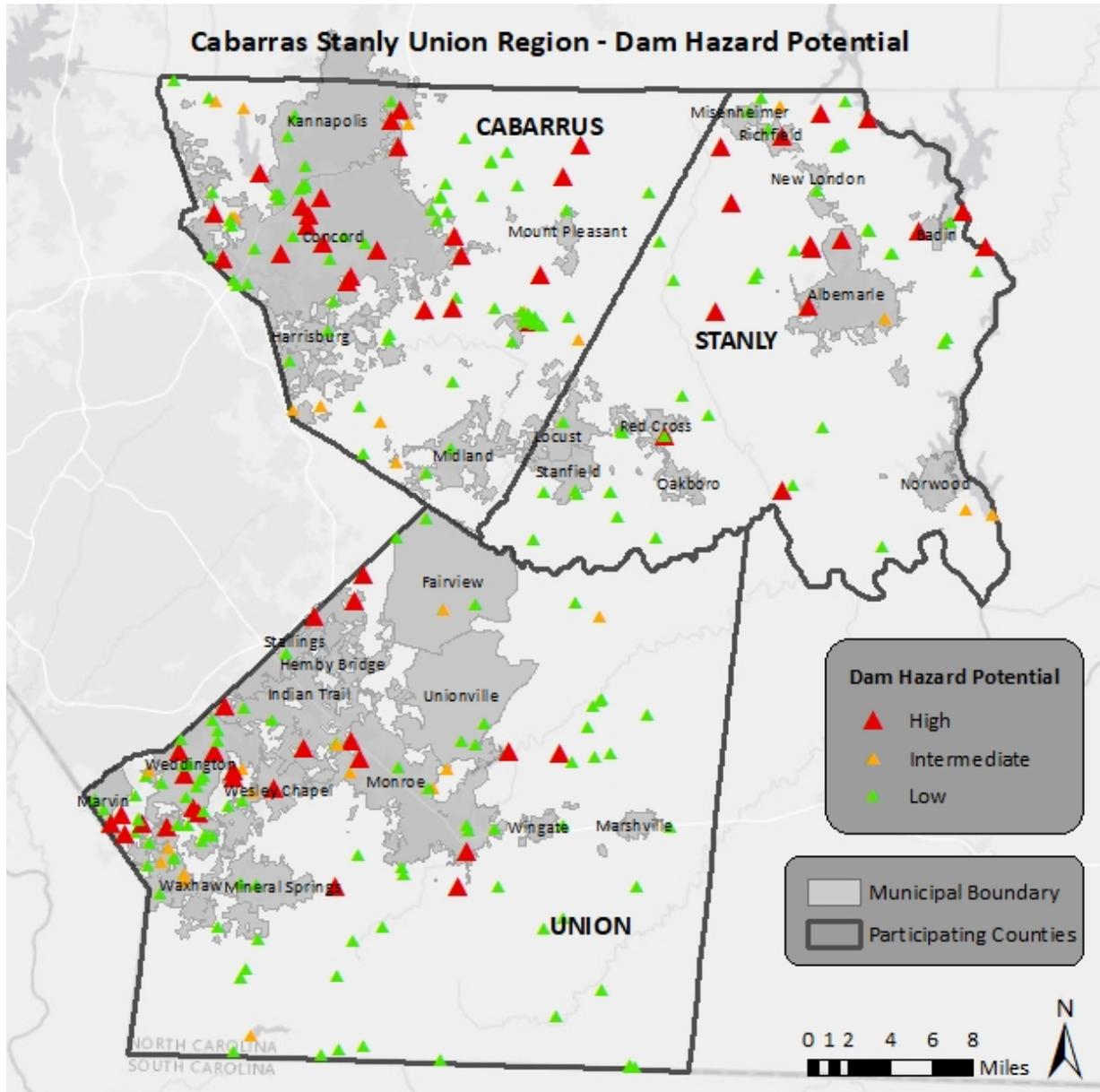
**TABLE 5.25: SUMMARY OF HIGH HAZARD DAM LOCATION**

<sup>21</sup> The October 23, 2018 list of high hazard dams obtained from the North Carolina Division of Energy, Mineral, and Land Resources (<http://portal.ncdenr.org/web/lr/dams>) was reviewed and amended by local officials to the best of their knowledge.

Location	Number High Hazard Dams
Cabarrus County	19
Stanly County	14
Union County	25
<b>Cabarrus Stanly Union Region Total</b>	<b>58</b>

Source: North Carolina Division of Energy, Mineral, and Land Resources

FIGURE 5.16: CABARRUS STANLY UNION REGION HIGH HAZARD DAM LOCATIONS



Source: North Carolina Division of Land Resources, 2018

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

### 5.10.3 Historical Occurrences

There is no record of significant dam failure in the Cabarrus Stanly Union Region, though little information was available. In addition, it should be noted that several breach scenarios in the area could be catastrophic.

### 5.10.4 Probability of Future Occurrence

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

## 5.11 FLOODING

### 5.11.1 Background and Description

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

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

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

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

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

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

### 5.11.2 Location and Spatial Extent

There are areas in the Cabarrus Stanly Union Region that are susceptible to flood events. Special flood hazard areas in the Cabarrus Stanly Union Region were mapped using Geographic Information System

(GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM)<sup>22</sup>. This includes Zone A (1-percent annual chance floodplain), Zone AE (1-percent annual chance floodplain with elevation), Zone X500 (0.2-percent annual chance floodplain). According to GIS analysis, of the 2,357 square miles that make up the Cabarrus Stanly Union Region, there are approximately 90 square miles of land in zones A and AE (1-percent annual chance floodplain/100-year floodplain) and 5.36 square miles of land in zone X500 (0.2-percent annual chance floodplain/500-year floodplain). The county totals are presented below in **Table 5.26**.

**TABLE 5.26: SUMMARY OF FLOODPLAIN AREAS**

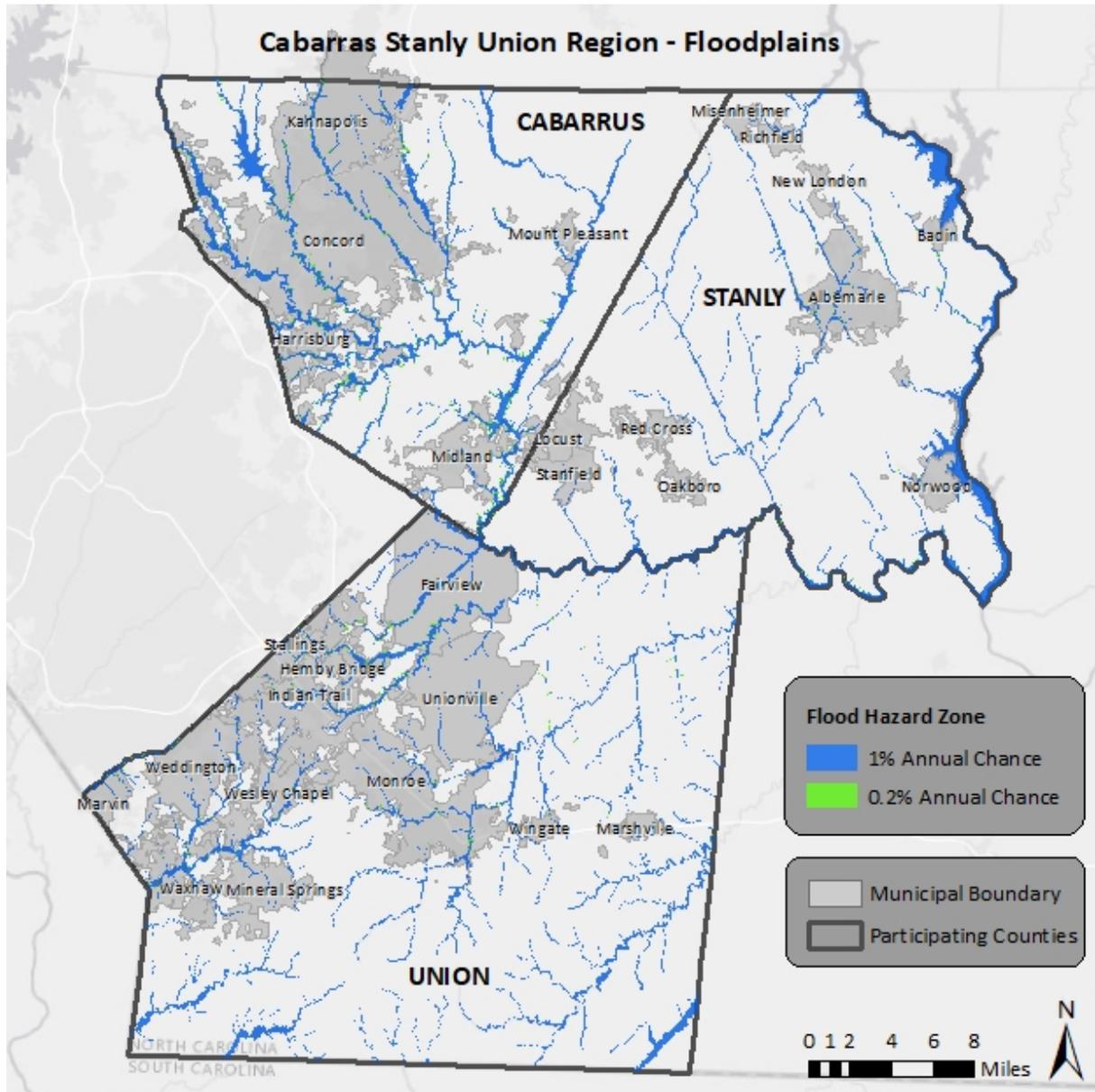
Location	100-year area (square miles)	500-year area (square miles)
Cabarrus County	29.96	3.19
Stanly County	25.21	0.55
Union County	40.11	1.62
<b>CABARRUS STANLY UNION REGION TOTAL</b>	<b>89.28</b>	<b>5.36</b>

These flood zone values account for 4.01 percent of the total land area in the Cabarrus Stanly Union Region. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas. **Figure 5.17** illustrates the location and extent of currently mapped special flood hazard areas for the Cabarrus Stanly Union Region based on best available FEMA DFIRM data from October of 2018.

---

<sup>22</sup> The county-level flood map data used for the Cabarrus Stanly Union Region were updated in 2014 for Union County, and 2018 for Stanly and Cabarrus Counties.

FIGURE 5.17: SPECIAL FLOOD HAZARD AREAS



Source: Federal Emergency Management Agency

### 5.11.3 Historical Occurrences

Information from the National Centers for Environmental Information was used to ascertain historical flood events. The National Centers for Environmental Information reported a total of 197 events throughout the Cabarrus Stanly Union Region since 1993<sup>23</sup>. A summary of these events is presented in **Table 5.27**. These events accounted for over \$19.2 million (2018 dollars) in property damage throughout the region<sup>24</sup>.

<sup>23</sup> These events are only inclusive of those reported by NCEI. It is likely that additional occurrences have occurred and have gone unreported.

<sup>24</sup> The total damage amount was averaged over the number of affected counties when multiple counties were involved in the flood event.

TABLE 5.27: SUMMARY OF FLOOD OCCURRENCES

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2018)
<b>Cabarrus County</b>	<b>64</b>	<b>0/4</b>	<b>\$18,462,638</b>
Concord	7	0/0	\$58,624
Harrisburg	7	0/0	\$72,552
Kannapolis	7	0/0	\$1,299,215
Midland	1	0/0	\$5,325
Mount Pleasant	3	0/0	\$13,719
Unincorporated Area	39	0/4	\$17,013,203
<b>Stanly County</b>	<b>63</b>	<b>5/0</b>	<b>\$299,847</b>
Albemarle	21	0/0	\$0
Badin	0	0/0	\$0
Locust	2	0/0	\$0
Misenhiemer	1	0/0	\$0
New London	0	0/0	\$0
Norwood	4	0/0	\$0
Oakboro	2	0/0	\$0
Red Cross	1	0/0	\$0
Richfield	5	0/0	\$28,941
Stanfield	3	0/0	\$0
Unincorporated Area	24	5/0	\$270,906
<b>Union County</b>	<b>70</b>	<b>1/0</b>	<b>\$455,175</b>
Fairview	5	0/0	\$0
Hemby Bridge	0	0/0	\$0
Indian Trail	11	0/0	\$70,686
Lake Park	0	0/0	\$0
Marshville	1	0/0	\$0
Marvin	0	0/0	\$0
Mineral Springs	1	0/0	\$23,449
Monroe	20	0/0	\$12,521
Stallings	1	0/0	\$0
Unionville	1	0/0	\$0
Waxhaw	2	0/0	\$138,246
Weddington	2	0/0	\$29,569
Wesley Chapel	1	0/0	\$21,301
Wingate	5	0/0	\$10,480
Unincorporated Area	20	1/0	\$148,923
<b>Cabarrus Stanly Union Regional Total</b>	<b>197</b>	<b>6/4</b>	<b>\$19,217,660</b>

Source: National Centers for Environmental Information

#### 5.11.4 Historical Summary of Insured Flood Losses

According to FEMA flood insurance policy records as of August 2018, there have been 264 flood losses reported in the Cabarrus Stanly Union Region through the National Flood Insurance Program (NFIP) since 1978, totaling over \$4.82 million in claims payments (2018 dollars). A summary of these figures for each Cabarrus Stanly Union county is provided in **Table 5.28**. It should be emphasized that these numbers include only those losses to structures that were insured through the NFIP policies, and for losses in which claims were sought and received. It is likely that many additional instances of flood loss in the Cabarrus Stanly Union Region were either uninsured, denied claims payment, or not reported.

**TABLE 5.28: SUMMARY OF INSURED FLOOD LOSSES**

Location	Flood Losses	Claims Payments
<b>Cabarrus County</b>	<b>182</b>	<b>\$3,856,036</b>
Concord	21	\$131,442
Harrisburg	44	\$660,642
Kannapolis	17	\$1,208,377
Midland	0	\$0
Mount Pleasant	0	\$0
Unincorporated Area	100	\$1,855,575
<b>Stanly County</b>	<b>37</b>	<b>\$398,730</b>
Albemarle	30	\$351,635
Badin	1	\$0
Locust	0	\$0
Misenhiemer	0	\$0
New London	0	\$0
Norwood	1	\$6,706
Oakboro	1	\$10,622
Red Cross	0	\$0
Richfield	0	\$0
Stanfield	0	\$0
Unincorporated Area	4	\$29,767
<b>Union County</b>	<b>47</b>	<b>\$573,370</b>
Fairview	0	\$0
Hemby Bridge	0	\$0
Indian Trail	10	\$49,878
Lake Park	0	\$0
Marshville	0	\$0
Marvin	0	\$0
Mineral Springs	0	\$0
Monroe	3	\$15,578
Stallings	3	\$91,652
Unionville	0	\$0
Waxhaw	0	\$0
Weddington	0	\$0
Wesley Chapel	2	\$40,660
Wingate	0	\$0
Unincorporated Area	29	\$375,602
<b>Cabarrus Stanly Union Regional Total</b>	<b>266</b>	<b>\$4,828,136</b>

Source: Federal Emergency Management Agency, National Flood Insurance Program

### 5.11.5 Repetitive Loss Properties

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

Currently (as of October 2013), there are 24 non-mitigated repetitive loss properties located in the Cabarrus Stanly Union Region, which accounted for 71 losses and more than \$2.2 million in claims payments under the NFIP. The average claim amount for these properties is \$31,600. Many of the 24

properties are single family residential and the remaining are other residential, commercial, or government-owned buildings. Without mitigation these properties will likely continue to experience flood losses. **Table 5.27** presents a summary of these figures for the Cabarrus Stanly Union Region. Detailed information on repetitive loss properties and NFIP claims and policies can be found in the jurisdiction-specific annexes.

**TABLE 5.27: SUMMARY OF REPETITIVE LOSS PROPERTIES**

Location	Number of Properties	Number of Losses	Total Payments
<b>Cabarrus County</b>	<b>18</b>	<b>54</b>	<b>\$1,963,776</b>
Concord	3	9	\$259,425
Harrisburg	5	18	\$216,892
Kannapolis	2	5	\$1,126,022
Midland	0	0	\$0
Mount Pleasant	0	0	\$0
Unincorporated Area	8	22	\$361,437
<b>Stanly County</b>	<b>3</b>	<b>8</b>	<b>\$190,231</b>
Albemarle	3	8	\$190,231
Badin	0	0	\$0
Locust	0	0	\$0
Misenhiemer	0	0	\$0
New London	0	0	\$0
Norwood	0	0	\$0
Oakboro	0	0	\$0
Red Cross	0	0	\$0
Richfield	0	0	\$0
Stanfield	0	0	\$0
Unincorporated Area	0	0	\$0
<b>Union County</b>	<b>3</b>	<b>9</b>	<b>\$89,606</b>
Fairview	0	0	\$0
Hemby Bridge	0	0	\$0
Indian Trail	2	7	\$76,587
Lake Park	0	0	\$0
Marshville	0	0	\$0
Marvin	0	0	\$0
Mineral Springs	0	0	\$0
Monroe	1	2	\$13,020
Stallings	0	0	\$0
Unionville	0	0	\$0
Waxhaw	0	0	\$0
Weddington	0	0	\$0
Wesley Chapel	0	0	\$0
Wingate	0	0	\$0
Unincorporated Area	0	0	\$0
<b>CABARRUS STANLY UNION REGION TOTAL</b>	<b>24</b>	<b>71</b>	<b>\$2,243,613</b>

Source: National Flood Insurance Program

### 5.11.6 Probability of Future Occurrences

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

## SECTION 5: HAZARD PROFILES

---

It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the Cabarrus Stanly Union Region. For example, Union County has more floodplains and a higher history of flood occurrences, and thus a higher risk of flood than other counties. Flooding is not the greatest hazard of concern, but will continue to occur and cause damage. Therefore, mitigation actions may be warranted, particularly for repetitive loss properties.

# Other Hazards

## 5.12 WILDFIRES

### 5.12.1 Background and Description

A wildfire is any outdoor fire (i.e. grassland, forest, brush land) that is not under control, supervised, or prescribed<sup>25</sup>. Wildfires are part of the natural management of forest ecosystems, but may also be caused by human factors.

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

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

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

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

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

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

---

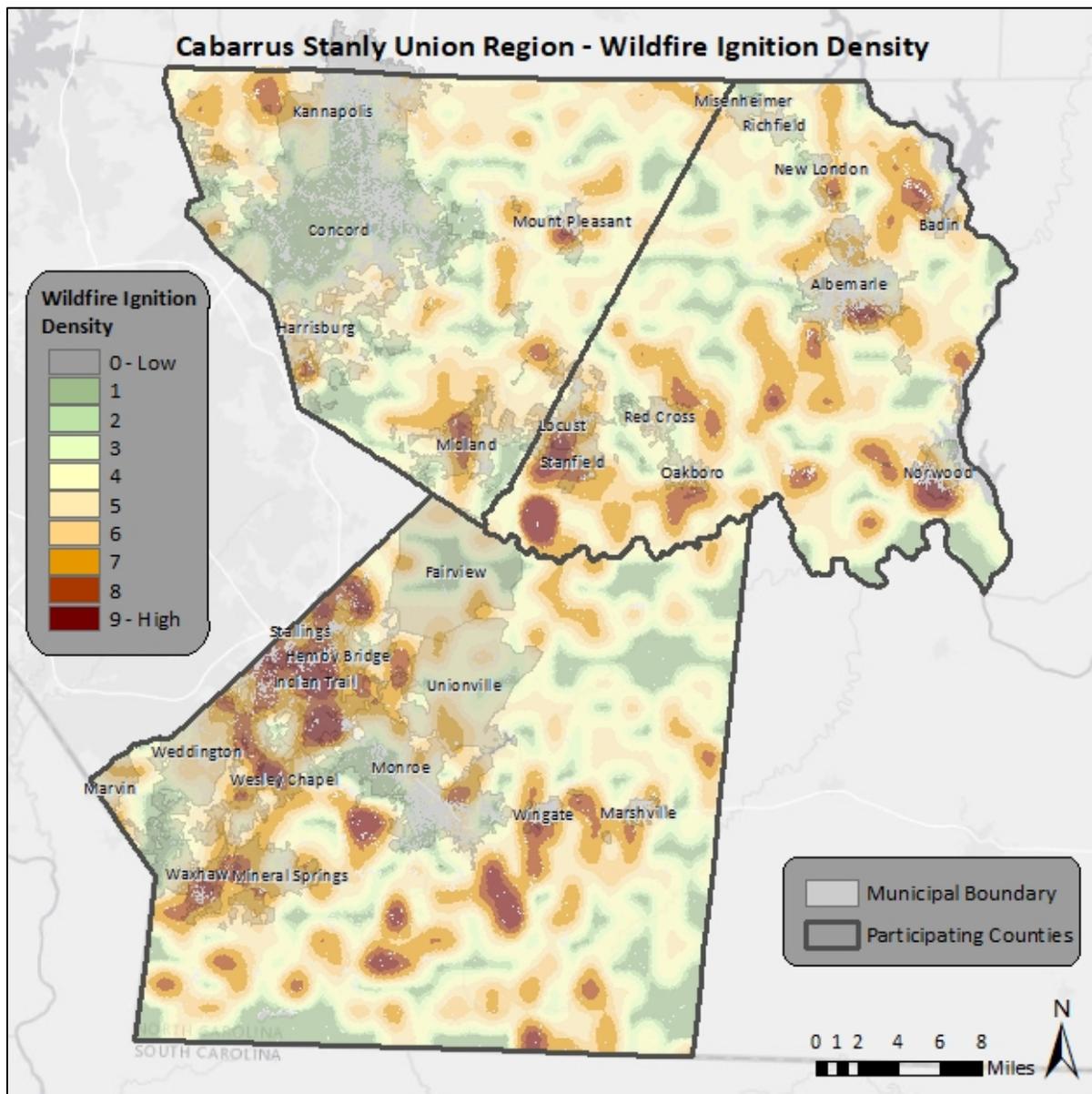
<sup>25</sup> Prescription burning, or “controlled burn,” undertaken by land management agencies is the process of igniting fires under selected conditions, in accordance with strict parameters.

### 5.12.2 Location and Spatial Extent

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

Figure 5.18 shows the Wildfire Ignition Density in the Cabarrus Stanly Union Region based on data from the Southern Wildfire Risk Assessment. This data represents the likelihood of wildfire igniting in the area, which is derived from historical wildfire occurrences to create an average ignition rate map.

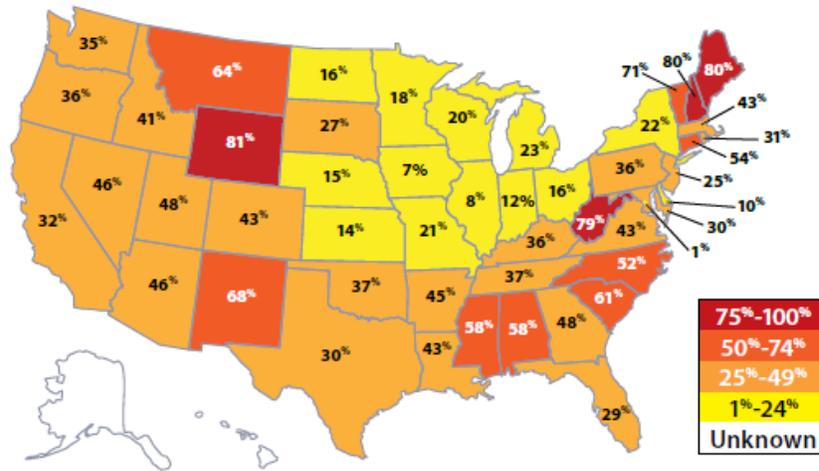
**FIGURE 5.18: WILDFIRE IGNITION DENSITY**



Source: Southern Wildfire Risk Assessment

Every state also has a Wildland Urban Interface (WUI), which is the rating of potential impact of wildfires on people and their homes. The WUI is not a fixed geographical location, but rather a combination of human development and vegetation where wildfires have the greatest potential to result in negative impacts. Nationally, one-third of all homes lie in the WUI, which is a growing danger. Below, **Figure 5.19** shows a map of each state’s WUI. Based on the data from the US Department of Agriculture, 52% of homes in North Carolina lie within the WUI.

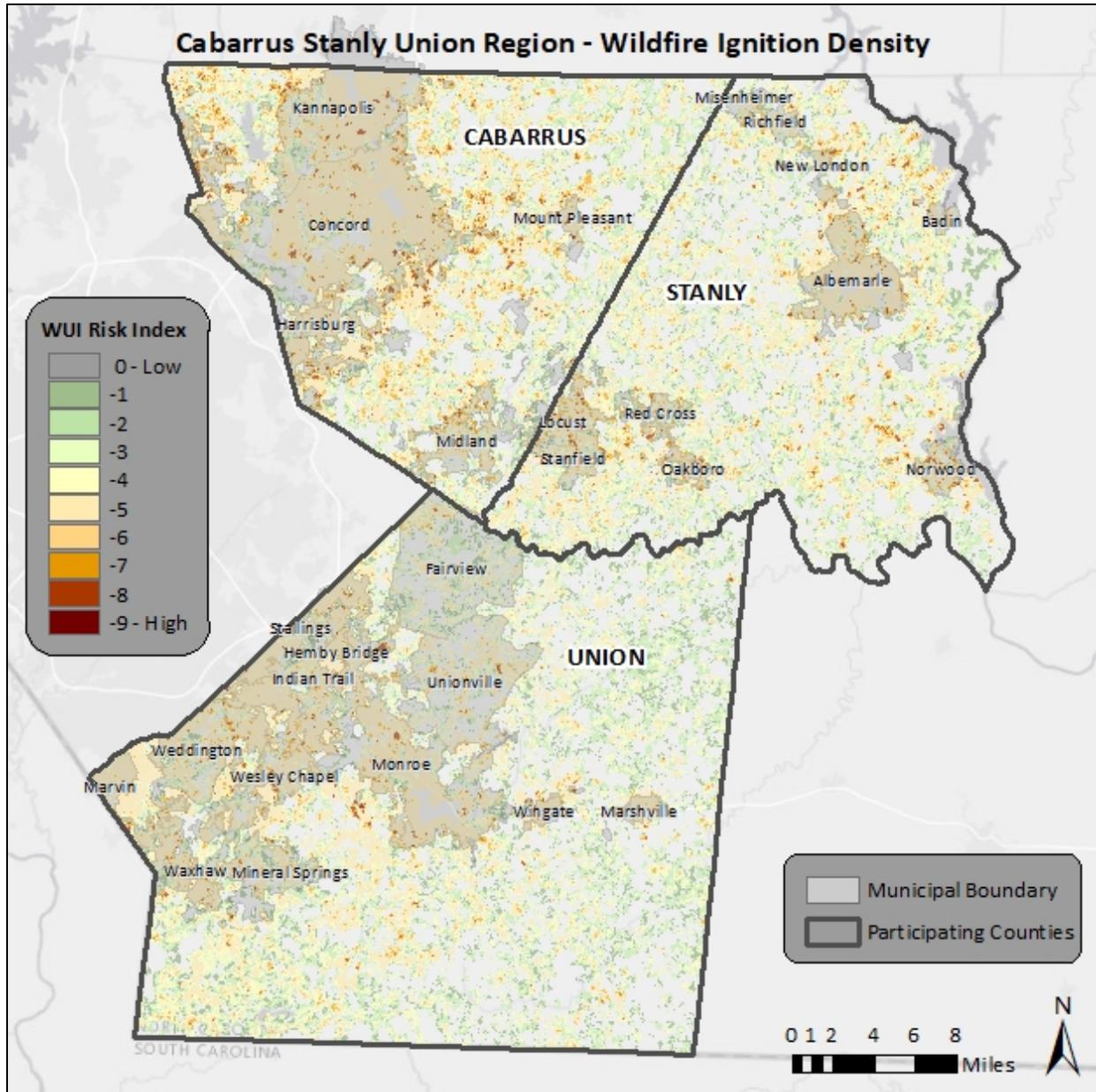
**FIGURE 5.19: PERCENT OF TOTAL HOMES IN THE WILDLAND URBAN INTERFACE**



Source: US Department of Agriculture

Below, **Figure 5.20** displays the WUI Risk Index specifically for the Cabarrus Stanly Union Region.

**FIGURE 5.20: WILDLAND URBAN INTERFACE RISK INDEX**



Source: Southern Wildfire Risk Assessment

Based on data from the North Carolina Division of Forest Resources from 2003 to 2018, the Cabarrus Stanly Union Region experiences an average of 188 wildfires annually which burn a combined 185 acres, on average. The data indicates that most of these fires are small, averaging about one acre per fire. Although it is certain that wildfires have occurred in the region, NCEI reports that none have taken place in recent history.

### 5.12.3 Historical Occurrences

Information from the National Association of State Foresters was used to ascertain historical wildfire events. The National Association of State Foresters reported that a total of 701 events that impacted an

area greater than 1 acre have occurred throughout the Cabarrus Stanly Union Region since 2001<sup>26</sup>. A summary of these events is presented in **Table 5.30**. The largest of these events was the Morrow Mountain Easter Fire which occurred in Stanly County in 2010 and impacted 100 acres.

**TABLE 5.30: SUMMARY OF WILDFIRE EVENTS**

Location	Number of Events	Number of Acres Impacted
<b>Cabarrus County</b>	<b>98</b>	<b>315.69</b>
Concord	8	22.4
Harrisburg	3	11.1
Kannapolis	4	11.77
Midland	10	24.9
Mount Pleasant	0	0
Unincorporated Area	73	245.52
<b>Stanly County</b>	<b>321</b>	<b>1051.89</b>
Albemarle	7	29
Badin	2	13
Locust	11	73.4
Misenhiemer	2	16.96
New London	0	0
Norwood	6	7
Oakboro	0	0
Red Cross	1	1.81
Richfield	0	0
Stanfield	6	15
Unincorporated Area	286	895.72
<b>Union County</b>	<b>282</b>	<b>1016.31</b>
Fairview	9	22.5
Hemby Bridge	1	1.5
Indian Trail	17	133.71
Lake Park	2	2.5
Marshville	1	5
Marvin	0	0
Mineral Springs	5	10.5
Monroe	6	14.18
Stallings	4	9
Unionville	6	33.4
Waxhaw	5	8.2
Weddington	9	12.44
Wesley Chapel	3	15.98
Wingate	0	0
Unincorporated Area	214	747.4
<b>CABARRUS STANLY UNION REGION TOTAL</b>	<b>701</b>	<b>2383.89</b>

<sup>26</sup> These events are only inclusive of those reported by NASFI. It is likely that additional occurrences have occurred and have gone unreported.

Other than the Morrow Mountain Easter Fire in 2010 that did not impact any buildings or cause loss of life, there is no narrative information on historical wildfires to impact the Cabarrus Stanly Union Region found in the NCEI database, the NC State Hazard Mitigation Plan, the North Carolina Forest Service or provided by local emergency managers. The main causes of previous wildfires in the Region are from debris burning (38%) and incendiary causes (20%) but they are generally smaller fires that are controlled before causing major damages.

#### **5.12.4 Probability of Future Occurrences**

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

## 5.13 INFECTIOUS DISEASE

### 5.13.1 Background and Description

For the purposes of this plan, this section will assess infectious diseases and vector-borne diseases within the Cabarrus Stanly Union region.

#### **Infectious Disease**

Communicable, or infectious, diseases are conditions that result in clinically evident illness which are transmissible directly from one person to another or indirectly through vectors such as insects, air, water, blood, or other objects. The impact of communicable disease can range from the mild effects of the common cold to the extreme lethality of pneumonic plague or anthrax. The public health system in the United States was developed in large part as a response to the often urgent need to respond to or prevent outbreaks of communicable diseases. Through public health methods of disease reporting, vaccinations, vector control, and effective treatments, most communicable diseases are well controlled in the United States and across the Cabarrus Stanly Union region. However, control systems can fail and when people come together from locations outside of the state, outbreaks can occur, even in the most modern of communities. In this section, some of the more significant potential communicable disease concerns are described.

The threats discussed in this section usually do not occur on a regular basis, though some are more frequent. The diseases described herein do not originate from intentional exposure (such as through terrorist actions) but do present significant issues and concerns for the public health community. There are numerous infectious diseases that rarely, if ever, occur in the State of North Carolina, such as botulism or bubonic plague. Some highly dangerous diseases which could potentially be used as biological weapons, such as anthrax, pneumonic plague, and smallpox, are safely housed and controlled in laboratory settings such as at the Center for Disease Control and Prevention (CDC). Other diseases have not (yet) mutated into a form that can infect humans, or otherwise lie dormant in nature.

There have been several significant viral outbreaks from emerging diseases in recent years of both national and international importance. The Zika virus and West Nile virus are viruses that are typically passed to humans or animals by mosquitoes and made major news as emergent disease threats. Meanwhile, diseases that are spread directly between human beings such as Severe Acute Respiratory Syndrome (SARS) and Ebola have also been identified as serious threats. While each of these conditions caused a great deal of public health concern when they were first identified, SARS has virtually disappeared, West Nile virus occurs with low frequency and causes serious disease in only a very small percentage of cases, Ebola has been more or less contained and a vaccine is in development, and many people infected with Zika will not experience symptoms from the disease.

Other communicable diseases pose a much more frequent threat to the citizens of in the region. Some of the infectious diseases of greatest concern include influenza, particularly in a pandemic form, as well as norovirus, and multiple antibiotic-resistant tuberculosis. Even in one of its normal year-to-year variants, influenza (commonly referred to as “flu”) can result in serious illness and even death in young children, the elderly and immune-compromised persons. But there is always the potential risk of the emergence of influenza in one of the pandemic H1N1 forms, such as in the “Spanish Flu” outbreak of 1918-19, which killed over 50 million people worldwide. Every year, North Carolina sees hundreds of cases of influenza, leading to hundreds of hours of lost productivity in businesses due to sick employees.

Of note, a vaccine for influenza is produced every year and, according to the CDC, is highly effective in preventing the disease.

Norovirus is recognized as the leading cause of foodborne-disease outbreaks in the United States. The virus can cause diarrhea, vomiting, and stomach pain, and is easily spread from person to person through contaminated food or water and by surface to surface contact. Especially vulnerable populations to this virus include those living or staying in nursing homes and assisted living facilities and other healthcare facilities such as hospitals. Norovirus could also be a threat in the event of large public gatherings such as sporting events, concerts, festivals, and so forth. North Carolina often experiences norovirus outbreaks on an annual basis. No vaccine or treatment exists for the Norovirus, making it especially dangerous for the public in the event of an outbreak.

Public health threats can occur at any time and can have varying impacts. Discussions between public health professionals, planning officials, and first response agencies are essential in order to facilitate safe, effective, and collaborative efforts toward outbreaks.

### **Vector-Borne Diseases**

Bacterial, viral and parasitic diseases that are transmitted by mosquitoes, ticks and fleas are collectively called "vector-borne diseases" (the insects and arthropods are the "vectors" that carry the diseases). Although the term "vector" can also apply to other carriers of disease — such as mammals that can transmit rabies or rodents that can transmit hantavirus — those diseases are generally called zoonotic (animal-borne) diseases.

The most common vector-borne diseases found in North Carolina and the Cabarrus Stanly Union region are carried by ticks and mosquitoes. The tick-borne illnesses most often seen in the state are Rocky Mountain Spotted Fever, ehrlichiosis, Lyme disease and Southern Tick-Associated Rash Illness (STARI). The most frequent mosquito-borne illnesses, or "arboviruses," in North Carolina include La Crosse encephalitis, West Nile virus and Eastern equine encephalitis. An outbreak of the West Nile Virus began showing up in the United States in 1999, with North Carolina reporting 63 cases from that time through the end of 2016.

## **5.13.2 Location and Spatial Extent**

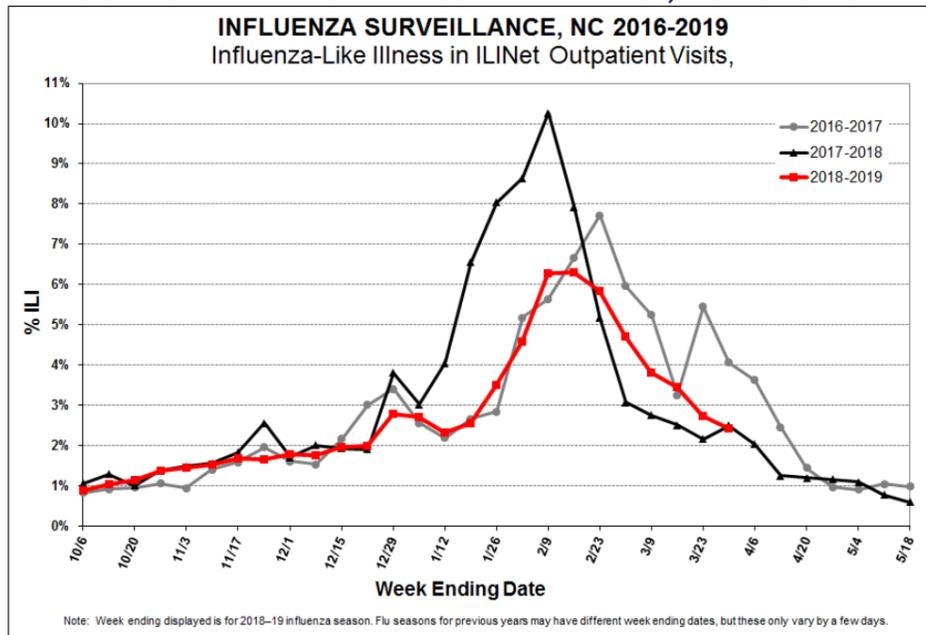
Extent is difficult to measure for an infectious disease event as the extent is largely dependent on the type of disease and on the effect that it has on the population (discussed above). Extent can be somewhat defined by the number of people impacted, which depending on the type of disease could number in the tens of thousands within the state.

## **5.13.3 Historical Occurrences**

### **Infectious Disease**

The influenza is historically the most common infectious disease that has occurred in the Cabarrus Stanly Union region. Cases of the flu tend to occur in the late fall and early winter months. In recent years, cases of the influenza and influenza-like illnesses have been reported in hospitals. As seen in **Figure 5.21** below, 172 people throughout North Carolina died from the flu between 2018 and 2019.

**FIGURE 5.21: INFLUENZA SURVEILLANCE, NC 2016-2019**



N.C. Flu-Associated Deaths\*

**2**  
New Flu Deaths 3/24/19-3/30/19

**172**  
Total Flu Deaths This Season (9/30/2018-5/18/2019)

Source: NC Department of Health and Human Services

**Vector-Borne Diseases**

In 2016, North Carolina state health officials encouraged citizens to take preventative measures against mosquito bites to avoid contracting the Zika virus. \$477,500 dollars was allocated from the Governor’s yearly budget to develop an infrastructure to detect, prevent, control, and respond to the Zika virus and other vector-borne illnesses<sup>27</sup>.

**5.13.4 Probability of Future Occurrence**

It is difficult to predict the future probability of infectious diseases due to the difficulty with obtaining information on this type of hazard. The most common and probable disease in the state has shown to be influenza; however, based on historical data, it is relatively unlikely (between 1 and 33.3 percent annual probability) that the Cabarrus Stanly Union Region will experience an outbreak of infectious diseases in the future.

<sup>27</sup> <https://www.ncdhhs.gov/news/press-releases/nc-prepared-zika-virus-risk-local-virus-carrying-mosquitoes-low>

# Technological Hazards

## 5.14 HAZARDOUS SUBSTANCES

### 5.14.1 Background and Description

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

Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation related accidents in the air, by rail, on the nation's highways, and on the water. Approximately 6,774 HAZMAT events occur each year, 5,517 of which are highway incidents, 991 are railroad incidents, and 266 are due to other causes<sup>28</sup>. In essence, HAZMAT incidents consist of solid, liquid, and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind, and possibly wildlife as well.

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

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

### 5.14.2 Location and Spatial Extent

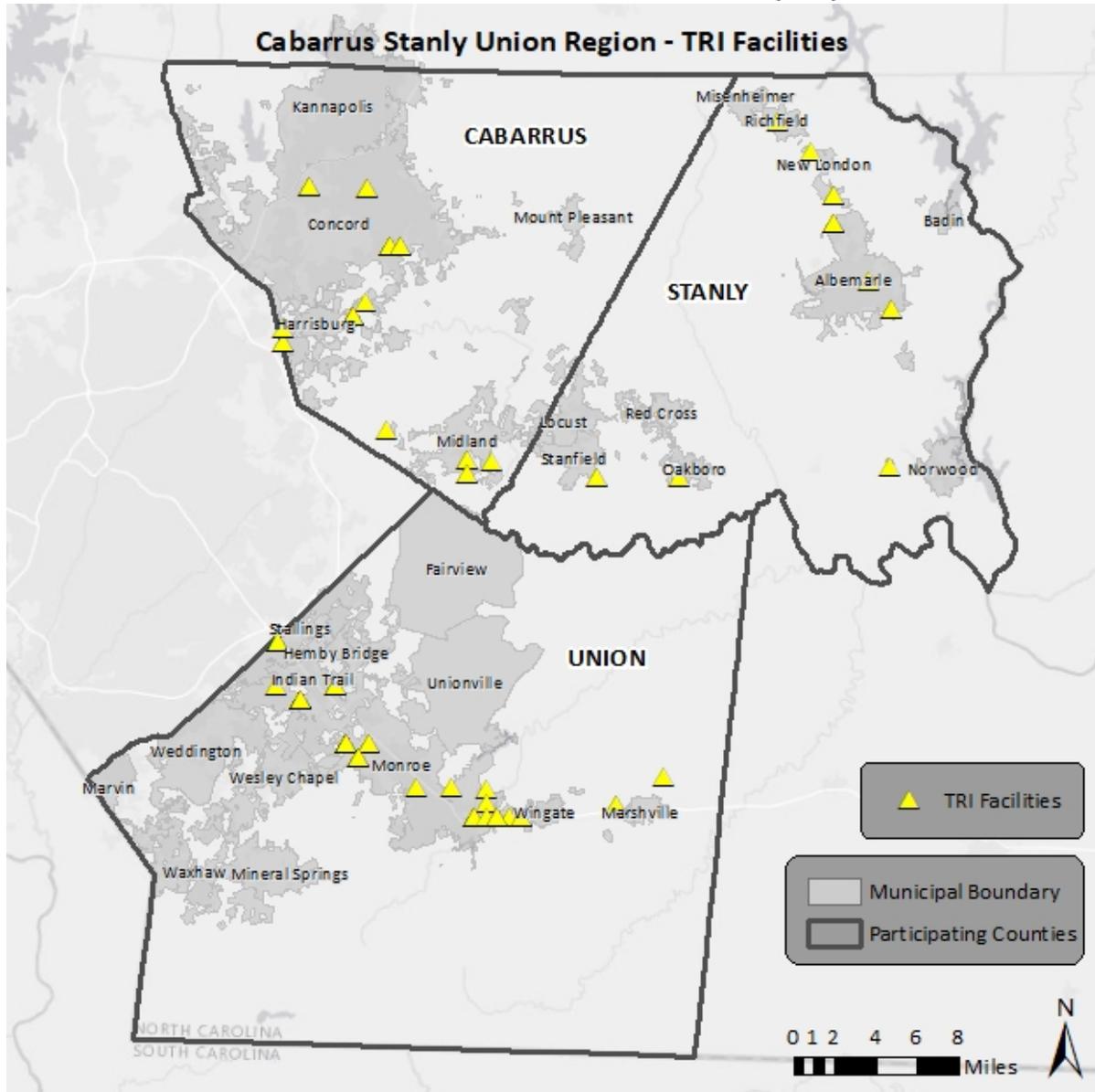
As a result of the 1986 Emergency Planning and Community Right to Know Act (EPCRA), the Environmental Protection Agency provides public information on hazardous materials. One facet of this program is to collect information from industrial facilities on the releases and transfers of certain toxic agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where

---

<sup>28</sup> FEMA, 1997.

such activity is occurring. The Cabarrus Stanly Union Region has 111 TRI sites. These sites are shown in Figure 5.22.

**FIGURE 5.22: TOXIC RELEASE INVENTORY (TRI) SITES**



Source: Environmental Protection Agency

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

### 5.14.3 Historical Occurrences

The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) lists historical occurrences throughout the nation. A “serious incident” is a hazardous

materials incident that involves:

- ◆ a fatality or major injury caused by the release of a hazardous material,
- ◆ the evacuation of 25 or more persons as a result of release of a hazardous material or exposure to fire,
- ◆ a release or exposure to fire which results in the closure of a major transportation artery,
- ◆ the alteration of an aircraft flight plan or operation,
- ◆ the release of radioactive materials from Type B packaging,
- ◆ the release of over 11.9 galls or 88.2 pounds of a severe marine pollutant, or
- ◆ the release of a bulk quantity (over 199 gallons or 882 pounds) of a hazardous material.

However, prior to 2002, a hazardous material “serious incident” was defined as follows:

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

Updated information regarding county specific releases and TRI sites have been provided through 2016. In Cabarrus County, there are 30 reported TRI facilities. On-site releases have overall gone down in recent years and the majority of the releases by environmental mediums (land, water, or air) have been through land. In Stanly County, 15 TRI facilities have been reported. On-site releases have primarily been through air, but have overall lessened since 2013. Union County has 66 reported TRI facilities. On-site releases have generally maintained the same rates since 2003, and are primarily via air. In the following three figures, the top five chemicals released through air and water are shown for each of the counties in the region.

**FIGURE 5.23: CHEMICALS RELEASED IN CABARRUS COUNTY**

Top Five Chemicals Released to Air and Water  
Cabarrus County, NC, 2016



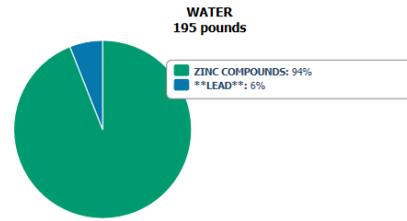
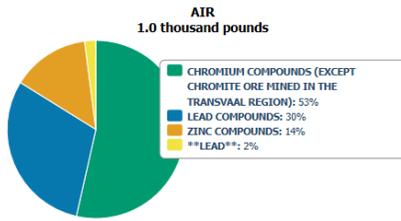
Note: \*\*=Carcinogenic Chemical

Note: Trend graphs were created using the 2001 core chemicals/industries list.

Source: Environmental Protection Agency

**FIGURE 5.24: CHEMICALS RELEASED IN STANLY COUNTY**

Top Five Chemicals Released to Air and Water  
Stanly County, NC, 2016



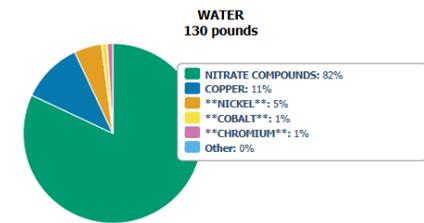
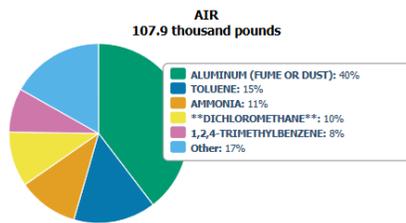
Note: \*\*=Carcinogenic Chemical

Note: Trend graphs were created using the 2001 core chemicals/industries list.

Source: Environmental Protection Agency

**FIGURE 5.25: CHEMICALS RELEASED IN UNION COUNTY**

Top Five Chemicals Released to Air and Water  
Union County, NC, 2016



Note: \*\*=Carcinogenic Chemical

Note: Trend graphs were created using the 2001 core chemicals/industries list.

Source: Environmental Protection Agency

Table 5.30 summarizes the serious HAZMAT incidents reported in the Cabarrus Stanly Union Region.

**TABLE 5.30: SUMMARY OF HAZMAT INCIDENTS**

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2018)
<b>Cabarrus County</b>	<b>5</b>	<b>0/0</b>	<b>\$378,848</b>
Concord	1	0/0	\$1,603
Harrisburg	2	0/0	\$16,844
Kannapolis	0	0/0	\$0
Midland	1	0/0	\$185,325
Mount Pleasant	1	0/0	\$175,076
Unincorporated Area	0	0/0	\$0
<b>Stanly County</b>	<b>2</b>	<b>0/0</b>	<b>\$154,179</b>
Albemarle	0	0/0	\$0
Badin	1	0/0	\$334
Locust	0	0/0	\$0
Misenhiemer	0	0/0	\$0
New London	0	0/0	\$0
Norwood	0	0/0	\$0
Oakboro	0	0/0	\$0
Red Cross	0	0/0	\$0
Richfield	1	0/0	\$153,845
Stanfield	0	0/0	\$0

## SECTION 5: HAZARD PROFILES

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2018)
Unincorporated Area	0	0/0	\$0
<b>Union County</b>	<b>1</b>	<b>0/0</b>	<b>\$32,955</b>
Fairview	0	0/0	\$0
Hemby Bridge	0	0/0	\$0
Indian Trail	0	0/0	\$0
Lake Park	0	0/0	\$0
Marshville	0	0/0	\$0
Marvin	0	0/0	\$0
Mineral Springs	0	0/0	\$0
Monroe	0	0/0	\$0
Stallings	0	0/0	\$0
Unionville	1	0/0	\$32,955
Waxhaw	0	0/0	\$0
Weddington	0	0/0	\$0
Wesley Chapel	0	0/0	\$0
Wingate	0	0/0	\$0
Unincorporated Area	0	0/0	\$0
<b>Cabarrus Stanly Union Regional Total</b>	<b>8</b>	<b>0/0</b>	<b>\$565,982</b>

Source: U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration

### 5.14.4 Probability of Future Occurrence

As of 2017, 111 toxic release inventory sites are located in the Cabarrus Stanly Union Region. Given the location of these sites and several roadway, rail, and air incidents, it is possible that a hazardous material incident may occur in the region (between 1 and 10 percent annual probability). County and municipal officials are mindful of this possibility and take precautions to prevent such an event from occurring. Furthermore, there are detailed plans in place to respond to an occurrence.

## 5.15 RADIOLOGICAL EMERGENCY – FIXED NUCLEAR FACILITIES

### 5.15.1 Background and Description

Although not referenced in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan, radiological emergencies will be assessed in this update.

A nuclear and radiation accident is defined by the International Atomic Energy Agency as “an event that has led to significant consequences to people, the environment or the facility. Often, this type of incident results from damage to the reactor core of a nuclear power plant which can release radioactivity into the environment. The degree of exposure from nuclear accidents has varied from serious to catastrophic. While radiological emergencies generally are a rare occurrence, many incidents are extremely well known due to their large-scale impact and serious effects on people and the environment.

McGuire Nuclear Station, which is the plant located closest to the Cabarrus Stanly Union Region, is a 2,258-megawatt power plant that began commercial operation in 1981. It uses uranium dioxide fuel and its reactor is a pressurized water reactor. The plant operates with a very high level of security.

The region is also located within a close proximity to the Catawba Nuclear Station in South Carolina which houses two 1,129-megawatt pressurized water reactors. The plant was commissioned in 1985 and the second unit was added in 1986. It also operates with a very high level of security. It is jointly owned by North Carolina Municipal Power Agency Number One. Its first unit began operating in 1985, followed by the next unit in 1986, and is only 11 miles southwest of Charlotte, NC<sup>29</sup>.

### 5.15.2 Location and Spatial Extent

The entire region is at risk to a nuclear incident. However, areas in the eastern part of the region are more susceptible due to their proximity to the McGuire Nuclear Station. The International Atomic Energy Association has developed a scale called the International Nuclear and Radiological Event Scale (INES) which provides a quantitative means of assessing the extent of a nuclear event. This scale, like the MMI used for earthquakes, is logarithmic which means that each increasing level on the scale represents an event 10 times more severe than the previous level (**Figure 5.23**).

---

<sup>29</sup> <https://www.duke-energy.com/our-company/about-us/power-plants>

**FIGURE 5.23: INTERNATIONAL NUCLEAR EVENT SCALE**

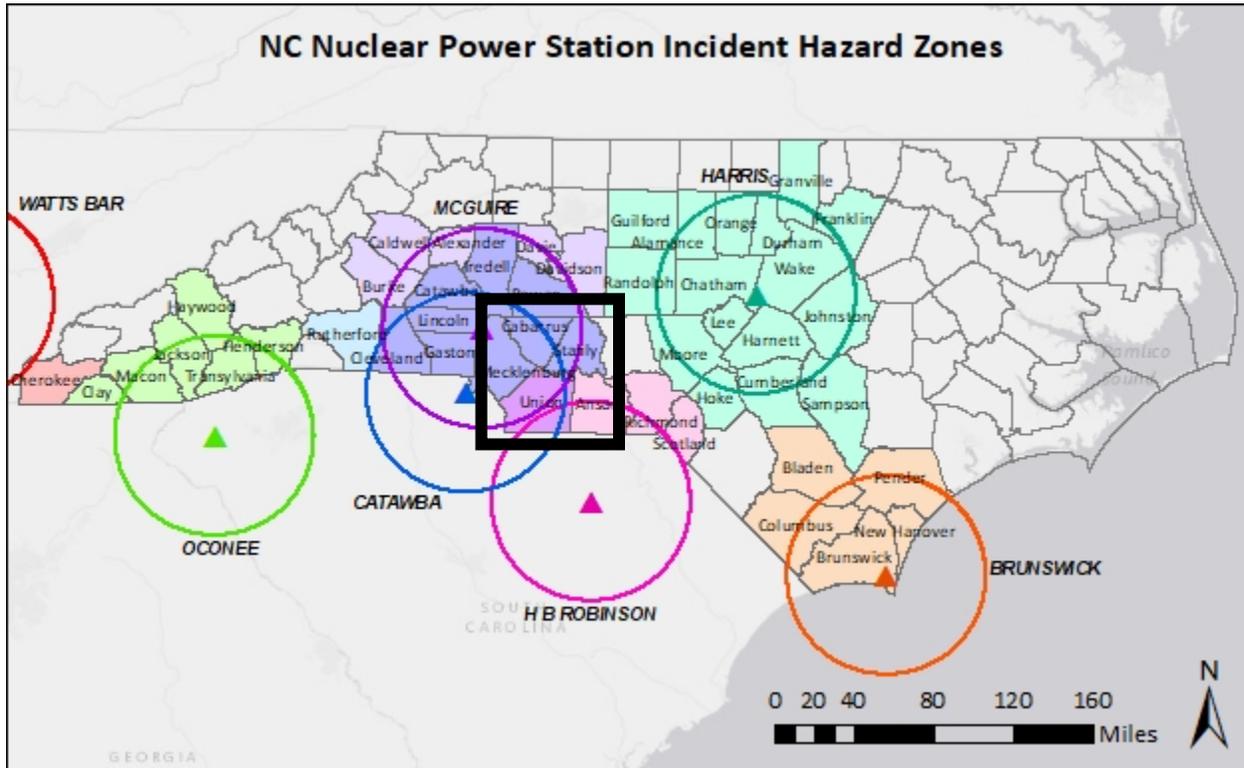


Source: International Atomic Energy Agency

The Nuclear Regulatory Commission defines two emergency planning zones around nuclear plants. Areas located within 10 miles of the station are considered to be within the zone of highest risk to a nuclear incident and this radius is the designated evacuation radius recommended by the Nuclear Regulatory Commission. Within the 10-mile zone, the primary concern is exposure to and inhalation of radioactive contamination. The most concerning effects in the secondary 50-mile zone are related to ingestion of food and liquids that may have been contaminated. All areas of the counties that are not located within the 10-mile radius are located within this 50-mile radius that is still considered to be at risk from a nuclear incident.

Both the McGuire Nuclear Station and the Catawba Nuclear Station are within ten miles of the Cabarrus Stanly Union. Furthermore, both of the plant’s 50-mile buffer zones intersect the three counties. A map of all nuclear power plants in North Carolina can be seen below in **Figure 5.24**. Note that the Cabarrus Stanly Union region is identified in the black box.

**FIGURE 5.24: NORTH CAROLINA NUCLEAR POWER STATIONS INCIDENT HAZARD ZONES**



Source: International Atomic Energy Agency

### 5.15.3 Historical Occurrences

Although there have been no major nuclear events at either the McGuire or Catawba Nuclear Station, there is some possibility that one could occur as there have been incidents in the past in the United States at other facilities and at facilities around the world.

### 5.15.4 Probability of Future Occurrences

A nuclear event is a very rare occurrence in the United States due to the intense regulation of the industry. There have been incidents in the past, but it is considered unlikely (less than 1 percent annual probability).

## 5.16 TERRORISM

### 5.16.1 Background and Description

Terrorism was not referenced in the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan, but is addressed in this update. For the purpose of this report, terrorism encompasses explosive, chemical, radiological, biological, nuclear, and other threats.

Terrorism is defined in the United States by the Code of Federal Regulations is “the unlawful use of force or violence against persons or property to intimidate or coerce a government, civilian population, or any segment thereof, in furtherance of political or social objectives.” Terrorist acts may include assassinations, kidnappings, hijackings, bombings, small arms attacks, vehicle ramming attacks, edged weapon attacks, incendiary attacks, cyber-attacks (computer based), and the use of chemical, biological, nuclear and radiological weapons. For the purposes of this plan, cyber-attacks are included as a separate hazard.

Historically the main categories of weapons of mass destruction (WMDs) used in terror attacks are Chemical, Biological, Radiological, Nuclear, and Explosive (collectively referred to as CBRNE). As we rank these categories, considering immediate danger posed, impact, probability, technical feasibility, frequency, and historical success, they are typically ranked in the following way.

#### **Explosive**

Explosive attacks lead all others due to their immediate danger to life and health, immediate and measurable impact, high probability, low cost/easy degree of technical feasibility, and a long history of successful attacks.

#### **Chemical**

Chemical attacks can pose immediate danger to life and health depending upon the materials used. Chemicals are easy to access, low cost, and easy to deploy. Chemical terrorism can have high and persistent impacts to people and places. These types of attacks are probable and have enjoyed historical success.

#### **Radiological**

Radiological attacks can pose significant threats to life and health depending upon the specific materials used. Radiological materials while restricted and regulated are accessible to people with some knowledge in this discipline. While radiological incidents have occurred, they occur less frequently than explosive and chemical attacks.

#### **Biological**

Biological attacks can pose significant threats to life and health. They are typically deployed as diseases and bio-toxins. They require some degree of technical expertise in order to be deployed successfully. While biological incidents have occurred, they occur less frequently than explosive and chemical attacks.

#### **Nuclear**

While yielding a very high impact, the Nuclear attack is extremely rare due to the fact that it is cost prohibitive and very technically difficult to achieve. This type of attack, however, could be state sponsored which makes it viable.

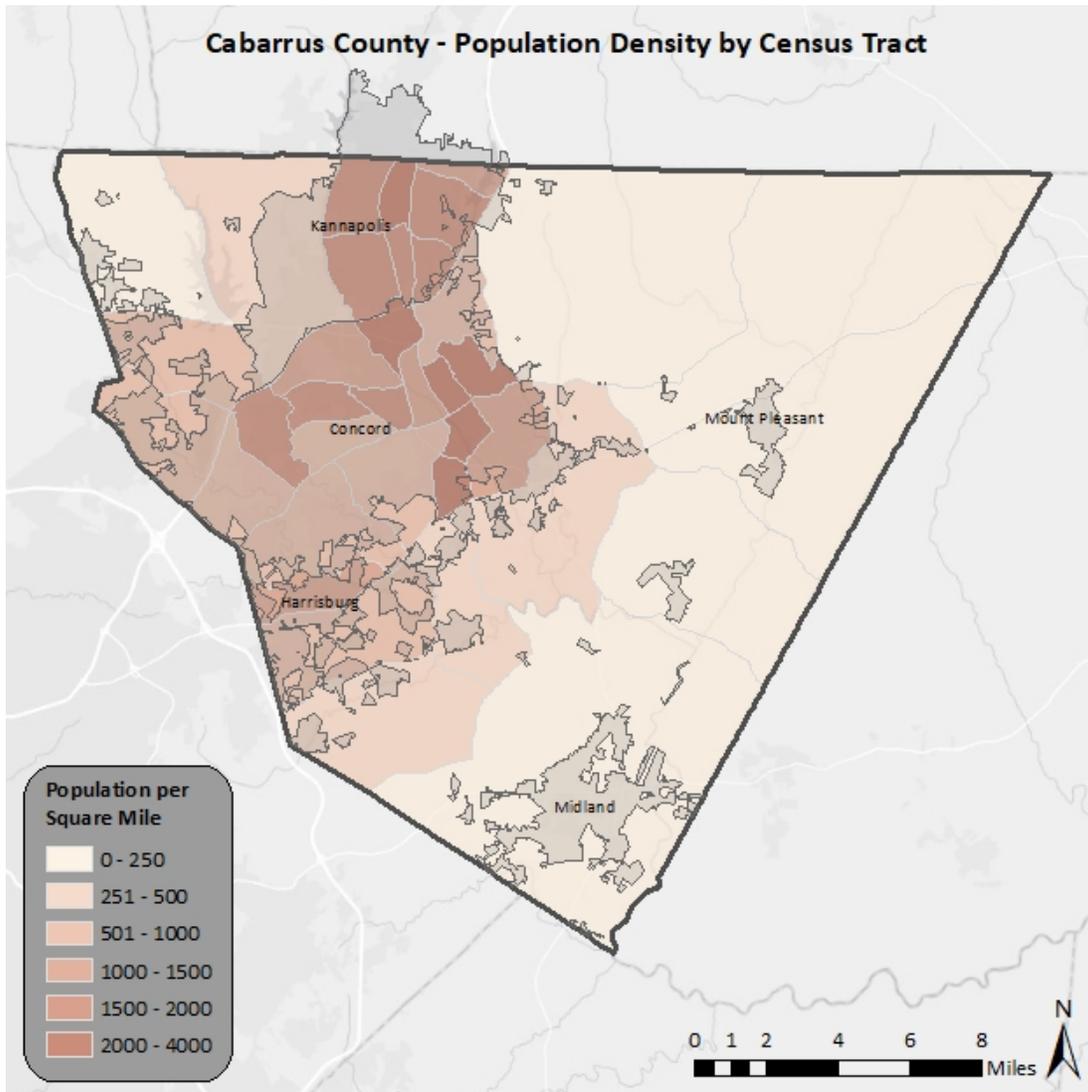
**OTHER**

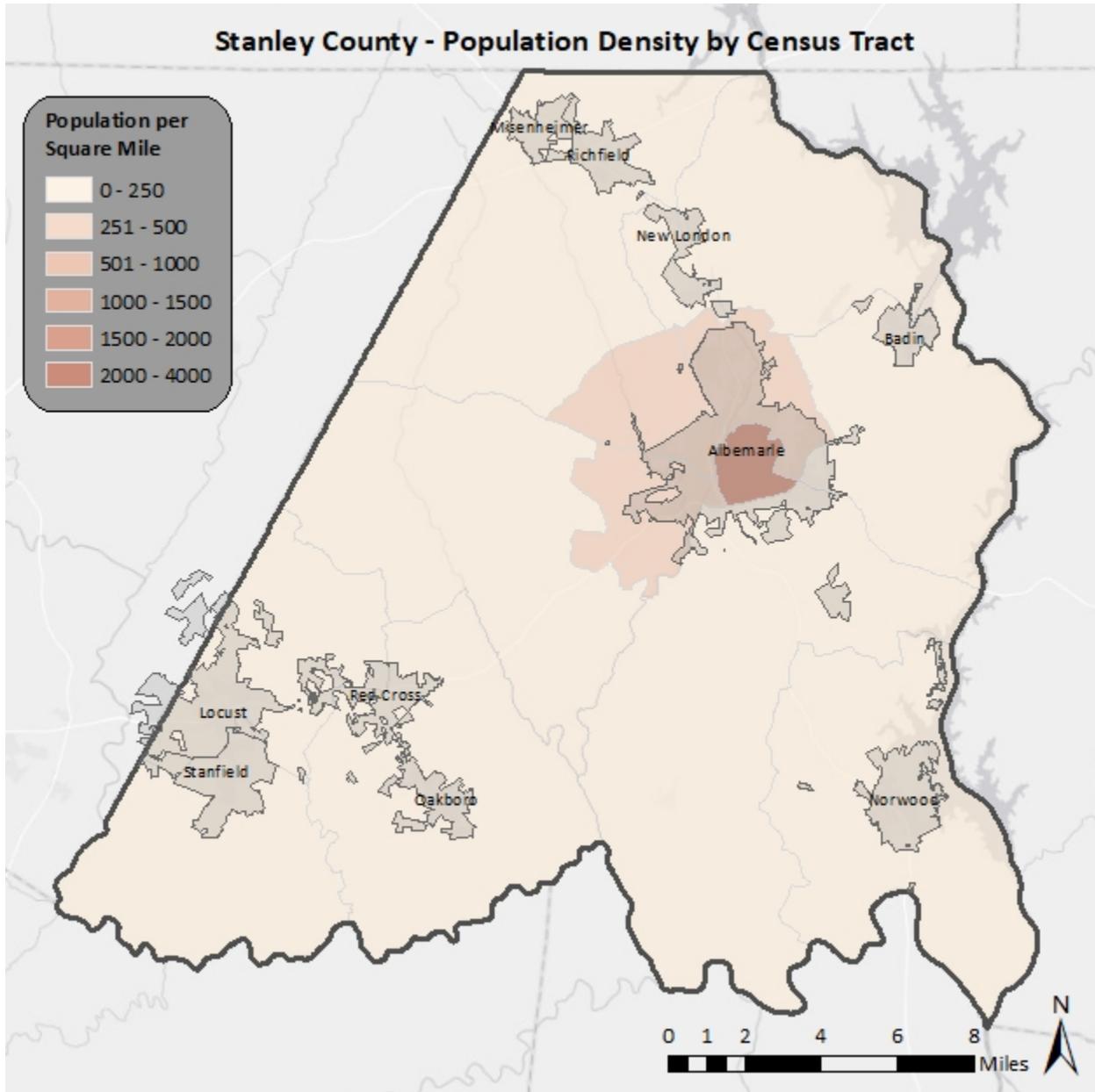
Terrorism Hazard Assessment must also account for modern trends and changes. An additional “OTHER” category should be considered that includes small arms attacks, vehicle ramming attacks, edged weapon attacks, and incendiary attacks.

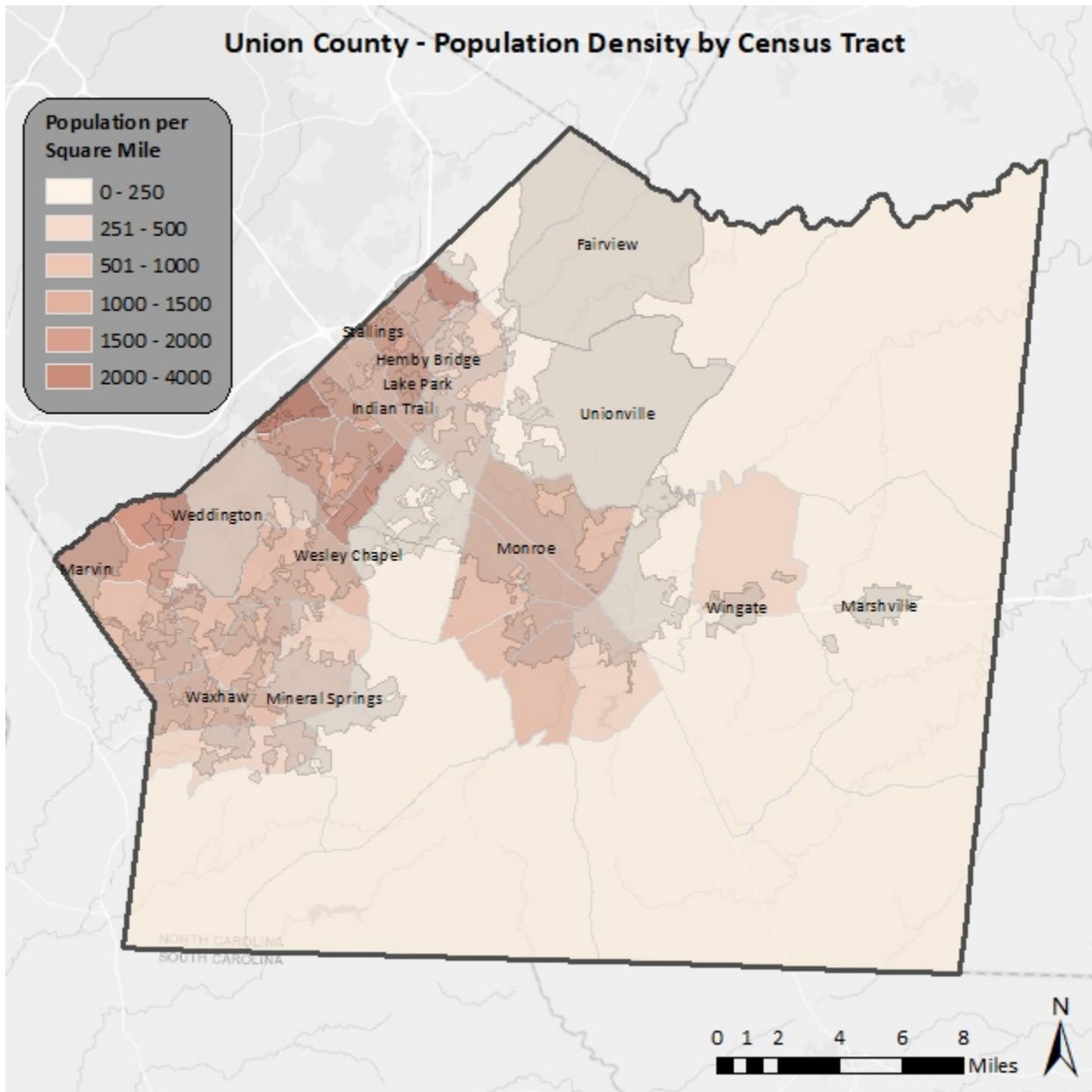
**5.16.2 Location and Spatial Extent**

All parts of North Carolina are vulnerable to a terror event; however, terrorism tends to target more densely populated areas. The map in **Figure 5.25** displays the population density in the Cabarrus Stanly Union region using census tract levels.

**FIGURE 5.25: POPULATION DENSITY IN THE CABARRUS STANLY UNION REGION**







Furthermore, the most recent population counts of each participating county and jurisdictions can be seen in **Table 5.31** below.

**TABLE 5.31: 2017 POPULATION ESTIMATES**

Location	2017 Population Estimate
<b>Cabarrus County</b>	205,204
Concord	90,820
Harrisburg	16,877
Kannapolis	47,276
Midland	3,890
Mount Pleasant	1,911
Unincorporated Area	44,430

Location	2017 Population Estimate
<b>Stanly County</b>	62,727
Albemarle	16,109
Badin	1,984
Locust	3,393
Misenhiemer	692
New London	721
Norwood	2,402
Oakboro	2,012
Red Cross	769
Richfield	646
Stanfield	1,601
Unincorporated Area	32,398
<b>Union County</b>	228,492
Fairview	3,720
Hemby Bridge	1,561
Indian Trail	38,795
Lake Park	3,676
Marshville	2,461
Marvin	6,967
Mineral Springs	3,019
Monroe	35,034
Stallings	16,102
Unionville	6,642
Waxhaw	13,645
Weddington	10,679
Wesley Chapel	8,801
Wingate	3,989
Unincorporated Area	73,401
<b>Cabarrus Stanly Union Regional Total</b>	<b>496,423</b>

Source: US Census Bureau, NC Office of State Budget and Management

### 5.16.3 Historical Occurrences

No extreme cases of terror attacks have previously affected the Cabarrus Stanly Union region. However, as the population in the area continues to increase, so does the chance of an attack.

### 5.16.4 Probability of Future Occurrences

The Cabarrus Stanly Union region has experienced no major terrorist attacks, but the area’s population is continuing to rise. The probability of future occurrences of a terrorist attack, while unlikely (between 1 and 10 percent annual probability) is a real possibility that the area must be prepared for.

## 5.17 CYBER

### 5.17.1 Background and Description

Cyberattacks are deliberate attacks on information technology systems in an attempt to gain illegal access to a computer, or purposely cause damage. As the world and the Cabarrus Stanly Union region become more technologically advanced and dependent upon computer systems, the threat of cyberattacks is becoming increasingly prevalent. Also known as computer network attacks, cyberattacks are difficult to recognize and typically use malicious code to alter computer data or steal information.

Mitigating and preparing for cyberattacks is challenging because of how diverse and complex attacks can be. The FBI is the lead federal agency for investigating cyberattacks by criminals, overseas adversaries, and terrorists. In North Carolina, the Department of Information Technology is the lead agency that maintains Cybersecurity and Risk Management resources.

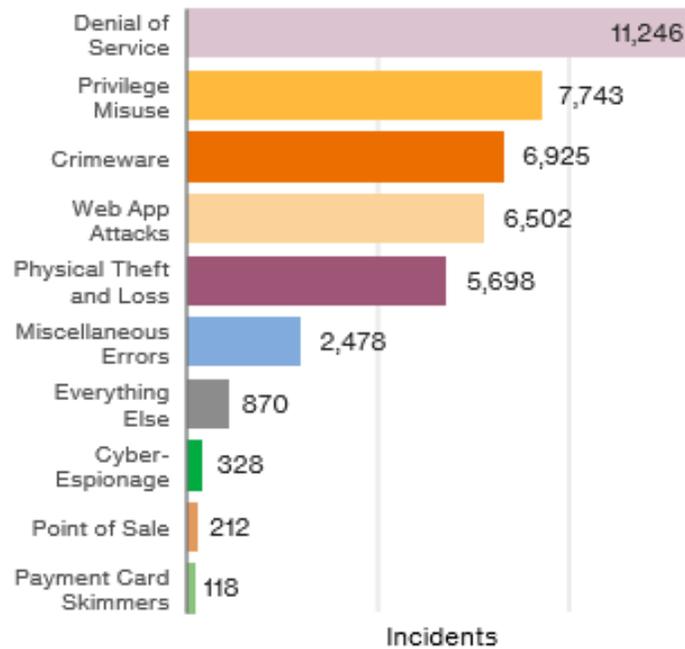
Cyberattacks can happen in both the public and private sector. They may be carried out by a specific individual, or by groups from afar. Many attacks attempt to steal money or to disturb normal operations. According to the 2017 Verizon Report of Data Breaching, 93% of all data breaches had a financial or espionage motive, and espionage cases are rising.

There are many types of cyberattack incident patterns, which include:

- ◆ Web App Attacks: Incidents in which web applications were attacked, which can include exploiting code-level vulnerabilities in the application.
- ◆ Point-of-Sale Intrusions: Remote attacks against environments where card-present retail transactions are conducted.
- ◆ Insider and Privilege Misuse: Unapproved or malicious use of organizational resources.
- ◆ Miscellaneous Errors: Incidents in which unintentional actions directly compromise an attribute of a security asset.
- ◆ Physical Theft and Loss: Incidents where an information asset went missing.
- ◆ Crimeware: Instances involving malware that do not fit into a more specific pattern.
- ◆ Payment Card Skimmers: Incidents involving skimming devices physically implanted on an asset that reads magnetic stripe data from payment cards.
- ◆ Cyber-espionage: Unauthorized network or system access linked to state-affiliated actors.
- ◆ Denial-of-Service Attacks: Any attack intended to compromise the availability of networks and systems that are designed to overwhelm systems, resulting in performance degradation or interruption of service.

**Figure 5.26** below displays nationwide cyberattack incident patterns from the 2017 Verizon Data Breach Investigations Report.

**FIGURE 5.26: PERCENTAGE AND COUNTS OF INCIDENTS PER PATTERN**



Source: 2017 Verizon Data Breach Investigations Report

### 5.17.2 Location and Spatial Extent

Cyberattacks happen all over the world and are not restricted to a certain locational boundary. They tend to affect the public industry rather than private industries.

### 5.71.3 Historical Occurrences

In North Carolina and the Cabarrus Stanly Union region, the Department of Information Technology specializes in cybersecurity and risk management. Within the department, the NC Information Sharing and Analysis Center gathers information on cyber threats within the State raise cybersecurity.

In 2016, North Carolina reported the highest number of cybercrimes in the “non-payment/non-delivery” sector, which can be seen in **Table 5.32** below.

**TABLE 5.32: NORTH CAROLINA CYBERCRIMES AND VICTIM COUNTS IN 2016**

Crime Type by Victim Count			
Crime Type	Victim Count	Crime Type	Victim Count
419/Overpayment	614	Health Care Related	10
Advanced Fee	384	IPR/Copyright and Counterfeit	58
Auction	442	Identity Theft	345
BEC/EAC	254	Investment	28
Charity	10	Lottery/Sweepstakes	119
Civil Matter	28	Malware/Scareware	62
Confidence Fraud/Romance	326	Misrepresentation	102
Corporate Data Breach	74	No Lead Value	121
Credit Card Fraud	274	Non-payment/Non-Delivery	1,844
Crimes Against Children	19	Other	218
Criminal Forums	0	Personal Data Breach	569
Denial of Service	28	Phishing/Vishing/Smishing/Pharming	399
Employment	467	Ransomware	67
Extortion	468	Re-shipping	25
Gambling	1	Real Estate/Rental	280
Government Impersonation	319	Tech Support	298
Hacktivist	2	Terrorism	6
Harassment/Threats of Violence	364	Virus	29
Descriptors*			
Social Media	455	Virtual Currency	38

Source: FBI Internet Crime Complaint Center, 2016

Although the Cabarrus Stanly Union region has not reported any major catastrophic cyberattacks, the potential to experience one is unpredictable and can happen at any time.

#### 5.15.4 Probability of Future Occurrences

As the world's dependency on technology grows, the possibility of experiencing cyberattacks rises as well. There have not been severe past occurrences in the region, and it is considered unlikely (less than 1 percent annual probability) to experience one in the near future.

## 5.18 ELECTROMAGNETIC PULSE

### 5.18.1 Background and Description

The United States Department of Energy defines electromagnetic pulses (EMPs) as “intense pulses of electromagnetic energy resulting from solar-caused effects or man-made nuclear and pulse power devices.” EMPs can be naturally occurring or human-caused hazards. Examples of natural EMP events include:

- ◆ Lightning electromagnetic pulse
- ◆ Electrostatic discharge
- ◆ Meteoric electromagnetic pulse, and

Coronal mass ejection, also known as a solar electromagnetic pulse.

A human-caused EMP (such as a nuclear EMP) is a technological hazard that can cause severe damage to electrical components attached to power lines or communication systems. One of the most complex aspects of EMPs is the fact they are invisible, unpredictable, and rapid. They can also overload electronic devices that people heavily rely on every day. EMPs are harmless to people biologically; however, an EMP attack could damage electronic systems such as planes or cars. This could cause destruction of property and life and potentially generate disease or societal collapse.

In 2015, Congress amended the Homeland Security Act of 2002 by passing the Critical Infrastructure Protection Act (CIPA), which protects Americans from an EMP. It also required reporting of EMP threats, research and development, and a campaign to educate planners and emergency responders about EMP events.

### 5.18.2 Location and Spatial Extent

An EMP can happen in any location, and they are relatively unpredictable. Due to advancing technologies, densely populated may be more prone to damages from an EMP. Therefore, bigger cities in the Cabarrus Stanly Union region may be more susceptible.

### 5.18.3 Historical Occurrences

There have been no reports of EMP occurrences in the Cabarrus Stanly Union region.

### 5.18.4 Probability of Future Occurrences

The probability of an EMP is unlikely (less than 1 percent annual probability), but an occurrence could have catastrophic impacts.

## 5.19 CONCLUSIONS ON HAZARD RISK

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

### 5.19.1 Hazard Extent

**Table 5.33** describes the extent of each natural hazard identified for the Cabarrus Stanly Union Region. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

**TABLE 5.33 EXTENT OF CABARRUS STANLY UNION REGION HAZARDS**

Natural Hazards	
Drought	Drought extent is defined by the North Carolina Drought Monitor Classifications which include Abnormally Dry, Moderate Drought, Severe Drought, Extreme Drought, and Exceptional Drought (page 5:6). According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Each of the participating counties has received this ranking (three times) over the nineteen-year reporting period.
Excessive Heat	The extent of excessive heat can be defined by the maximum temperature reached. The highest temperature recorded in the Cabarrus Stanly Union Region is 109 degrees Fahrenheit (reported on July 28, 1940). <ul style="list-style-type: none"> <li>• Cabarrus County: 107°F</li> <li>• Stanly County: 109°F</li> <li>• Union County: 107°F</li> </ul>
Hurricane and Coastal Hazards	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5 (Table 5.9). The greatest classification of hurricane to traverse directly through the Cabarrus Stanly Union Region was Hurricane Hugo in 1989 which carried tropical force winds of 58 miles per hour upon arrival. The following list the greatest extent of hurricane winds to pass through the area, though it should be noted that stronger storms could impact the region without a direct hit: <ul style="list-style-type: none"> <li>• Cabarrus County: Hurricane Hugo (1989), Tropical Storm (58 miles per hour)</li> <li>• Stanly County: Hurricane Hugo (1989), Tropical Storm (58 miles per hour)</li> <li>• Union County: Hurricane Hugo (1989), Tropical Storm (58 miles per hour)</li> </ul>
Tornadoes/ Thunderstorms	<u>Tornadoes</u> : Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA (Figure 5.6) as well as the Fujita/Enhanced Fujita Scale (Tables 5.12 and 5.13). The greatest magnitude reported in the region was an F4 (reported on May 5, 1989). <ul style="list-style-type: none"> <li>• Cabarrus County: F2</li> <li>• Stanly County: F2</li> <li>• Union County: F4</li> </ul> <u>Thunderstorms</u> : Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Climatic Data Center, the strongest recorded wind event in the Cabarrus Stanly Union Region was reported on June 22, 2001 at 100 knots (approximately 115 mph). It should be noted that future events may exceed these historical occurrences. <ul style="list-style-type: none"> <li>• Cabarrus County: 65 knots</li> <li>• Stanly County: 70 knots</li> <li>• Union County: 100 knots</li> </ul>

	<p><u>Lightning</u>: According to the Vaisala flash density map (Figure 5.15), the Cabarrus Stanly Union Region is located in an area that experiences 4 to 5 lightning flashes per square kilometer per year. It should be noted that future lightning occurrences may exceed these figures.</p> <p><u>Hailstorms</u>: Hail extent can be defined by the size of the hail stone. The largest hail stone reported in the Cabarrus Stanly Union Region was 4.5 inches (reported on June 5, 1985). It should be noted that future events may exceed this.</p> <ul style="list-style-type: none"> <li>• Cabarrus County: 4.5 inches</li> <li>• Stanly County: 2.75 inches</li> <li>• Union County: 2.25 inches</li> </ul>
<p>Severe Winter Weather</p>	<p>The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall was reported in the region was 25 inches reported on January 26, 1920. Due to variations in elevation throughout the region, extent totals will vary for each participating jurisdiction and reliable data on snowfall totals is not available.</p> <ul style="list-style-type: none"> <li>• Cabarrus County: 11 inches</li> <li>• Stanly County: 25 inches</li> <li>• Union County: 13 inches</li> </ul>
<p>Earthquakes</p>	<p>Earthquake extent can be measured by the Richter Scale (Table 5.21) and the Modified Mercalli Intensity (MMI) scale (Table 5.22) and the distance of the epicenter from the Cabarrus Stanly Union Region. According to data provided by the National Geophysical Data Center, the greatest MMI to impact the region was VI (strong) with a correlating Richter Scale measurement of approximately 5.4 (reported on September 1, 1886). The epicenter of this earthquake was located between 236 and 284 km away.</p> <ul style="list-style-type: none"> <li>• Cabarrus County: VI; 284 km to epicenter</li> <li>• Stanly County: V; 273 km to epicenter</li> <li>• Union County: VI; 236 km to epicenter</li> </ul>
<p>Geological</p>	<p><u>Landslide</u>: As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is high throughout most of Cabarrus County and Stanly County (the remainder of the region has low incidence). There is also at least moderate susceptibility throughout a majority of the region (excluding a small area in southeast Union County which has low susceptibility).</p> <p><u>Sinkhole</u>: The western part of North Carolina and the Cabarrus Stanly Union region is susceptible to sinkholes; however, there are no historical records of sinkholes in the region.</p> <p><u>Erosion</u>: The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records available for the Cabarrus Stanly Union region.</p>
<p>Dam Failure</p>	<p>Dam failure extent is defined using the North Carolina Division of Land Resources criteria (Table 5.25). Of the 242 dams in Cabarrus Stanly Union Region, 58 are classified as high-hazard.</p> <ul style="list-style-type: none"> <li>• Cabarrus County: 19 high hazard dams</li> <li>• Stanly County: 14 high hazard dams</li> <li>• Union County: 25 high hazard dams</li> </ul>
<p>Flooding</p>	<p>Flood extent can be measured by the amount of land and property in the floodplain as well as flood height and velocity. The amount of land in the floodplain accounts for nearly 7 percent of the total land area in the Cabarrus Stanly Union Region. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gauge does not exist for each participating jurisdiction, there is one at or near many areas. The greatest peak discharge recorded for the area was reported on September 18, 1945. Water reached a discharge of 105,000 cubic feet per second and the</p>

stream gauge height was recorded at 46.37 feet. Additional peak discharge readings and gage heights are in the table below.

Location/Jurisdiction	Date	Peak Discharge (cfs)	Gage Height (ft)
Cabarrus County			
Rocky Road at Irish Buffalo Creek near Rocky River	4/11/2003	9,760	23.21
Stanly County			
Rocky River near Norwood	9/18/1945	105,000	46.37
Union County			
EF Twelve Mile Creek near Waxhaw	9/7/1959	6,500	25.50

Depth of flooding inside structures across the region during a maximum flood event ranges from 2-4 feet and varies based on the structure’s location in the floodplain and the elevation of the structure.

**Other Hazards**

Wildfires

Wildfire data was provided by the North Carolina Division of Forest Resources and is reported annually by county from 2003-2018. Analyzing the data by county indicates the following wildfire hazard extent for each county.

**Cabarrus County**

- The greatest number of fires to occur in any year was 55 in 2004.
- The greatest number of acres to burn in a single year occurred in 2011 when 61 acres were burned.

**Stanly County**

- The greatest number of fires to occur in any year was 103 in 2007.
- The greatest number of acres to burn in a single year occurred in 2010 when 149 acres were burned.

**Union County**

- The greatest number of fires to occur in any year was 144 in 2007.
- The greatest number of acres to burn in a single year occurred in 2005 when 182 acres were burned.

Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout the region.

Infectious Disease

There is no available method for determining dollar losses due to infectious diseases at this time; however, \$477,500 dollars was allocated from the Governor’s yearly budget in 2016 for preventative measures regarding the Zika Virus. The entire Cabarrus Stanly Union region is susceptible to infectious diseases such as the flu, which kills hundreds of people annually.

**Technological Hazards**

Hazardous Materials Incident

According to USDOT PHMSA, the largest hazardous materials incident reported in the region is 100 LGA released on the highway on March 27, 1976. It should be noted that larger events are possible.

- Cabarrus County: 100 LGA
- Stanly County: None reported
- Union County: 0.5 LGA

Radiological Emergency –

Although there is no history of a nuclear accident at the McGuire or Catawba Nuclear Stations, other events across the globe and in the United States in particular indicate that

Fixed Nuclear Facilities	an event is possible. Since several national and international events were Level 7 events on the INES, the potential for a Level 7 event at McGuire or Catawba is possible.
Terrorism	Although no severe terrorism attacks have been reported in the Cabarrus Stanly Union region, the entire area is still at risk to a future event. Densely populated areas, such as cities, are considered more susceptible. Terror events have the potential to affect the human population, buildings and infrastructure, and the economy in the region.
Cyber	No cyber attacks have been historically reported in the Cabarrus Stanly Union region. Technology usage, however, is increasing. A cyber attack could potentially devastate the region’s economy and could have lasting negative impacts.
Electromagnetic Pulse	Electromagnetic Pulse (EMP) occurrences have not taken place in the Cabarrus Stanly Union region, but the risk still exists. If an EMP were to occur, the effects would negatively impact first responders and communication efforts and may cause panic within the area.

### 5.19.2 Priority Risk Index

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

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

The application of the PRI results in numerical values that allow identified hazards to be ranked against one another (the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories for each hazard (probability, impact, spatial extent, warning time, and duration). Each degree of risk has been assigned a value (1 to 4) and an agreed upon weighting factor<sup>30</sup>, as summarized in **Table 5.34**. To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final PRI value, as demonstrated in the example equation below:

$$\text{PRI VALUE} = [( \text{PROBABILITY} \times .30) + ( \text{IMPACT} \times .30) + ( \text{SPATIAL EXTENT} \times .20) + ( \text{WARNING TIME} \times .10) + ( \text{DURATION} \times .10)]$$

According to the weighting scheme and point system applied, the highest possible value for any hazard

<sup>30</sup> The Regional Hazard Mitigation Planning Team, based upon any unique concerns or factors for the planning area, may adjust the PRI weighting scheme during future plan updates.

is 4.0. When the scheme is applied for the Cabarrus Stanly Union Region, the highest PRI value is 3.0 (Severe Winter Weather). Prior to being finalized, PRI values for each identified hazard were reviewed and accepted by the members of the Regional Hazard Mitigation Planning Team.

**TABLE 5.34: PRIORITY RISK INDEX**

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

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	10%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

### 5.19.3 Priority Risk Index Results

**Table 5.35** summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Regional Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

**TABLE 5.35: SUMMARY OF PRI RESULTS**

Hazard	Subhazard(s) Assessed	Category/Degree of Risk					
		Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
<b>Natural Hazards</b>							
Drought		Likely	Minor	Large	More than 24 hours	More than 1 week	2.5
Excessive Heat		Possible	Minor	Large	More than 24 hours	Less than 1 week	2.1
Hurricane and Coastal Hazards		Possible	Critical	Large	More than 24 hours	Less than 24 hours	2.6
Tornadoes/Thunderstorms	Hailstorm, Lightning	Highly Likely	Limited	Moderate	6 to 12 hours	Less than 6 hours	2.8
Severe Winter Weather		Likely	Critical	Large	More than 24 hours	Less than one week	3.0
Earthquakes		Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.0
Geological	Landslide, Sinkholes, Erosion	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.1
Dam Failure		Unlikely	Critical	Moderate	Less than 6 hours	Less than 24 hours	2.2
Flooding		Likely	Limited	Moderate	6 to 12 hours	Less than 1 week	2.7
<b>Other Hazards</b>							
Wildfires		Likely	Minor	Small	Less than 6 hours	More than 1 week	2.4
Infectious Disease		Unlikely	Minor	Small	More than 24 hours	More than 1 week	1.6

**SECTION 5: HAZARD PROFILES**

---

Hazard	Subhazard(s) Assessed	Category/Degree of Risk					
		Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
<b>Technological Hazards</b>							
Hazardous Substances		Possible	Limited	Small	Less than 6 hours	Less than 24 hours	2.2
Radiological Emergency	Fixed Nuclear Facilities	Unlikely	Critical	Small	6 to 12 hours	Less than 1 week	1.9
Terrorism		Unlikely	Critical	Small	Less than 6 hours	Less than 24 hours	2.2
Cyber		Unlikely	Minor	Small	Less than 6 hours	Less than 24 hours	1.3
Electromagnetic Pulse		Unlikely	Minor	Large	12 to 24 hours	Less than 6 hours	1.7

## 5.20 FINAL DETERMINATIONS

The conclusions drawn from the hazard profiling process for the Cabarrus Stanly Union Region, including the PRI results and input from the Regional Hazard Mitigation Planning Team, resulted in the classification of risk for each identified hazard according to three categories: High Risk, Moderate Risk, and Low Risk. For purposes of these classifications, risk is expressed in relative terms according to the estimated impact that a hazard will have on human life and property throughout all of the Cabarrus Stanly Union Region. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

A more quantitative analysis to estimate potential dollar losses for each hazard has been performed separately, and is described in Section 6: *Vulnerability Assessment*.

**Table 5.36** ranks the hazards that were assessed in the update that were renamed to be consistent with the State of State of North Carolina Hazard Mitigation Plan. These conclusions were based on the PRI calculations and input from the Cabarrus Stanly Union Regional Planning Committee.

**TABLE 5.36: 2020 CONCLUSIONS ON HAZARD RISK FOR THE CABARRUS STANLY UNION REGION**

<b>HIGH RISK</b>	Winter Storm and Freeze Thunderstorm Wind / High Wind Flooding Hurricane and Coastal Hazards
<b>MODERATE RISK</b>	Drought Wildfires Hazardous Substances Dam Failure Terrorism Excessive Heat
<b>LOW RISK</b>	Geological Earthquakes Radiological Emergency Electromagnetic Pulse Infectious Disease Cyber

# SECTION 6

## VULNERABILITY ASSESSMENT

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

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

### 44 CFR Requirement

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

## 6.1 OVERVIEW

This section builds upon the information provided in Section 4: *Hazard Identification* and Section 5: *Hazard Profiles* by identifying and characterizing an inventory of assets in the Cabarrus Stanly Union Region. Additionally, an assessment is conducted for each identified hazard, including the potential impact and expected amount of damages it may cause. The primary objective of the vulnerability assessment is to quantify exposure and the potential loss estimates for each hazard. In doing so, each county and their participating jurisdictions may better understand their unique risks to identified hazards and be better prepared to evaluate and prioritize specific hazard mitigation actions.

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

## 6.2 METHODOLOGY

This vulnerability assessment was conducted using three distinct methodologies: (1) A stochastic risk assessment; (2) a geographic information system (GIS)-based analysis; and (3) a risk modeling software analysis. Each approach provides estimates for the potential impact of hazards by using a common, systematic framework for evaluation, including historical occurrence information provided in the *Hazard Identification* and *Hazard Profiles* sections. A brief description of the three different approaches is provided on the following pages.

### 6.2.1 Stochastic Risk Assessment

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

- ◆ Geological
- ◆ Tornadoes/Thunderstorms
- ◆ Severe Winter Weather
- ◆ Hazardous Substances

With the exception of Hazardous Substances, the hazards listed above are considered natural and have the potential to affect all current and future buildings and all populations. **Table 6.1** provides information about all improved property in the Cabarrus Stanly Union region that is vulnerable to these hazards. For all hazards annualized loss estimates were determined using the best available data on historical losses from sources including NOAA's National Centers for Environmental Information records, the previous Cabarrus Stanly Union Regional Hazard Mitigation Plan, and local knowledge. Annualized loss estimates were generated by totaling the amount of property damage over the period of time for which records were available, and calculating the average annual loss. Given the standard weighting analysis, losses can be readily compared across hazards providing an objective approach for evaluating mitigation alternatives.

For the dam failure<sup>1</sup>, drought, excessive heat, infectious disease, radiological emergency, terrorism, cyber, EMP, and geological hazards, no data with historical property damages was available. Therefore, a detailed vulnerability assessment could not be completed for these hazards at this time.

The results for these hazards are found at the end of this section in **Table 6.26**.

---

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

### 6.2.2 GIS-Based Analysis

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

- ◆ Flooding
- ◆ Hazardous Substances
- ◆ Geological (Landslide)
- ◆ Wildfires

The objective of the GIS-based analysis was to determine the estimated vulnerability of critical facilities and populations for the identified hazards in the Cabarrus Stanly Union Region using best available geospatial data. Digital data was collected from local, regional, state, and national sources for hazards and buildings. This included local tax assessor records for individual parcels and buildings and georeferenced point locations for identified assets (critical facilities and infrastructure, special populations, etc.) when available. ESRI® ArcGIS™ 10.6.1 was used to assess hazard vulnerability utilizing digital hazard data, as well as local building data. Using these data layers, hazard vulnerability can be quantified by estimating the assessed building value for parcels and/or buildings determined to be located in identified hazard areas. To estimate vulnerable populations in hazard areas, digital Census 2010 data by census tract was obtained and was supplemented with current population estimates from the US Census Bureau. This was intersected with hazard areas to determine exposed population counts. Unfortunately, due to the large scale of census tracts, the results are limited, but will be revised as population by census block becomes available for all areas in the region. The results of the analysis provided an estimate of the number of people and critical facilities, as well as the assessed value of parcels and improvements, determined to be potentially at risk to those hazards with delineable geographic hazard boundaries.

### 6.2.3 Risk Management Tool

The Risk Management Tool (RMT) was developed by NCEM-Risk Management (RM) as a tool to simplify hazard mitigation plan development into a single, automated, tool-based format to include geospatially based risk assessment data, also developed by NCEM-RM. The RMT is a twofold system used to create and/or update a local and state hazard mitigation plan. The two parts of the RMT are a step-by-step system that will prompt a user to input information and narrative as well as upload pictures, documents and other information as needed. The second part of the system is the Risk Tool. The Risk Tool will run a risk assessment at the building level for certain hazards selected based on predetermined calculations for each hazard. Some hazards will have a single return period and others have multi-return periods. The availability of multi-returns periods are based on the availability of datasets for each hazard and the degree of detail in each dataset.

The Risk Assessment produced by the Risk Tool will also identify high-risk structures in the planning area and estimate cost by types of mitigation projects (wind retrofits, elevation, acquisition, mitigation reconstruction) and benefit-cost estimates by type of mitigation. The mitigation tool is only meant to begin the process of thinking about problem areas where mitigation may be of interest to the jurisdiction and property owners. It is also designed to drive mitigation actions that are specific, measurable, attainable, realistic and timely.

Finally, the Risk Management Tool also assesses vulnerable populations, such as children and elderly persons. Data used to assess these populations is from the US 2010 Census. According to the US Census

Bureau, those defined as “elderly,” are 65 years old or older, while those defined as “children” are 5 years old or younger. It is important to note that the numbers assessed are from the most recent Census in 2010.

Once all of the information was input into the system, a hazard mitigation plan can then be exported into multiple document formats. The system will also store the plan so that when it is time to update the plan, the information is already in the system.

The RMT was originally developed as part of the Integrated Hazard Risk Management (IHRM) pilot project which included Durham, Edgecombe, Macon and New Hanover counties. The pilot was successful and it was determined that there is a need and interest in a system designed to be used statewide and potentially nationwide in the future. The RMT used in this update was the second version created by NCEM.

A list of the hazards assessed by the RMT follows:

- ◆ Hurricane and Coastal Hazards
- ◆ Tornadoes/Thunderstorms
- ◆ Earthquakes
- ◆ Flooding
- ◆ Wildfires

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

### Hazard Prioritization

When it comes to evaluating hazards and determining which hazards a jurisdiction should spend the most time and effort addressing, a number of factors affect the prioritization. As discussed in *Section 5: Hazard Profiles*, the risk (magnitude, probability, location) of a hazard is one of the primary driving forces that helps determine the relative importance of addressing the potential impacts of a hazard. However, the assessment of a hazard’s risk is generally focused on the hazard itself and how severe or likely it could be within geographic scope of the study area. This assessment does not necessarily analyze the potential effects of that hazard on humans and the built environment. This is a critical component of planning for hazards since a hazard that does not impact human life, safety, or welfare is typically not considered as important to address through mitigation. The analysis that follows attempts to bring this consideration into the planning process by estimating the impacts on humans and the built environment and prioritizing hazards accordingly.

## 6.3 EXPLANATION OF DATA SOURCES

### **Hurricane and Coastal Hazards**

NCEM's Risk Management Tool assessed vulnerable areas to the Hurricane and Coastal Hazards. For this assessment, vulnerable buildings and populations were analyzed against damages caused by hurricane winds.

### **Tornadoes/Thunderstorms**

NCEM's Risk Management Tool analyzed the vulnerable buildings and populations to the Tornadoes/Thunderstorms hazard. Sub hazards assessed under the thunderstorms hazard include hail and lightning; however, for the purposes of this assessment, thunderstorm winds were the only risk analyzed.

### **Earthquakes**

NCEM's Risk Management Tool assessed vulnerable areas to the earthquake hazard. This assessment included susceptible buildings by the type of structure, and the potential dollar losses associated with the buildings. It also analyzed susceptible populations, such as children and elderly.

### **Geological (Landslide)**

Data from the U.S. Geological Survey was used to first determine what areas are considered high, moderate, or low susceptibility areas to the landslide hazard. Data was downloaded in an ArcGIS compatible format. This allowed the parcel data received by local governments to be layered on top of the landslide regions to assess vulnerability to landslide occurrences.

### **Flooding**

FEMA Digital Flood Insurance Rate Maps (DFIRMs) were used to determine flood vulnerability. DFIRM data can be used in ArcGIS for mapping purposes and, they identify several features including floodplain boundaries and base flood elevations. Identified areas on the DFIRM represent some features of a Flood Insurance Rate Maps including the 100-year flood areas (1.0-percent annual chance flood), and the 500-year flood areas (0.2-percent annual chance flood). For the vulnerability assessment, local parcel data and critical facilities were overlaid on the 100-year floodplain areas and 500-year floodplain areas. This data was also supplemented with the NCEM RMT data, which assessed structure type and vulnerable populations within the floodplain areas. It should be noted that such an analysis does account for building elevation.

### **Wildfires**

The data used to determine vulnerability to wildfires in the Cabarrus Stanly Union Region is based on GIS data called the Southern Wildfire Risk Assessment (SWRA). It was provided for use in this plan by the North Carolina Division of Forest Resources. A specific layer known as the "Wildland Urban Interface" (WUI) was used to determine vulnerability of people and property. This layer uses the key input of housing density to define potential wildfire impacts to people and homes. The WUI Risk Index is then derived from a scale of -1 to -9, with the least negative impact being a -1, and uses flame length to measure fire intensity. The primary purpose of this data is to highlight areas of concern that may be conducive to mitigation actions. Many assumptions are made, making it not a true probability; however, it does provide a comparison of risk throughout the region. Data was also supplemented with

the data from NCEM’s RMT, which assessed vulnerable buildings, potential dollar losses of those buildings, and susceptible populations.

### **Hazardous Substances**

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

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

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

## **6.4 ASSET INVENTORY**

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

### **6.4.1 Physical and Improved Assets**

The two categories of physical assets consist of:

1. **Improved Property**: Includes all improved properties in the Cabarrus Stanly Union Region

---

<sup>2</sup> While potentially not all-inclusive for the jurisdictions in the Cabarrus Stanly Union region, “georeferenced” assets include those assets for which specific location data is readily available for connecting the asset to a specific geographic location for purposes of GIS analysis.

**SECTION 6: VULNERABILITY ASSESSMENT**

according to local parcel data provided by the counties. The information has been expressed in terms of the number of parcels and total assessed value of improvements (buildings) that may be exposed to the identified hazards.

2. Critical Facilities: Critical facilities vary by jurisdiction. Each county provided data from their respective critical facilities that were used in this section. Identified critical facilities are fire stations, police stations, medical care facilities, schools, government facilities, emergency operation centers, or other important buildings. It should be noted that this listing is not all-inclusive for assets located in the region, but it is anticipated that it will be expanded during future plan updates as more geo-referenced data becomes available for use in GIS analysis.

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

**Table 6.1** lists the number of parcels, total value of parcels, total number of parcels with improvements, and the total assessed value of improvements for participating areas of the Cabarrus Stanly Union Region (study area of vulnerability assessment)<sup>3</sup>.

**TABLE 6.1: IMPROVED PROPERTY IN THE CABARRUS STANLY UNION REGION**

Location <sup>4</sup>	Number of Parcels	Total Assessed Value of Parcels	Estimated Number of Buildings	Total Assessed Value of Improvements
<b>Cabarrus County</b>	<b>95,874</b>	<b>\$9,634,181,545</b>	<b>71,150</b>	<b>\$6,977,682,145</b>
Concord	36,730	\$9,634,181,545	30,930	\$6,977,682,145
Harrisburg	6,984	\$1,942,853,690	5,982	\$1,449,623,770
Kannapolis	22,079	\$3,441,157,797	14,094	\$2,480,647,517
Midland	2,320	\$344,504,050	1,517	\$209,888,660
Mount Pleasant	752	\$128,580,690	614	\$85,729,600
Unincorporated Area	27,009	\$5,041,615,330	18,013	\$3,115,253,440
<b>Stanly County</b>	<b>40,191</b>	<b>\$4,958,756,453</b>	<b>26567</b>	<b>\$3,092,910,470</b>
Albemarle	8,620	\$1,182,237,757	6,677	\$921,385,554
Badin	892	\$57,515,732	665	\$44,590,815
Locust	2,249	\$410,140,057	1,619	\$348,011,831
Misenhiemer	135	\$61,313,747	92	\$60,328,617
New London	703	\$93,749,135	487	\$88,613,530
Norwood	2,989	\$294,858,092	1,805	\$262,689,828
Oakboro	1,665	\$162,669,658	1,093	\$148,664,634
Red Cross	482	\$62,435,411	335	\$58,406,385
Richfield	901	\$101,361,602	570	\$88,042,654
Stanfield	891	\$131,868,399	676	\$125,179,966
Unincorporated Area	20,664	\$2,400,606,863	12,548	\$946,996,656
<b>Union County</b>	<b>104,493</b>	<b>\$33,446,809,060</b>	<b>85,032</b>	<b>\$31,903,348,860</b>
Fairview	2061	\$523,596,100	1,546	\$467,637,700

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

<sup>4</sup> Number of buildings for each county is based on the number of parcels with an improved building value greater than zero.

**SECTION 6: VULNERABILITY ASSESSMENT**

Location <sup>4</sup>	Number of Parcels	Total Assessed Value of Parcels	Estimated Number of Buildings	Total Assessed Value of Improvements
Hemby Bridge	735	\$82,284,200	576	\$77,183,200
Indian Trail	15,464	\$4,459,884,100	13,615	\$4,358,171,100
Lake Park	1,345	\$242,153,200	1,213	\$240,536,200
Marshville	1,206	\$229,300,900	979	\$224,134,100
Marvin	1,863	\$986,654,400	1,641	\$968,672,900
Mineral Springs	1,481	\$280,141,100	1,182	\$266,913,800
Monroe	13,601	\$5,233,280,060	11,822	\$5,093,604,760
Stallings	6,636	\$1,751,941,200	5,895	\$1,709,895,100
Unionville	3,326	\$964,101,300	2,587	\$911,983,900
Waxhaw	7,112	\$1,826,547,700	5,846	\$1,741,375,500
Weddington	4,993	\$2,292,398,800	3,954	\$2,195,748,100
Wesley Chapel	2,799	\$926,038,300	2,381	\$901,244,400
Wingate	995	\$285,176,800	865	\$282,902,600
Unincorporated Area	40,876	\$13,363,310,900	30,930	\$12,463,345,500
<b>Cabarrus Stanly Union Regional Total</b>	<b>240,558</b>	<b>\$58,938,458,615</b>	<b>182,749</b>	<b>\$49,315,084,462</b>

Source: Local governments

The following table lists the fire stations, police stations, emergency operations centers (EOCs), medical care facilities, schools, and other critical facilities located in the Cabarrus Stanly Union Region. Local governments at the county level provided a majority of the data for this analysis. In addition, **Figure 6.1** shows the locations of essential facilities in the Cabarrus Stanly Union Region. **Table 6.26**, at the end of this section, shows a complete list of the critical facilities by name, as well as the hazards that affect each facility. As noted previously, this list is not all inclusive and only includes information provided by the counties.

**TABLE 6.2: CRITICAL FACILITY INVENTORY IN THE CABARRUS STANLY UNION REGION**

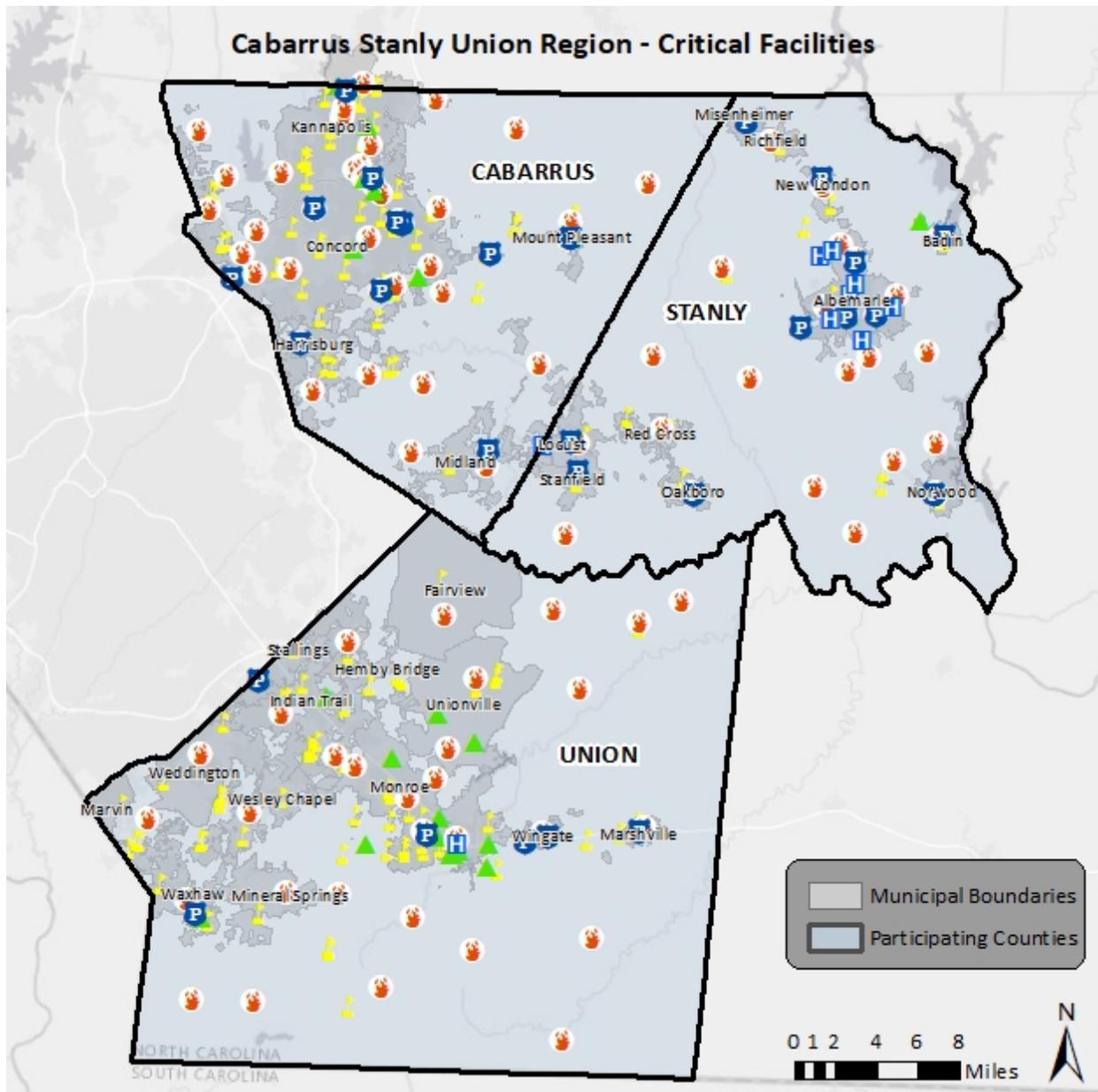
Location	Fire/EMS Stations	Police Stations	Medical Care Facilities	Schools	Other
<b>Cabarrus County</b>	<b>36</b>	<b>11</b>	<b>1</b>	<b>52</b>	<b>11</b>
Concord	17	7	1	26	9
Harrisburg	3	1	0	3	0
Kannapolis	4	1	0	13	2
Midland	2	1	0	1	0
Mount Pleasant	2	1	0	3	1
Unincorporated Area	8	0	0	6	0
<b>Stanly County</b>	<b>27</b>	<b>12</b>	<b>2</b>	<b>21</b>	<b>8</b>
Albemarle	11	5	1	9	7
Badin	1	1	0	1	0
Locust	2	1	1	3	0
Misenhiemer	0	1	0	0	0
New London	3	1	0	0	0
Norwood	6	1	0	4	0
Oakboro	1	1	0	1	0

**SECTION 6: VULNERABILITY ASSESSMENT**

Location	Fire/EMS Stations	Police Stations	Medical Care Facilities	Schools	Other
Red Cross	1	0	0	1	0
Richfield	1	0	0	1	0
Stanfield	1	1	0	1	0
Unincorporated Area	0	0	0	0	1
<b>Union County</b>	<b>23</b>	<b>6</b>	<b>1</b>	<b>63</b>	<b>15</b>
Fairview	1	0	0	1	0
Hemby Bridge	1	0	0	0	0
Indian Trail	1	0	0	9	0
Lake Park	0	0	0	0	1
Marshville	1	1	0	2	1
Marvin	0	0	0	1	0
Mineral Springs	1	0	0	1	0
Monroe	1	1	1	17	8
Stallings	0	1	0	1	0
Unionville	2	0	0	3	2
Waxhaw	1	1	0	3	1
Weddington	2	0	0	3	0
Wesley Chapel	1	0	0	2	0
Wingate	1	1	0	1	0
Unincorporated Area	10	1	0	19	2
<b>Cabarrus Stanly Union Regional Total</b>	<b>86</b>	<b>29</b>	<b>4</b>	<b>136</b>	<b>34</b>

Source: Local governments

**FIGURE 6.1: CRITICAL FACILITIES IN THE CABARRUS STANLY UNION REGION**



Source: Local governments

### 6.4.2 Social Vulnerability

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

**Table 6.3** lists the population by county according to U.S. Census 2010 population estimates. The population estimates are updated using the most recent vintage tables dated July 1, 2018. The total population in the Cabarrus Stanly Union Region according to Census data is 505,582.

**TABLE 6.3: TOTAL POPULATION IN THE CABARRUS STANLY UNION REGION**

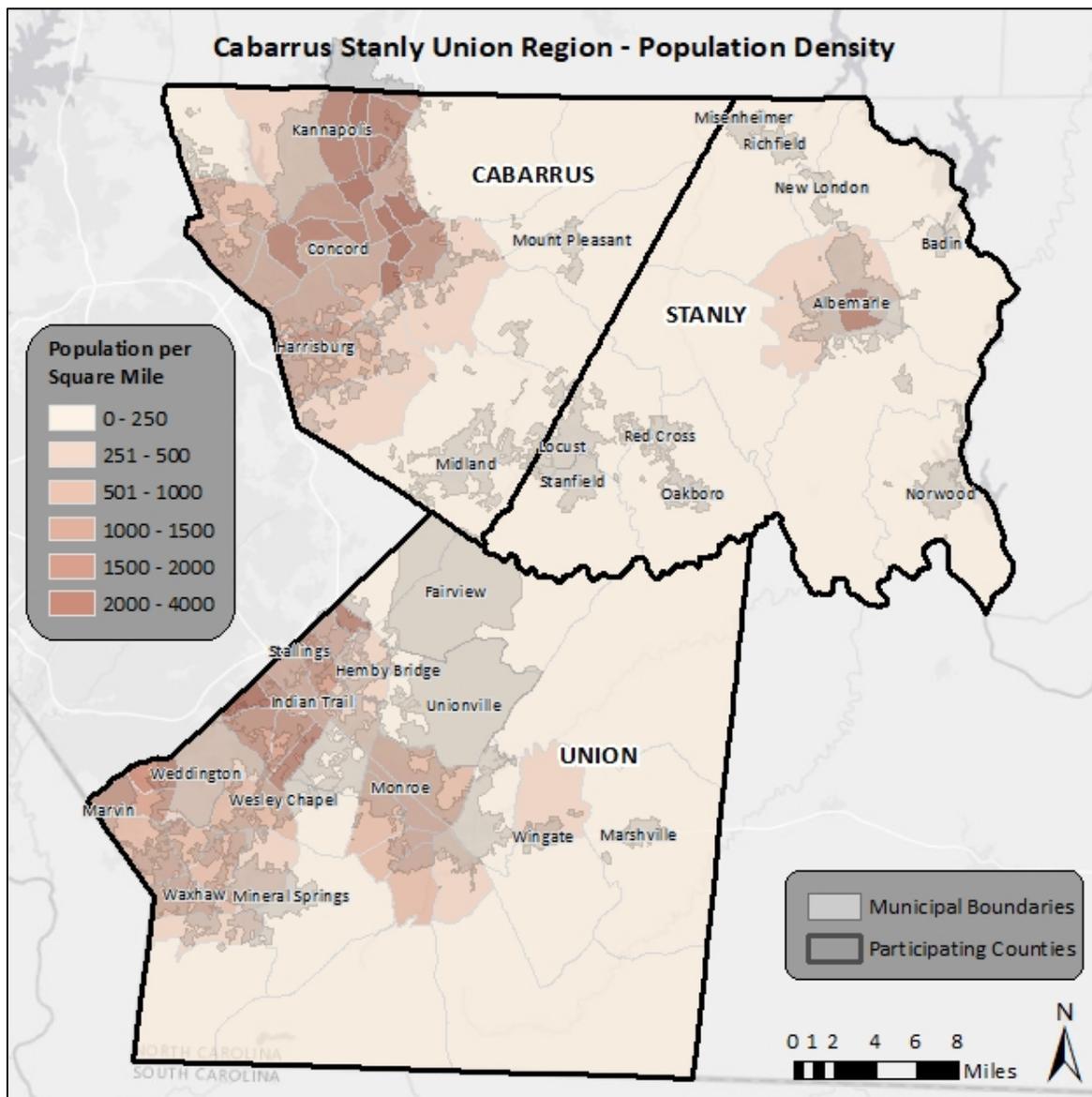
Location	2018 Population Estimates
Cabarrus County	209,303
Stanly County	63,465
Union County	232,814
<b>Cabarrus Stanly Union Regional Total</b>	<b>505,582</b>

Source: US Census Bureau

Additional population estimates are presented in Section 3: *Community Profile*.

In addition, **Figure 6.2** illustrates the population density by census tract as it was reported by the US Census Bureau in 2010 and updated with 2017 population estimates.

**FIGURE 6.2: POPULATION DENSITY IN THE CABARRUS STANLY UNION REGION**



### 6.4.3. Development Trends and Changes in Vulnerability

Since the previous regional hazard mitigation plan was approved (in 2015), the Cabarrus Stanly Union Region has experienced strong growth and development. **Table 6.4** shows the number of building units constructed since 2010 according to the US Census American Community Survey.

**TABLE 6.4: BUILDING COUNTS FOR THE CABARRUS STANLY UNION REGION**

Location	Total Housing Units (2017)	Units Built 2010 or Later	% Building Stock Built Post-2010
<b>Cabarrus County</b>	<b>79,443</b>	<b>10,985</b>	<b>13.83%</b>
Concord	33,835	3,304	9.77%
Harrisburg	4,912	1,257	25.59%
Kannapolis	19,255	1,529	7.94%
Midland	1,420	327	23.03%
Mount Pleasant	773	38	4.92%
Unincorporated Area	19,248	4,530	23.53%
<b>Stanly County</b>	<b>27,787</b>	<b>1,224</b>	<b>4.40%</b>
Albemarle	7,060	113	1.60%
Badin	690	4	0.58%
Locust	1,403	319	22.74%
Misenhiemer	142	4	2.82%
New London	255	21	8.24%
Norwood	1,411	38	2.69%
Oakboro	841	60	7.13%
Red Cross	361	9	2.49%
Richfield	254	31	12.20%
Stanfield	596	32	5.37%
Unincorporated Area	14,774	593	4.01%
<b>Union County</b>	<b>81,147</b>	<b>10,375</b>	<b>12.79%</b>
Fairview	1,547	83	5.37%
Hemby Bridge	578	18	3.11%
Indian Trail	12,403	1,708	13.77%
Lake Park	1,389	21	1.51%
Marshville	954	26	2.73%
Marvin	1,784	319	17.88%
Mineral Springs	1,168	172	14.73%
Monroe	12,197	725	5.94%
Stallings	5,562	753	13.54%
Unionville	2,462	187	7.60%
Waxhaw	4,382	2,241	51.14%
Weddington	3,496	732	20.94%
Wesley Chapel	2,758	267	9.68%
Wingate	1,135	15	1.32%
Unincorporated Area	29,332	3,108	10.60%
<b>Cabarrus Stanly Union Regional Total</b>	<b>188,377</b>	<b>22,584</b>	<b>11.99%</b>

Source: US Census Bureau

**Table 6.5** shows population growth estimates for the region from 2010 to 2017 based on the US Census Annual Estimates of Resident Population and 2017 population estimates.

**TABLE 6.5: POPULATION GROWTH FOR THE CABARRUS STANLY UNION REGION**

Location	2017	2016	2015	2010	% Change 2010-2017
<b>Cabarrus County</b>	206,724	201,470	196,215	178,535	15.79%
Concord	87,607	85,753	83,903	75,172	16.54%
Harrisburg	14,856	14,500	13,883	10,328	43.84%
Kannapolis	46,498	45,685	44,520	41,663	11.61%
Midland	3,422	3,322	3,243	2,978	14.91%
Mount Pleasant	2,064	2,133	1,825	1,727	19.51%
Unincorporated Area	52,277	50,077	48,841	46,667	12.02%
<b>Stanly County</b>	61,451	60,792	60,635	60,585	1.43%
Albemarle	15,874	15,968	15,969	15,912	-0.24%
Badin	2,009	1,906	1,895	1,774	13.25%
Locust	3,253	3,036	2,956	2,959	9.94%
Misenhiemer	723	732	711	920	-21.41%
New London	618	593	596	621	-0.48%
Norwood	2,787	2,960	2,881	2,122	31.34%
Oakboro	1,958	1,958	1,924	1,912	2.41%
Red Cross	732	695	706	740	-1.08%
Richfield	601	643	653	464	29.53%
Stanfield	1,475	1,597	1,612	1,573	-6.23%
Unincorporated Area	31,421	30,704	30,732	31,588	-0.53%
<b>Union County</b>	231,424	226,383	222,017	201,292	14.97%
Fairview	3,660	3,602	3,530	3,323	10.14%
Hemby Bridge	1,563	1,264	1,307	1,570	-0.45%
Indian Trail	37,191	36,357	35,602	30,362	22.49%
Lake Park	3,706	3,678	3,636	3,243	14.28%
Marshville	2,614	2,598	2,538	2,391	9.33%
Marvin	6,174	6,056	5,938	4,889	26.28%
Mineral Springs	2,904	2,847	2,797	2,553	13.75%
Monroe	34,368	34,212	33,951	32,297	6.41%
Stallings	14,970	14,759	14,495	12,682	18.04%
Unionville	6,497	6,397	6,295	5,853	11.00%
Waxhaw	13,343	12,398	11,586	8,754	52.42%
Weddington	10,388	10,254	10,091	9,207	12.83%
Wesley Chapel	8,447	8,217	8,010	6,702	26.04%
Wingate	3,867	3,798	3,742	3,398	13.80%
Unincorporated Area	81,732	79,946	78,499	74,068	10.35%
<b>Cabarrus Stanly Union Regional Total</b>	<b>499,599</b>	<b>488,645</b>	<b>478,867</b>	<b>440,412</b>	<b>13.44%</b>

Source: US Census Bureau

Based on the above data, the rate of residential development and population growth in the region since 2010 has increased, most dramatically in Cabarrus and Union Counties. The overall population increased slightly in Stanly County, too, but has decreased in some of the participating jurisdictions. Changes in development do impact the region's vulnerability since the last update. The greater the population, the greater the risk is that persons are impacted by hazards. It should be noted that if

## SECTION 6: VULNERABILITY ASSESSMENT

---

future development occurs in vulnerable areas, populations and infrastructure will be exposed to potential hazards.

## 6.5 VULNERABILITY ASSESSMENT RESULTS

As noted earlier, only hazards with a specific geographic boundary, modeling tool, or sufficient historical data allow for further analysis. Those results are presented here. All other hazards are assumed to impact the entire planning region (drought, excessive heat, hailstorm, lightning, and severe winter weather) or, due to lack of data, analysis would not lead to credible results (sinkholes, erosion, dam failure, infectious disease, terrorism, cyber, EMP). The total region exposure, and thus risk, was presented in **Table 6.26**.

The annualized loss estimate for all hazards is presented at the end of this section in **Table 6.25**.

The hazards presented in this subsection include: hurricane and coastal hazards, tornadoes/thunderstorms, earthquakes, landslides, flooding, wildfires, and hazardous substances.

### 6.5.1. Hurricane and Coastal Hazards

Historical evidence indicates that the Cabarrus Stanly Union Region has a significant risk to the hurricane and tropical storm hazard, mostly due to the location of the state of North Carolina. In recent years, there have been four disaster declarations from hurricanes in the region (Hurricane Hugo, Tropical Storm Frances, Hurricane Katrina Evacuation). The most recent hurricane experienced by the region was Hurricane Michael in 2018. Many more storm tracks have come near or traversed through the region, as shown and discussed in Section 5: Hazard Profiles.

Numerous secondary hazards, such as erosion, flooding, tornadoes, and high winds, tend to be a result of hurricanes or tropical storms. These cumulative effects often make potential loss estimates difficult to calculate and track.

NCEM's Risk Management Tool analyzes hurricane winds and no other hazards often associated with hurricanes; therefore, only hurricane winds are analyzed in this section. Building and population vulnerabilities to hurricane winds in a 100-year frequency event (return period) are reported in the following **Table 6.6** and **Table 6.7**.

It is assumed that all existing and future buildings and populations are at risk to the hurricane and tropical storm hazard.

**TABLE 6.6: BUILDING VULNERABILITIES TO HURRICANE WINDS**

Location	Pre-Firm Buildings at Risk	Residential Buildings at Risk		Commercial Buildings at Risk		Public Buildings at Risk		Total Buildings at Risk	
		Number	Damages	Number	Damages	Number	Damages	Number	Damages
<b>Cabarrus County</b>	<b>39,290</b>	<b>74,256</b>	<b>\$7,237,390</b>	<b>6,843</b>	<b>\$2,880,129</b>	<b>1,535</b>	<b>\$674,739</b>	<b>82,634</b>	<b>\$10,792,255</b>
Concord	9,960	24,727	\$2,706,298	2,540	\$1,836,588	576	\$287,461	27,843	\$4,830,347
Harrisburg	3,276	3,328	\$401,218	650	\$140,380	110	\$41,695	4,088	\$583,292
Kannapolis	16,814	18,793	\$1,923,489	1,431	\$328,901	431	\$193,156	20,655	\$2,445,546
Midland	1,144	1,627	\$105,213	157	\$28,229	30	\$7,968	1,814	\$141,409
Mount Pleasant	1,497	1,543	\$104,161	143	\$32,467	53	\$8,520	1,739	\$145,148
Unincorporated Area	6,599	24,238	\$1,997,011	1,922	\$513,564	335	\$135,939	26,495	\$2,646,513
<b>Stanly County</b>	<b>29,362</b>	<b>33,784</b>	<b>\$3,458,565</b>	<b>4,297</b>	<b>\$858,746</b>	<b>791</b>	<b>\$269,725</b>	<b>38,872</b>	<b>\$4,587,036</b>

**SECTION 6: VULNERABILITY ASSESSMENT**

Location	Pre-Firm Buildings at Risk	Residential Buildings at Risk		Commercial Buildings at Risk		Public Buildings at Risk		Total Buildings at Risk	
		Number	Damages	Number	Damages	Number	Damages	Number	Damages
Albemarle	6,654	6,509	\$436,449	1,391	\$105,106	214	\$40,115	8,114	\$581,670
Badin	711	595	\$40,430	86	\$19,580	34	\$6,544	715	\$66,554
Locust	1,581	1,524	\$103,841	232	\$20,800	36	\$8,730	1,792	\$133,371
Misenhiemer	169	158	\$11,400	11	\$577	29	\$7,066	198	\$19,043
New London	703	646	\$75,911	80	\$29,147	25	\$2,030	751	\$107,087
Norwood	2,080	1,918	\$474,464	206	\$104,393	45	\$44,040	2,169	\$622,898
Oakboro	1,235	1,180	\$84,282	205	\$27,868	39	\$5,705	1,424	\$117,855
Red Cross	397	512	\$39,328	39	\$1,752	15	\$4,092	566	\$45,171
Richfield	919	865	\$58,295	141	\$9,562	24	\$1,805	1,030	\$69,663
Stanfield	886	855	\$61,327	125	\$26,876	23	\$1,267	1,003	\$89,470
Unincorporated Area	14,027	19,022	\$2,072,838	1,781	\$513,085	307	\$148,331	21,110	\$2,734,254
<b>Union County</b>	<b>33,837</b>	<b>81,695</b>	<b>\$12,607,660</b>	<b>5,903</b>	<b>\$3,578,618</b>	<b>1,388</b>	<b>\$1,500,959</b>	<b>88,986</b>	<b>\$17,687,237</b>
Fairview	1,247	2,203	\$225,444	166	\$58,527	63	\$22,033	2,432	\$306,003
Hemby Bridge	628	842	\$44,416	62	\$9,459	25	\$3,559	929	\$57,434
Indian Trail	2,031	11,191	\$812,482	854	\$135,789	115	\$13,582	12,160	\$961,853
Lake Park	3	1,179	\$98,473	14	\$10,714	5	\$166	1,198	\$109,353
Marshville	1,491	1,535	\$402,744	220	\$96,236	43	\$162,426	1,798	\$661,406
Marvin	141	1,579	\$366,999	42	\$10,412	10	\$3,553	1,631	\$380,964
Mineral Springs	638	1,361	\$67,110	96	\$15,323	31	\$4,099	1,488	\$86,532
Monroe	7,010	11,003	\$1,283,738	1,754	\$281,696	244	\$413,747	13,001	\$1,979,182
Stallings	2,078	5,089	\$507,762	387	\$37,645	25	\$2,553	5,501	\$547,960
Unionville	1,732	3,123	\$363,589	190	\$123,171	108	\$35,902	3,421	\$522,662
Waxhaw	673	3,062	\$236,195	187	\$17,544	35	\$5,094	3,284	\$258,832
Weddington	667	3,489	\$537,884	107	\$29,605	59	\$7,097	3,655	\$574,586
Wesley Chapel	439	2,696	\$255,486	36	\$8,541	29	\$8,923	2,761	\$272,951
Wingate	536	902	\$246,124	41	\$3,725	64	\$34,501	1,007	\$284,350
Unincorporated Area	14,523	32,441	\$7,159,214	1,747	\$2,740,231	532	\$783,724	34,720	\$10,683,169
<b>Cabarrus Stanly Union Regional Total</b>	<b>102,489</b>	<b>189,735</b>	<b>\$23,303,615</b>	<b>17,043</b>	<b>\$7,317,493</b>	<b>3,714</b>	<b>\$2,445,423</b>	<b>210,492</b>	<b>\$33,066,528</b>

Source: NCEM Risk Management Tool

**TABLE 6.7: POPULATION VULNERABILITIES TO HURRICANE WINDS**

Location	Elderly at Risk	Children at Risk	Total at Risk
<b>Cabarrus County</b>	<b>21,577</b>	<b>13,665</b>	<b>188,059</b>
Concord	8,840	5,728	78,329
Harrisburg	1,414	918	12,540
Kannapolis	5,361	3,156	44,366
Midland	331	214	2,926
Mount Pleasant	304	197	2,692
Unincorporated Area	5,327	3,452	47,206
<b>Stanly County</b>	<b>9,439</b>	<b>3,571</b>	<b>60,172</b>
Albemarle	2,477	936	15,776

**SECTION 6: VULNERABILITY ASSESSMENT**

Location	Elderly at Risk	Children at Risk	Total at Risk
Badin	283	107	1,799
Locust	516	202	3,350
Misenhiemer	113	43	720
New London	176	66	1,118
Norwood	516	195	3,289
Oakboro	361	136	2,303
Red Cross	117	44	743
Richfield	219	83	1,392
Stanfield	274	103	1,739
Unincorporated Area	4,387	1,656	27,943
<b>Union County</b>	<b>19,360</b>	<b>14,604</b>	<b>200,219</b>
Fairview	323	244	3,336
Hemby Bridge	149	113	1,545
Indian Trail	3,185	2,402	32,928
Lake Park	309	233	3,197
Marshville	287	216	2,963
Marvin	528	398	5,463
Mineral Springs	252	190	2,601
Monroe	3,227	2,434	33,374
Stallings	1,301	983	13,465
Unionville	573	432	5,930
Waxhaw	934	705	9,668
Weddington	911	687	9,416
Wesley Chapel	704	531	7,281
Wingate	324	244	3,346
Unincorporated Area	6,353	4,792	65,706
<b>Cabarrus Stanly Union Regional Total</b>	<b>50,376</b>	<b>31,840</b>	<b>448,450</b>

Source: NCEM Risk Management Tool

**SOCIAL VULNERABILITY**

Given the equal susceptibility across the entire Cabarrus Stanly Union Region, it can be assumed that the entire population is at risk to the hurricane and tropical storm hazard.

**CRITICAL FACILITIES**

Given equal vulnerability across the Cabarrus Stanly Union Region, all critical facilities are considered to be at risk. Although some buildings may perform better than others in the face of such an event due to construction, age, and other factors, determining individual building response is beyond the scope of this plan. However, this plan will consider mitigation actions for vulnerable structures, including critical facilities, to reduce the impacts of the hurricane wind hazard. A list of specific critical facilities and their associated risk can be found in **Table 6.26** at the end of this section.

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

## 6.5.2 Tornadoes/Thunderstorms

### Tornadoes

A probabilistic scenario was created to estimate building and population vulnerabilities in the Cabarrus Stanly Union region for the tornado hazard. For this scenario, a tornado ranked F2 on the Fujita scale was analyzed. The Risk Management Tool analyzed this information which has been reported in **Table 6.8** and **Table 6.9**.

**TABLE 6.8: BUILDING VULNERABILITY TO THE TORNADES HAZARD**

Location	Pre-Firm Buildings at Risk	Residential Buildings at Risk		Commercial Buildings at Risk		Public Buildings at Risk		Total Buildings at Risk	
		Number	Damages	Number	Damages	Number	Damages	Number	Damages
<b>Cabarrus County</b>	<b>39,350</b>	<b>74,589</b>	<b>\$8,742,812,588</b>	<b>6,843</b>	<b>\$6,740,809,158</b>	<b>1,535</b>	<b>\$1,554,583,104</b>	<b>82,967</b>	<b>\$17,038,204,848</b>
Concord	9,968	24,811	\$3,221,556,718	2,540	\$3,846,849,929	576	\$661,789,159	27,927	\$7,730,195,805
Harrisburg	3,298	3,354	\$511,781,898	650	\$438,059,825	110	\$115,054,213	4,114	\$1,064,895,935
Kannapolis	16,839	18,850	\$2,021,583,967	1,431	\$1,007,143,054	431	\$421,753,442	20,712	\$3,450,480,462
Midland	1,144	1,629	\$158,772,018	157	\$100,218,483	30	\$23,195,954	1,816	\$282,186,456
Mount Pleasant	1,499	1,568	\$144,084,088	143	\$86,057,302	53	\$38,252,495	1,764	\$268,393,885
Unincorporated Area	6,602	24,377	\$2,685,033,899	1,922	\$1,262,480,565	335	\$294,537,841	26,634	\$4,242,052,305
<b>Stanly County</b>	<b>29,574</b>	<b>34,112</b>	<b>\$3,122,108,002</b>	<b>4,297</b>	<b>\$1,727,558,710</b>	<b>791</b>	<b>\$468,387,477</b>	<b>39,200</b>	<b>\$5,318,054,190</b>
Albemarle	6,688	6,554	\$593,064,088	1,391	\$561,510,144	214	\$135,727,965	8,159	\$1,290,302,198
Badin	762	646	\$49,611,345	86	\$72,583,203	34	\$44,002,275	766	\$166,196,824
Locust	1,582	1,527	\$138,837,063	232	\$76,563,731	36	\$25,490,251	1,795	\$240,891,044
Misenhiemer	169	158	\$13,208,091	11	\$1,865,242	29	\$29,572,757	198	\$44,646,090
New London	703	647	\$84,718,946	80	\$61,819,200	25	\$10,818,525	752	\$157,356,671
Norwood	2,080	1,918	\$179,963,316	206	\$63,464,456	45	\$20,270,489	2,169	\$263,698,261
Oakboro	1,237	1,186	\$102,556,274	205	\$74,943,966	39	\$14,522,533	1,430	\$192,022,773
Red Cross	397	513	\$48,529,535	39	\$7,916,604	15	\$16,989,639	567	\$73,435,778
Richfield	930	877	\$78,277,097	141	\$50,651,726	24	\$9,264,120	1,042	\$138,192,943
Stanfield	891	862	\$83,734,854	125	\$61,279,807	23	\$7,358,224	1,010	\$152,372,885
Unincorporated Area	14,135	19,224	\$1,749,607,393	1,781	\$694,960,631	307	\$154,370,699	21,312	\$2,598,938,723
<b>Union County</b>	<b>33,946</b>	<b>82,172</b>	<b>\$11,956,831,891</b>	<b>5,903</b>	<b>\$3,645,345,735</b>	<b>1,388</b>	<b>\$1,040,445,728</b>	<b>89,463</b>	<b>\$16,642,623,356</b>
Fairview	1,248	2,213	\$295,806,538	166	\$130,296,700	63	\$43,513,341	2,442	\$469,616,580
Hemby Bridge	631	852	\$69,724,647	62	\$17,745,052	25	\$8,126,226	939	\$95,595,926
Indian Trail	2,038	11,266	\$1,411,241,318	854	\$420,239,990	115	\$66,027,430	12,235	\$1,897,508,738
Lake Park	3	1,182	\$144,682,742	14	\$14,574,820	5	\$1,576,315	1,201	\$160,833,877
Marshville	1,491	1,535	\$142,951,322	220	\$88,299,877	43	\$37,195,621	1,798	\$268,446,819
Marvin	143	1,606	\$572,960,160	42	\$18,068,482	10	\$9,598,423	1,658	\$600,627,066
Mineral Springs	642	1,377	\$143,063,827	96	\$47,008,128	31	\$10,170,713	1,504	\$200,242,668
Monroe	7,037	11,060	\$1,183,462,749	1,754	\$976,496,135	244	\$175,414,425	13,058	\$2,335,373,309
Stallings	2,087	5,122	\$727,924,578	387	\$174,830,810	25	\$8,819,175	5,534	\$911,574,563
Unionville	1,733	3,134	\$411,790,873	190	\$213,385,505	108	\$75,716,803	3,432	\$700,893,181
Waxhaw	676	3,100	\$479,209,178	187	\$59,117,980	35	\$20,199,946	3,322	\$558,527,104
Weddington	673	3,521	\$912,756,861	107	\$40,657,219	59	\$46,110,674	3,687	\$999,524,754
Wesley Chapel	440	2,715	\$510,824,169	36	\$22,788,506	29	\$20,198,448	2,780	\$553,811,123
Wingate	536	902	\$102,173,339	41	\$8,740,090	64	\$47,289,451	1,007	\$158,202,880

**SECTION 6: VULNERABILITY ASSESSMENT**

Location	Pre-Firm Buildings at Risk	Residential Buildings at Risk		Commercial Buildings at Risk		Public Buildings at Risk		Total Buildings at Risk	
		Number	Damages	Number	Damages	Number	Damages	Number	Damages
Unincorporated Area	14,568	32,587	\$4,848,259,590	1,747	\$1,413,096,441	532	\$470,488,737	34,866	\$6,731,844,768
<b>Cabarrus Stanly Union Regional Total</b>	<b>102,870</b>	<b>190,873</b>	<b>\$23,821,752,481</b>	<b>17,043</b>	<b>\$12,113,713,603</b>	<b>3,714</b>	<b>\$3,063,416,309</b>	<b>211,630</b>	<b>\$38,998,882,394</b>

Source: NCEM Risk Management Tool

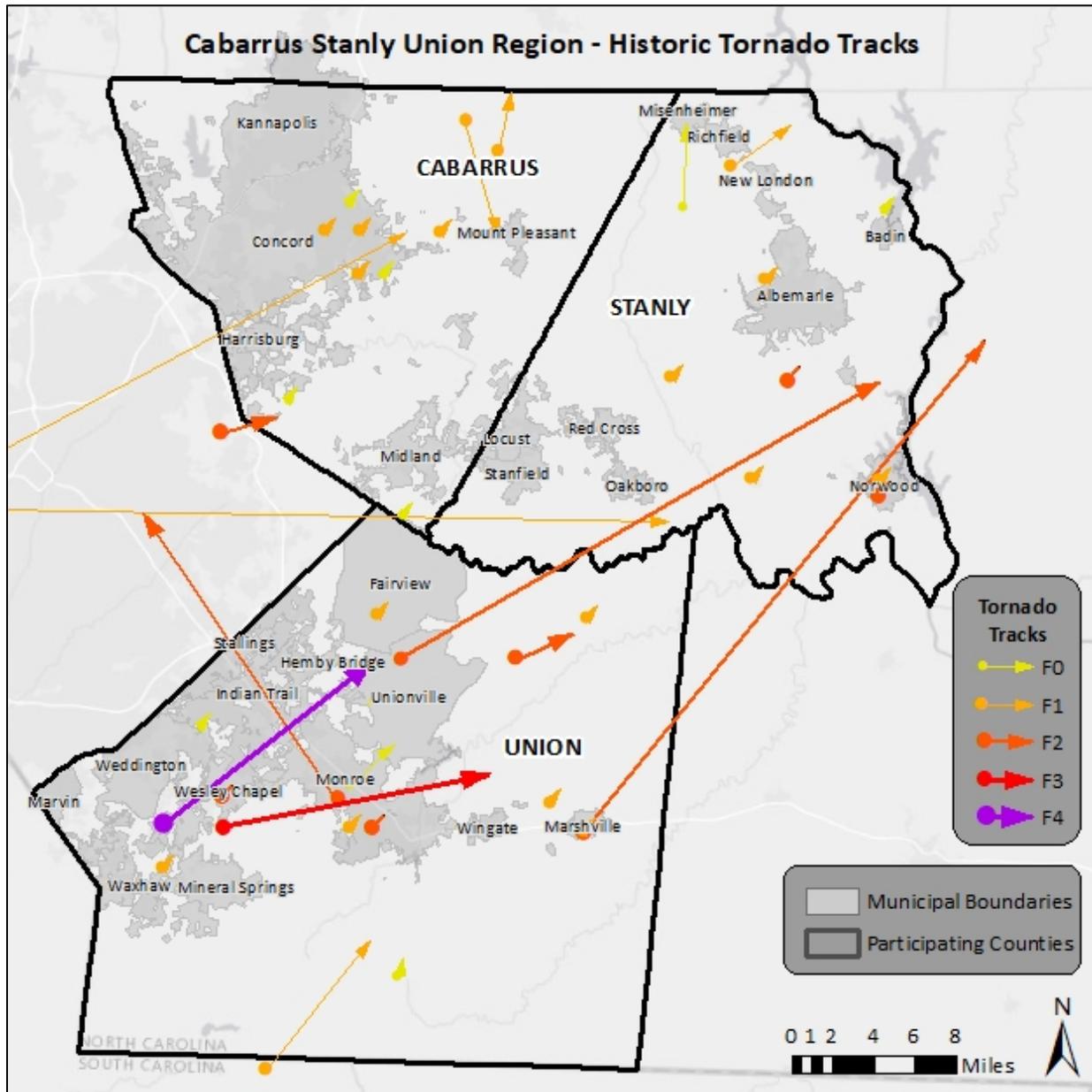
**TABLE 6.9: POPULATION VULNERABILITY TO THE TORNADES HAZARD**

Location	Elderly at Risk	Children at Risk	Total at Risk
<b>Cabarrus County</b>	<b>21,670</b>	<b>13,724</b>	<b>188,874</b>
Concord	8,870	5,747	78,594
Harrisburg	1,425	925	12,638
Kannapolis	5,377	3,166	44,500
Midland	331	214	2,930
Mount Pleasant	309	200	2,736
Unincorporated Area	5,358	3,472	47,476
<b>Stanly County</b>	<b>9,535</b>	<b>3,607</b>	<b>60,785</b>
Albemarle	2,494	942	15,885
Badin	307	116	1,952
Locust	517	202	3,357
Misenhiemer	113	43	720
New London	176	66	1,120
Norwood	516	195	3,289
Oakboro	363	137	2,315
Red Cross	117	44	744
Richfield	222	84	1,411
Stanfield	276	104	1,753
Unincorporated Area	4,434	1,674	28,239
<b>Union County</b>	<b>19,478</b>	<b>14,694</b>	<b>201,438</b>
Fairview	324	245	3,351
Hemby Bridge	151	114	1,563
Indian Trail	3,206	2,418	33,149
Lake Park	310	234	3,205
Marshville	287	216	2,963
Marvin	537	405	5,556
Mineral Springs	255	192	2,632
Monroe	3,244	2,447	33,546
Stallings	1,309	989	13,552
Unionville	575	434	5,951
Waxhaw	946	714	9,788
Weddington	919	693	9,502
Wesley Chapel	709	535	7,332
Wingate	324	244	3,346
Unincorporated Area	6,382	4,814	66,002
<b>Cabarrus Stanly Union Regional Total</b>	<b>50,683</b>	<b>32,025</b>	<b>451,097</b>

Source: NCEM Risk Management Tool

A map of historical tornado points of origin and paths can be seen below in Figure 6.3.

**FIGURE 6.3: HISTORICAL TORNADO TRACKS IN THE CABARRUS STANLY UNION REGION**



Source: NCEM Risk Management Tool

**Thunderstorms**

A probabilistic scenario was created to estimate building and population vulnerabilities in the Cabarrus Stanly Union region for the thunderstorm hazard. For this scenario, damages due to thunderstorm winds on a 50-year frequency event (return period) were analyzed. It is important to note that this data does not include damages caused by other remnants of thunderstorms, such as lightning or hail. The Risk Management Tool analyzed this information which has been reported below in **Table 6.10** and **Table 6.11**.

**TABLE 6.10: BUILDING VULNERABILITY TO THUNDERSTORM WINDS**

Location	Pre-Firm Buildings at Risk	Residential Buildings at Risk		Commercial Buildings at Risk		Public Buildings at Risk		Total Buildings at Risk	
		Number	Damages	Number	Damages	Number	Damages	Number	Damages
<b>Cabarrus County</b>	<b>39,350</b>	<b>74,589</b>	<b>\$24,745,882</b>	<b>6,843</b>	<b>\$13,764,592</b>	<b>1,535</b>	<b>\$3,280,289</b>	<b>82,967</b>	<b>\$41,790,763</b>
Concord	9,968	24,811	\$9,111,389	2,540	\$8,852,497	576	\$1,375,608	27,927	\$19,339,494
Harrisburg	3,298	3,354	\$1,441,852	650	\$625,986	110	\$215,649	4,114	\$2,283,488
Kannapolis	16,839	18,850	\$6,243,597	1,431	\$1,474,130	431	\$954,165	20,712	\$8,671,892
Midland	1,144	1,629	\$391,872	157	\$117,365	30	\$32,524	1,816	\$541,760
Mount Pleasant	1,499	1,568	\$372,258	143	\$151,951	53	\$30,571	1,764	\$554,780
Unincorporated Area	6,602	24,377	\$7,184,914	1,922	\$2,542,663	335	\$671,772	26,634	\$10,399,349
<b>Stanly County</b>	<b>29,574</b>	<b>34,112</b>	<b>\$13,675,367</b>	<b>4,297</b>	<b>\$4,567,532</b>	<b>791</b>	<b>\$1,415,895</b>	<b>39,200</b>	<b>\$19,658,794</b>
Albemarle	6,688	6,554	\$2,581,391	1,391	\$738,346	214	\$365,998	8,159	\$3,685,734
Badin	762	646	\$214,926	86	\$262,171	34	\$60,736	766	\$537,832
Locust	1,582	1,527	\$421,570	232	\$96,817	36	\$70,832	1,795	\$589,219
Misenhiemer	169	158	\$63,076	11	\$3,501	29	\$58,544	198	\$125,121
New London	703	647	\$412,726	80	\$139,336	25	\$16,583	752	\$568,645
Norwood	2,080	1,918	\$799,014	206	\$194,334	45	\$84,152	2,169	\$1,077,500
Oakboro	1,237	1,186	\$504,946	205	\$161,955	39	\$38,223	1,430	\$705,125
Red Cross	397	513	\$228,674	39	\$16,689	15	\$48,740	567	\$294,104
Richfield	930	877	\$329,720	141	\$85,172	24	\$10,018	1,042	\$424,911
Stanfield	891	862	\$291,557	125	\$162,654	23	\$9,833	1,010	\$464,044
Unincorporated Area	14,135	19,224	\$7,827,767	1,781	\$2,706,557	307	\$652,236	21,312	\$11,186,559
<b>Union County</b>	<b>33,942</b>	<b>82,147</b>	<b>\$34,788,579</b>	<b>5,903</b>	<b>\$9,164,379</b>	<b>1,388</b>	<b>\$2,959,975</b>	<b>89,438</b>	<b>\$46,912,934</b>
Fairview	1,248	2,213	\$781,330	166	\$282,131	63	\$97,200	2,442	\$1,160,660
Hemby Bridge	631	852	\$171,467	62	\$45,937	25	\$17,467	939	\$234,872
Indian Trail	2,038	11,266	\$3,404,024	854	\$549,276	115	\$43,775	12,235	\$3,997,075
Lake Park	3	1,182	\$363,284	14	\$55,262	5	\$535	1,201	\$419,081
Marshville	1,491	1,535	\$664,315	220	\$193,120	43	\$293,451	1,798	\$1,150,887
Marvin	143	1,598	\$1,410,859	42	\$49,696	10	\$13,989	1,650	\$1,474,544
Mineral Springs	642	1,377	\$286,446	96	\$67,142	31	\$16,985	1,504	\$370,573
Monroe	7,037	11,060	\$3,479,070	1,754	\$754,647	244	\$490,219	13,058	\$4,723,935
Stallings	2,087	5,122	\$1,887,663	387	\$137,056	25	\$10,112	5,534	\$2,034,831
Unionville	1,733	3,134	\$1,401,050	190	\$674,608	108	\$249,137	3,432	\$2,324,795
Waxhaw	676	3,099	\$997,581	187	\$71,525	35	\$18,596	3,321	\$1,087,703
Weddington	673	3,521	\$2,120,901	107	\$147,846	59	\$25,210	3,687	\$2,293,956
Wesley Chapel	440	2,715	\$1,138,183	36	\$38,857	29	\$39,161	2,780	\$1,216,201
Wingate	536	902	\$412,278	41	\$6,885	64	\$67,286	1,007	\$486,449
Unincorporated Area	14,564	32,571	\$16,270,128	1,747	\$6,090,391	532	\$1,576,852	34,850	\$23,937,372
<b>Cabarrus Stanly Union Regional Total</b>	<b>102,866</b>	<b>190,848</b>	<b>\$73,209,828</b>	<b>17,043</b>	<b>\$27,496,503</b>	<b>3,714</b>	<b>\$7,656,159</b>	<b>211,605</b>	<b>\$108,362,491</b>

Source: NCEM Risk Management Tool

**TABLE 6.11: POPULATION VULNERABILITY TO THUNDERSTORM WINDS**

Location	Elderly at Risk	Children at Risk	Total at Risk
<b>Cabarrus County</b>	<b>21,670</b>	<b>13,724</b>	<b>188,874</b>

**SECTION 6: VULNERABILITY ASSESSMENT**

Location	Elderly at Risk	Children at Risk	Total at Risk
Concord	8,870	5,747	78,594
Harrisburg	1,425	925	12,638
Kannapolis	5,377	3,166	44,500
Midland	331	214	2,930
Mount Pleasant	309	200	2,736
Unincorporated Area	5,358	3,472	47,476
<b>Stanly County</b>	<b>9,535</b>	<b>3,607</b>	<b>60,785</b>
Albemarle	2,494	942	15,885
Badin	307	116	1,952
Locust	517	202	3,357
Misenhiemer	113	43	720
New London	176	66	1,120
Norwood	516	195	3,289
Oakboro	363	137	2,315
Red Cross	117	44	744
Richfield	222	84	1,411
Stanfield	276	104	1,753
Unincorporated Area	4,434	1,674	28,239
<b>Union County</b>	<b>19,472</b>	<b>14,690</b>	<b>201,375</b>
Fairview	324	245	3,351
Hemby Bridge	151	114	1,563
Indian Trail	3,206	2,418	33,149
Lake Park	310	234	3,205
Marshville	287	216	2,963
Marvin	534	403	5,528
Mineral Springs	255	192	2,632
Monroe	3,244	2,447	33,546
Stallings	1,309	989	13,552
Unionville	575	434	5,951
Waxhaw	946	714	9,785
Weddington	919	693	9,502
Wesley Chapel	709	535	7,332
Wingate	324	244	3,346
Unincorporated Area	6,379	4,812	65,970
<b>Cabarrus Stanly Union Regional Total</b>	<b>50,677</b>	<b>32,021</b>	<b>451,034</b>

Source: NCEM Risk Management Tool

**SOCIAL VULNERABILITY**

It is assumed that all existing populations and future populations are at risk to the tornadoes/thunderstorms hazard.

**CRITICAL FACILITIES**

All critical facilities should still be considered at-risk to damage should an event occur. A list of all individual critical facilities in the region can be found in **Table 6.26**.

### 6.5.3. Earthquakes

A probabilistic scenario was created to estimate building and population vulnerabilities in the Cabarrus Stanly Union region for the earthquake hazard with a 500-year frequency (return period). The Risk Management Tool analyzed this information which has been reported below in **Table 6.12** and **Table 6.13**.

**TABLE 6.12: BUILDING VULNERABILITY TO THE EARTHQUAKE HAZARD**

Location	Pre-Firm Buildings at Risk	Residential Buildings at Risk		Commercial Buildings at Risk		Public Buildings at Risk		Total Buildings at Risk	
		Number	Damages	Number	Damages	Number	Damages	Number	Damages
<b>Cabarrus County</b>	<b>39,350</b>	<b>74,589</b>	<b>\$11,942,849</b>	<b>6,843</b>	<b>\$22,453,759</b>	<b>1,535</b>	<b>\$5,391,661</b>	<b>82,967</b>	<b>\$39,788,269</b>
Concord	9,968	24,811	\$4,691,928	2,540	\$12,901,541	576	\$2,373,371	27,927	\$19,966,840
Harrisburg	3,298	3,354	\$699,175	650	\$1,500,432	110	\$414,821	4,114	\$2,614,428
Kannapolis	16,839	18,850	\$2,719,762	1,431	\$3,453,247	431	\$1,381,467	20,712	\$7,554,476
Midland	1,144	1,629	\$229,988	157	\$325,011	30	\$94,063	1,816	\$649,061
Mount Pleasant	1,499	1,568	\$197,566	143	\$292,879	53	\$136,342	1,764	\$626,787
Unincorporated Area	6,602	24,377	\$3,404,430	1,922	\$3,980,649	335	\$991,597	26,634	\$8,376,677
<b>Stanly County</b>	<b>29,574</b>	<b>34,112</b>	<b>\$4,255,286</b>	<b>4,297</b>	<b>\$5,734,905</b>	<b>791</b>	<b>\$1,500,208</b>	<b>39,200</b>	<b>\$11,490,395</b>
Albemarle	6,688	6,554	\$774,865	1,391	\$1,949,797	214	\$444,057	8,159	\$3,168,718
Badin	762	646	\$56,562	86	\$204,986	34	\$123,880	766	\$385,428
Locust	1,582	1,527	\$196,163	232	\$302,260	36	\$85,446	1,795	\$583,868
Misenhiemer	169	158	\$14,408	11	\$5,368	29	\$81,098	198	\$100,874
New London	703	647	\$140,923	80	\$224,462	25	\$34,135	752	\$399,520
Norwood	2,080	1,918	\$276,990	206	\$233,345	45	\$72,544	2,169	\$582,879
Oakboro	1,237	1,186	\$151,003	205	\$275,832	39	\$51,426	1,430	\$478,261
Red Cross	397	513	\$67,489	39	\$28,625	15	\$60,782	567	\$156,896
Richfield	930	877	\$116,630	141	\$136,922	24	\$37,872	1,042	\$291,423
Stanfield	891	862	\$128,716	125	\$228,286	23	\$27,501	1,010	\$384,502
Unincorporated Area	14,135	19,224	\$2,331,537	1,781	\$2,145,022	307	\$481,467	21,312	\$4,958,026
<b>Union County</b>	<b>33,946</b>	<b>82,172</b>	<b>\$19,681,517</b>	<b>5,903</b>	<b>\$16,473,951</b>	<b>1,388</b>	<b>\$5,252,106</b>	<b>89,463</b>	<b>\$41,407,577</b>
Fairview	1,248	2,213	\$410,349	166	\$474,397	63	\$190,267	2,442	\$1,075,012
Hemby Bridge	631	852	\$99,669	62	\$84,425	25	\$37,207	939	\$221,302
Indian Trail	2,038	11,266	\$2,085,061	854	\$1,983,452	115	\$338,552	12,235	\$4,407,065
Lake Park	3	1,182	\$202,533	14	\$66,902	5	\$5,483	1,201	\$274,918
Marshville	1,491	1,535	\$249,141	220	\$379,518	43	\$203,644	1,798	\$832,303
Marvin	143	1,606	\$929,903	42	\$87,952	10	\$53,741	1,658	\$1,071,596
Mineral Springs	642	1,377	\$248,417	96	\$279,359	31	\$50,556	1,504	\$578,333
Monroe	7,037	11,060	\$2,210,419	1,754	\$4,658,114	244	\$827,667	13,058	\$7,696,200
Stallings	2,087	5,122	\$1,004,784	387	\$850,759	25	\$43,181	5,534	\$1,898,724
Unionville	1,733	3,134	\$628,576	190	\$901,184	108	\$372,631	3,432	\$1,902,391
Waxhaw	676	3,100	\$817,478	187	\$307,379	35	\$106,730	3,322	\$1,231,587
Weddington	673	3,521	\$1,407,378	107	\$221,651	59	\$231,842	3,687	\$1,860,871
Wesley Chapel	440	2,715	\$811,551	36	\$113,013	29	\$95,872	2,780	\$1,020,437
Wingate	536	902	\$191,410	41	\$47,869	64	\$221,194	1,007	\$460,474
Unincorporated Area	14,568	32,587	\$8,384,848	1,747	\$6,017,977	532	\$2,473,539	34,866	\$16,876,364
<b>Cabarrus Stanly Union Regional Total</b>	<b>102,870</b>	<b>190,873</b>	<b>\$35,879,652</b>	<b>17,043</b>	<b>\$44,662,615</b>	<b>3,714</b>	<b>\$12,143,975</b>	<b>211,630</b>	<b>\$92,686,241</b>

Source: NCEM Risk Management Tool

**TABLE 6.13: POPULATION VULNERABILITY TO THE EARTHQUAKE HAZARD**

**SECTION 6: VULNERABILITY ASSESSMENT**

Location	Elderly at Risk	Children at Risk	Total at Risk
<b>Cabarrus County</b>	<b>21,670</b>	<b>13,724</b>	<b>188,874</b>
Concord	8,870	5,747	78,594
Harrisburg	1,425	925	12,638
Kannapolis	5,377	3,166	44,500
Midland	331	214	2,930
Mount Pleasant	309	200	2,736
Unincorporated Area	5,358	3,472	47,476
<b>Stanly County</b>	<b>9,535</b>	<b>3,607</b>	<b>60,785</b>
Albemarle	2,494	942	15,885
Badin	307	116	1,952
Locust	517	202	3,357
Misenhiemer	113	43	720
New London	176	66	1,120
Norwood	516	195	3,289
Oakboro	363	137	2,315
Red Cross	117	44	744
Richfield	222	84	1,411
Stanfield	276	104	1,753
Unincorporated Area	4,434	1,674	28,239
<b>Union County</b>	<b>19,472</b>	<b>14,690</b>	<b>201,375</b>
Fairview	324	245	3,351
Hemby Bridge	151	114	1,563
Indian Trail	3,206	2,418	33,149
Lake Park	310	234	3,205
Marshville	287	216	2,963
Marvin	534	403	5,528
Mineral Springs	255	192	2,632
Monroe	3,244	2,447	33,546
Stallings	1,309	989	13,552
Unionville	575	434	5,951
Waxhaw	946	714	9,785
Weddington	919	693	9,502
Wesley Chapel	709	535	7,332
Wingate	324	244	3,346
Unincorporated Area	6,379	4,812	65,970
<b>Cabarrus Stanly Union Regional Total</b>	<b>50,677</b>	<b>32,021</b>	<b>451,034</b>

Source: NCEM Risk Management Tool

**SOCIAL VULNERABILITY**

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

**CRITICAL FACILITIES**

All critical facilities should still be considered at-risk to minor damage should an event occur. A list of all individual critical facilities in the region can be found in **Table 6.26**.

In conclusion, an earthquake could potentially impact all existing and future buildings, facilities, and populations in the Cabarrus Stanly Union region. Though minor earthquakes are often recorded but not felt, they may rattle breakables and cause minimal damage. Furthermore, major earthquakes have potential to damage structures. Severe impacts of earthquakes may result in debris clean-up, service disruption, building collapse, and fatalities. Specific vulnerabilities for assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available. Furthermore, mitigation actions to address earthquake vulnerability will be considered.

#### 6.5.4. Geological (Landslide)

GIS analysis was used to complete the vulnerability assessment for landslides in the Cabarrus Stanly Union Region. The potential dollar value of exposed land and property total can be determined using the USGS Landslide Susceptibility Index (detailed in Section 5: *Hazard Profiles*), county level tax parcel data, and GIS analysis. **Table 6.13** presents the potential at-risk property where available. All areas of the Cabarrus Stanly Union Region are identified as moderate or high incidence areas by the USGS landslide data. The incidence levels (high and moderate) were used to identify different areas of concern for the analysis below.

**TABLE 6.14: TOTAL POTENTIAL AT-RISK PARCELS FOR THE GEOLOGICAL (LANDSLIDE) HAZARD**

Location	Number of Parcels at Risk		Number of Improvements at Risk		Total Value of Improvements at Risk (\$)	
	Moderate	High	Moderate	High	Moderate	High
<b>Cabarrus County</b>	<b>0</b>	<b>54,804</b>	<b>0</b>	<b>44,302</b>	<b>0</b>	<b>\$9,305,045,272</b>
Concord	0	30,205	0	25,103	0	\$5,536,632,005
Harrisburg	0	6,960	0	5,968	0	\$1,447,534,330
Kannapolis	0	2,841	0	2,334	0	\$507,409,317
Midland	0	3	0	2	0	\$245,050
Mount Pleasant	0	752	0	614	0	\$85,729,600
Unincorporated Area	0	14,043	0	10,281	0	\$1,727,494,970
<b>Stanly County</b>	<b>0</b>	<b>27,241</b>	<b>0</b>	<b>18,490</b>	<b>0</b>	<b>\$2,090,608,997</b>
Albemarle	0	8,492	0	6,582	0	\$905,333,011
Badin	0	0	0	0	0	\$0
Locust	0	1,142	0	863	0	\$101,529,213
Misenhiemer	0	0	0	0	0	\$0
New London	0	658	0	459	0	\$66,263,170
Norwood	0	1,875	0	1,270	0	\$97,388,455
Oakboro	0	1,358	0	911	0	\$95,492,874
Red Cross	0	482	0	335	0	\$43,815,685
Richfield	0	143	0	98	0	\$7,663,986
Stanfield	0	0	0	0	0	\$0
Unincorporated Area	0	13,091	0	7,972	0	\$773,122,603
<b>Union County</b>	<b>11</b>	<b>0</b>	<b>11</b>	<b>0</b>	<b>\$520,200</b>	<b>\$0</b>
Fairview	0	0	0	0	0	\$0
Hemby Bridge	0	0	0	0	0	\$0
Indian Trail	0	0	0	0	0	\$0
Lake Park	0	0	0	0	0	\$0

## SECTION 6: VULNERABILITY ASSESSMENT

Location	Number of Parcels at Risk		Number of Improvements at Risk		Total Value of Improvements at Risk (\$)	
	Moderate	High	Moderate	High	Moderate	High
Marshville	0	0	0	0	0	\$0
Marvin	0	0	0	0	0	\$0
Mineral Springs	0	0	0	0	0	\$0
Monroe	0	0	0	0	0	\$0
Stallings	0	0	0	0	0	\$0
Unionville	0	0	0	0	0	\$0
Waxhaw	0	0	0	0	0	\$0
Weddington	0	0	0	0	0	\$0
Wesley Chapel	0	0	0	0	0	\$0
Wingate	0	0	0	0	0	\$0
Unincorporated Area	11	0	11	0	\$520,200	\$0
<b>Cabarrus Stanly Union Regional Total</b>	<b>11</b>	<b>82,045</b>	<b>11</b>	<b>62,792</b>	<b>\$520,200</b>	<b>\$11,395,654,269</b>

Source: United States Geological Survey, Local governments

### SOCIAL VULNERABILITY

Given moderate to high susceptibility across the entire Cabarrus Stanly Union Region, it is assumed that the total population is at risk.

### CRITICAL FACILITIES

There are 113 critical facilities located in a high susceptibility area, including the following: 43 fire/EMS stations, 9 police stations, 50 schools, and 11 others. The remaining critical facilities are located in low incidence areas. A list of specific critical facilities and their associated risk can be found in **Table 6.26** at the end of this section.

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

### 6.5.5 Flooding

Historical evidence indicates that the Cabarrus Stanly Union Region is susceptible to flood events. A total of 197 flood events have been reported by the National Centers for Environmental Information since 1993, resulting in over \$19.2 million dollars in damages and six fatalities. On an annualized level, these damages amounted to over \$700,000 for the Cabarrus Stanly Union Region.

In order to assess flood risk, a GIS-based analysis was used to estimate exposure to flood events using Digital Flood Insurance Rate Map (DFIRM) data in combination with local tax assessor records for each of the Cabarrus Stanly Union counties. The determination of assessed value at-risk (exposure) was calculated using GIS analysis by summing the total assessed building values for only those improved properties that were confirmed to be located within an identified floodplain. **Table 6.15** presents the potential at-risk property. Both the number of parcels and the approximate value are presented.

**TABLE 6.15: ESTIMATED EXPOSURE OF PARCELS TO THE FLOODING HAZARD**

Location	1.0-percent ACF			2.0-percent ACF		
	Approx. Number of Parcels	Approx. Number of Improved Buildings	Approx. Improved Value of Buildings	Approx. Number of Parcels	Approx. Number of Improved Buildings	Approx. Improved Value of Buildings
<b>Cabarrus County</b>	<b>6,119</b>	<b>3,901</b>	<b>\$1,897,075,860</b>	<b>0</b>	<b>0</b>	<b>\$0</b>
Concord	1,725	1,223	\$970,419,140	0	0	\$0
Harrisburg	692	517	\$191,857,390	0	0	\$0
Kannapolis	1,045	679	\$260,688,630	0	0	\$0
Midland	167	109	\$16,816,160	0	0	\$0
Mount Pleasant	15	13	\$4,038,840	0	0	\$0
Unincorporated Area	2,475	1,360	453,255,700	0	0	\$0
<b>Stanly County</b>	<b>3,000</b>	<b>1,576</b>	<b>\$243,672,709</b>	<b>863</b>	<b>417</b>	<b>\$72,621,465</b>
Albemarle	563	316	\$68,446,510	401	230	\$47,495,516
Badin	1	0	\$0	12	1	\$386,888
Locust	1	0	\$0	0	0	\$0
Misenhiemer	16	14	\$9,640,532	0	0	\$0
New London	1	0	\$0	0	0	\$0
Norwood	98	57	\$7,282,700	44	21	\$2,619,803
Oakboro	7	4	\$1,204,908	0	0	\$0
Red Cross	11	4	\$845,667	0	0	\$0
Richfield	60	36	\$2,454,212	0	0	\$0
Stanfield	54	22	\$5,977,334	0	0	\$0
Unincorporated Area	2,188	1,123	\$147,820,846	406	165	22119258
<b>Union County</b>	<b>9,531</b>	<b>5,721</b>	<b>\$4,150,156,591</b>	<b>4,109</b>	<b>2,997</b>	<b>\$2,748,499,969</b>
Fairview	389	230	\$54,444,000	166	109	\$18,921,000
Hemby Bridge	39	27	\$3,485,000	43	33	\$3,773,000
Indian Trail	1,031	763	\$349,400,691	578	484	\$302,342,791
Lake Park	6	4	\$9,746,600	2	0	\$0
Marshville	35	25	\$15,610,800	5	4	\$6,431,300
Marvin	146	120	\$60,565,500	143	123	\$65,415,000
Mineral Springs	127	86	\$12,534,500	3	3	\$390,000
Monroe	876	658	\$398,224,638	685	535	\$342,833,078
Stallings	197	168	\$64,788,322	74	64	\$11,947,000
Unionville	398	289	\$54,425,300	123	93	\$18,940,200
Waxhaw	288	215	\$60,757,100	270	205	\$64,472,500
Weddington	380	301	\$253,792,000	233	190	\$83,913,000
Wesley Chapel	229	179	\$46,926,300	202	163	\$44,899,000
Wingate	75	67	\$19,220,200	35	27	\$8,883,900
Unincorporated Area	5,315	2,589	\$2,746,235,640	1,547	964	\$1,775,338,200
<b>Cabarrus Stanly Union Regional Total</b>	<b>18,650</b>	<b>11,198</b>	<b>\$6,290,905,160</b>	<b>4,972</b>	<b>3,414</b>	<b>\$2,821,121,434</b>

Source: FEMA DFIRM

To assess flood risk, the NCEM Risk Management Tool (RMT) analyzed buildings located in the 1 percent chance of annual floodplains. The buildings are assessed by the type of building (commercial,

**SECTION 6: VULNERABILITY ASSESSMENT**

residential, or public) and also assesses Pre-Firm buildings, or structures built before flood code regulations were installed. This data is broken down by jurisdiction in **Table 6.16**.

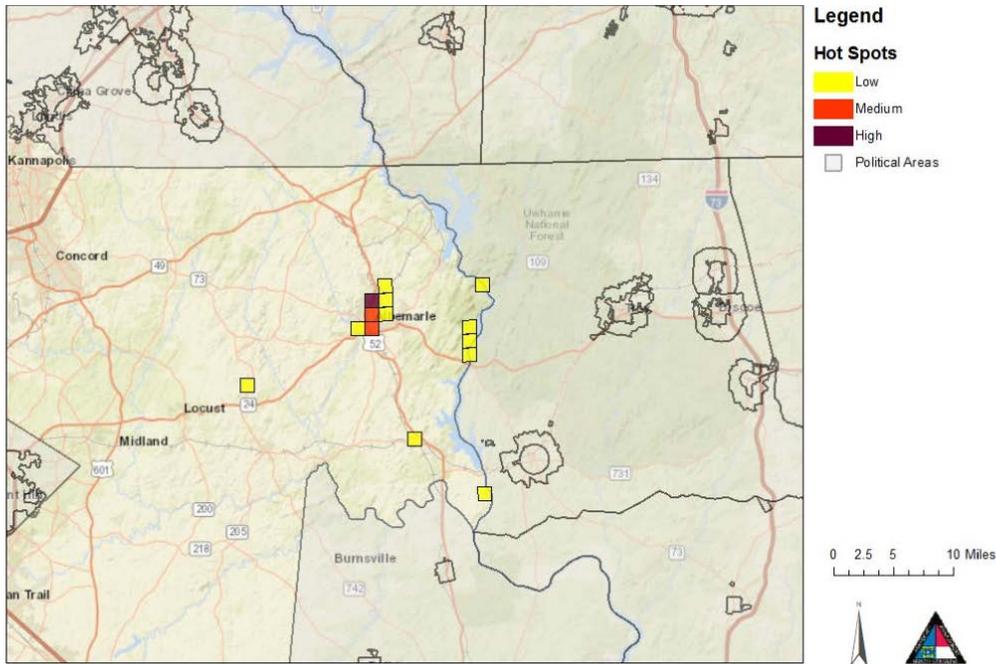
**TABLE 6.16: BUILDING VULNERABILITY FOR THE 100-YEAR FLOODPLAINS**

Location	Pre-Firm Buildings at Risk	Residential Buildings at Risk		Commercial Buildings at Risk		Public Buildings at Risk		Total Buildings at Risk	
		Number	Damages	Number	Damages	Number	Damages	Number	Damages
<b>Cabarrus County</b>	<b>416</b>	<b>1,023</b>	<b>\$7,302,691</b>	<b>34</b>	<b>\$848,380</b>	<b>8</b>	<b>\$347,450</b>	<b>1,065</b>	<b>\$8,498,521</b>
Concord	73	334	\$3,049,683	18	\$426,485	3	\$32,154	355	\$3,508,322
Harrisburg	172	220	\$1,809,688	5	\$99,568	1	\$107,646	226	\$2,016,903
Kannapolis	110	162	\$774,309	3	\$279,650	2	\$188,398	167	\$1,242,357
Midland	8	14	\$140,623	0	\$0	0	\$0	14	\$140,623
Mount Pleasant	7	8	\$20,751	0	\$0	0	\$0	8	\$20,751
Unincorporated Area	46	285	\$1,507,637	8	\$42,677	2	\$19,252	295	\$1,569,565
<b>Stanly County</b>	<b>130</b>	<b>89</b>	<b>\$1,709,458</b>	<b>54</b>	<b>\$2,159,299</b>	<b>0</b>	<b>\$0</b>	<b>143</b>	<b>\$3,868,758</b>
Albemarle	102	54	\$1,492,476	53	\$2,132,475	0	\$0	107	\$3,624,951
Badin	0	0	\$0	0	\$0	0	\$0	0	\$0
Locust	0	1	\$2,060	0	\$0	0	\$0	1	\$2,060
Misenhiemer	2	2	\$1,970	0	\$0	0	\$0	2	\$1,970
New London	0	0	\$0	0	\$0	0	\$0	0	\$0
Norwood	6	6	\$15,412	0	\$0	0	\$0	6	\$15,412
Oakboro	0	0	\$0	0	\$0	0	\$0	0	\$0
Red Cross	0	0	\$0	0	\$0	0	\$0	0	\$0
Richfield	1	1	\$406	0	\$0	0	\$0	1	\$406
Stanfield	0	0	\$0	0	\$0	0	\$0	0	\$0
Unincorporated Area	19	25	\$197,134	1	\$26,824	0	\$0	26	\$223,959
<b>Union County</b>	<b>93</b>	<b>210</b>	<b>\$689,226</b>	<b>56</b>	<b>\$1,682,249</b>	<b>2</b>	<b>\$9,126</b>	<b>268</b>	<b>\$2,380,600</b>
Fairview	1	6	\$39,753	1	\$2,804	0	\$0	7	\$42,557
Hemby Bridge	4	3	\$1,522	3	\$1,098	0	\$0	6	\$2,620
Indian Trail	4	70	\$165,042	17	\$161,549	0	\$0	87	\$326,590
Lake Park	0	0	\$0	0	\$0	0	\$0	0	\$0
Marshville	5	8	\$78,462	5	\$831,135	0	\$0	13	\$909,597
Marvin	0	1	\$699	0	\$0	0	\$0	1	\$699
Mineral Springs	0	1	\$882	0	\$0	0	\$0	1	\$882
Monroe	37	24	\$154,413	22	\$557,466	0	\$0	46	\$711,879
Stallings	2	8	\$20,228	0	\$0	0	\$0	8	\$20,228
Unionville	3	9	\$13,391	0	\$0	0	\$0	9	\$13,391
Waxhaw	0	4	\$5,875	0	\$0	0	\$0	4	\$5,875
Weddington	1	4	\$23,071	0	\$0	0	\$0	4	\$23,071
Wesley Chapel	1	3	\$18,468	0	\$0	0	\$0	3	\$18,468
Wingate	5	12	\$36,574	0	\$0	0	\$0	12	\$36,574
Unincorporated Area	30	57	\$130,846	8	\$128,197	2	\$9,126	67	\$268,169
<b>Cabarrus Stanly Union Regional Total</b>	<b>639</b>	<b>1,322</b>	<b>\$9,701,375</b>	<b>144</b>	<b>\$4,689,928</b>	<b>10</b>	<b>\$356,576</b>	<b>1476</b>	<b>\$14,747,879</b>

Source: NCEM Risk Management Tool

Figure 6.4 below displays visual hotspots of potential dollar losses for the flood hazard in Stanly County. Based on the photo, most hot spots are in an area with low vulnerability.

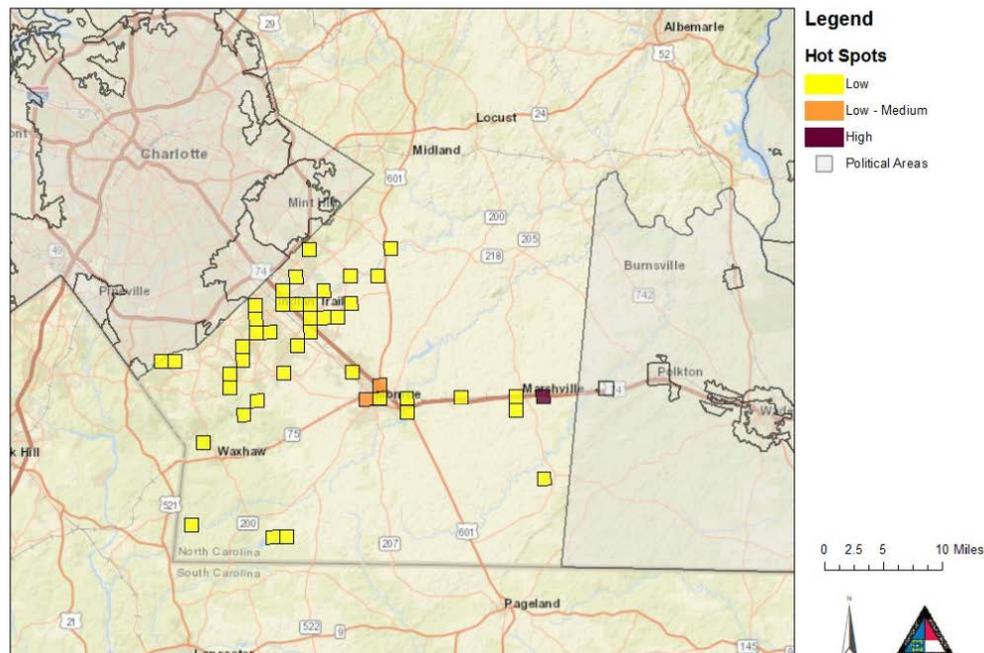
**FIGURE 6.4: POTENTIAL DOLLAR LOSSES FOR FLOODING IN STANLY COUNTY**



Source: NCEM Risk Management Tool

The same information for Union County is presented below in Figure 6.5.

**FIGURE 6.5: POTENTIAL DOLLAR LOSSES FOR FLOODING IN UNION COUNTY**



Source: NCEM Risk Management Tool

**SECTION 6: VULNERABILITY ASSESSMENT**

At the time this plan was developed, the Risk Management Tool did not include hot spot information for Cabarrus County.

**Table 6.17** assesses the vulnerability of the region’s population. This data is also from the RMT and analyzes the populations of elderly and children living at risk to the 1 percent annual flooding.

**TABLE 6.17: POPULATION VULNERABILITY FOR 100-YEAR FLOODPLAINS IN CABARRUS STANLY UNION REGION**

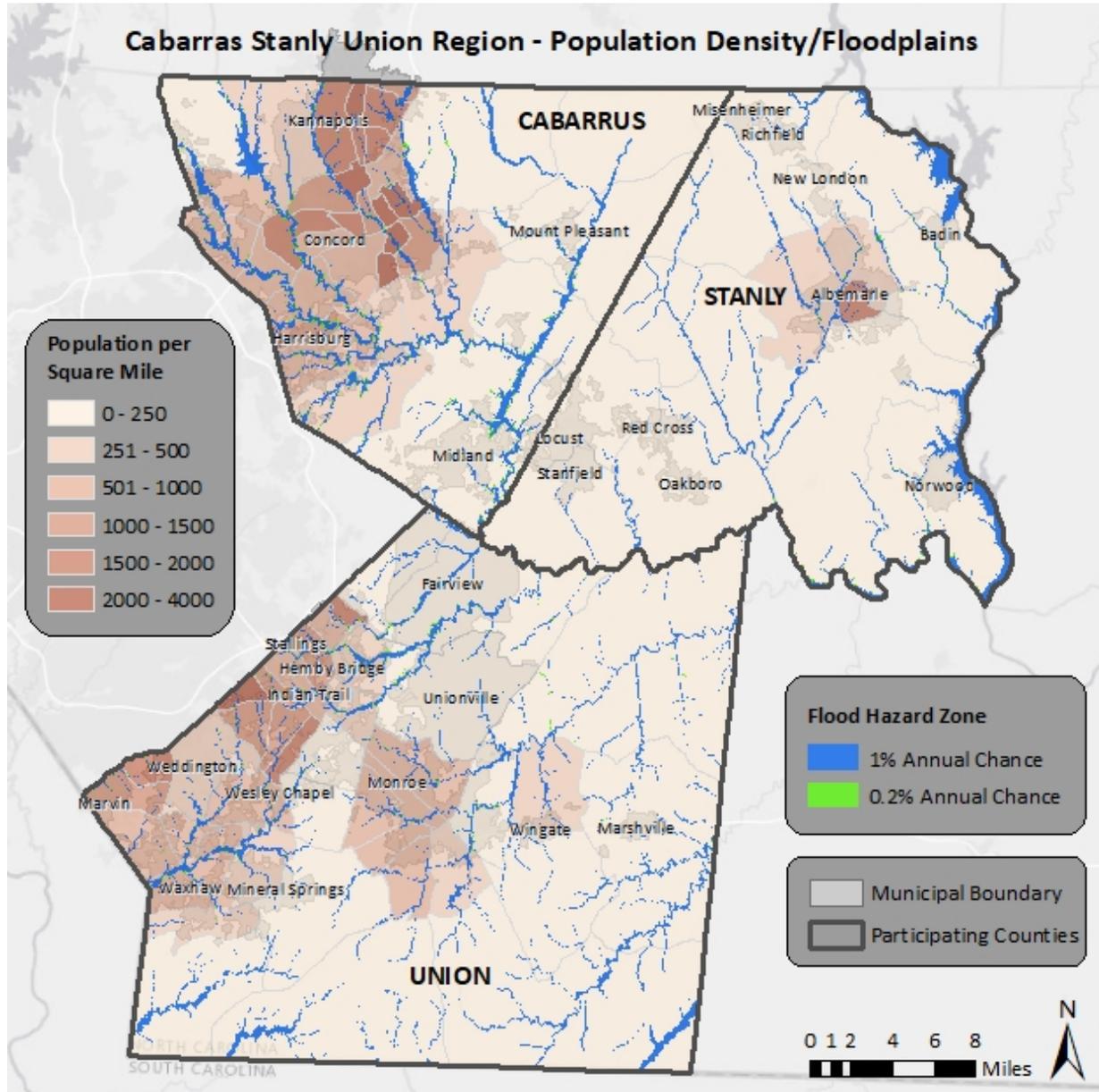
Incidence Level	Elderly at Risk	Children at Risk	Total at Risk
<b>Cabarrus County</b>	<b>327</b>	<b>209</b>	<b>2,864</b>
Concord	119	77	1,056
Harrisburg	94	61	830
Kannapolis	46	27	384
Midland	3	2	25
Mount Pleasant	2	1	14
Unincorporated Area	63	41	555
<b>Stanly County</b>	<b>23</b>	<b>12</b>	<b>190</b>
Albemarle	20	8	130
Badin	0	0	0
Locust	0	0	2
Misenhiemer	1	1	9
New London	0	0	0
Norwood	2	1	10
Oakboro	0	0	0
Red Cross	0	0	0
Richfield	0	0	2
Stanfield	0	0	0
Unincorporated Area	6	2	37
<b>Union County</b>	<b>52</b>	<b>39</b>	<b>542</b>
Fairview	1	1	9
Hemby Bridge	1	0	6
Indian Trail	20	15	206
Lake Park	0	0	0
Marshville	1	1	15
Marvin	0	0	3
Mineral Springs	0	0	2
Monroe	7	5	72
Stallings	2	2	21
Unionville	2	1	17
Waxhaw	1	1	13
Weddington	1	1	11
Wesley Chapel	1	1	8
Wingate	4	3	44
Unincorporated Area	11	8	115
<b>Cabarrus Stanly Union Regional Total</b>	<b>483</b>	<b>311</b>	<b>4,328</b>

Source: NCEM Risk Management Tool

**SOCIAL VULNERABILITY**

A national Census has not been conducted since 2010; therefore, 2010 Census tract level population counts are outdated for this update. However, population estimates from the US Census Bureau as of July 1, 2017 were available at a jurisdictional level. This data was analyzed to present at-risk populations to the flooding hazard in the Cabarrus Stanly Union region and can be seen below in **Figure 6.6**.

**FIGURE 6.6: POPULATION DENSITY NEAR FLOODPLAINS**



Source: FEMA DFIRM, US Census Bureau

**CRITICAL FACILITIES**

The critical facility analysis revealed that there are only two critical facilities located in the Cabarrus Stanly Union Region’s 1.0-percent and 2.0-percent annual chance floodplain based on FEMA DFIRM boundaries and GIS analysis. (As previously noted, this analysis does not consider building elevation,

which may negate risk.) These facilities are a fire station in Cabarrus County, and one health care facility in Union County. There are no critical facilities in a floodplain in Stanly County. A list of specific critical facilities and their associated risk can be found in **Table 6.26** at the end of this section.

In conclusion, a flood has the potential to impact many existing and future buildings, facilities, and populations in the Cabarrus Stanly Union Region, though some areas are at a higher risk than others. All types of structures in a floodplain are at-risk, though elevated structures will have a reduced risk. As noted, the floodplains used in this analysis include the 100-year and 500-year FEMA regulated floodplain boundaries. It is certainly possible that more severe events could occur beyond these boundaries or urban (flash) flooding could impact additional structures. Such site-specific vulnerability determinations should be considered during future plan updates. Furthermore, areas subject to repetitive flooding should be analyzed for potential mitigation actions. **Table 6.18** below lists repetitive loss properties and their associated payments for each county.

**TABLE 6.18: SUMMARY OF REPETITIVE LOSS PROPERTIES**

Location	Number of Properties	Number of Losses	Total Payments
<b>Cabarrus County</b>	<b>18</b>	<b>54</b>	<b>\$1,963,776</b>
Concord	3	9	\$259,425
Harrisburg	5	18	\$216,892
Kannapolis	2	5	\$1,126,022
Midland	0	0	\$0
Mount Pleasant	0	0	\$0
Unincorporated Area	8	22	361,437
<b>Stanly County</b>	<b>3</b>	<b>8</b>	<b>\$190,231</b>
Albemarle	3	8	\$190,231
Badin	0	0	\$0
Locust	0	0	\$0
Misenhiemer	0	0	\$0
New London	0	0	\$0
Norwood	0	0	\$0
Oakboro	0	0	\$0
Red Cross	0	0	\$0
Richfield	0	0	\$0
Stanfield	0	0	\$0
Unincorporated Area	0	0	\$0
<b>Union County</b>	<b>3</b>	<b>9</b>	<b>\$89,606</b>
Fairview	0	0	\$0
Hemby Bridge	0	0	\$0
Indian Trail	2	7	\$76,587
Lake Park	0	0	\$0
Marshville	0	0	\$0
Marvin	0	0	\$0
Mineral Springs	0	0	\$0
Monroe	1	2	\$13,020
Stallings	0	0	\$0
Unionville	0	0	\$0
Waxhaw	0	0	\$0

Location	Number of Properties	Number of Losses	Total Payments
Weddington	0	0	\$0
Wesley Chapel	0	0	\$0
Wingate	0	0	\$0
Unincorporated Area	0	0	\$0
<b>Cabarrus Stanly Union Regional Total</b>	<b>24</b>	<b>71</b>	<b>\$2,243,613</b>

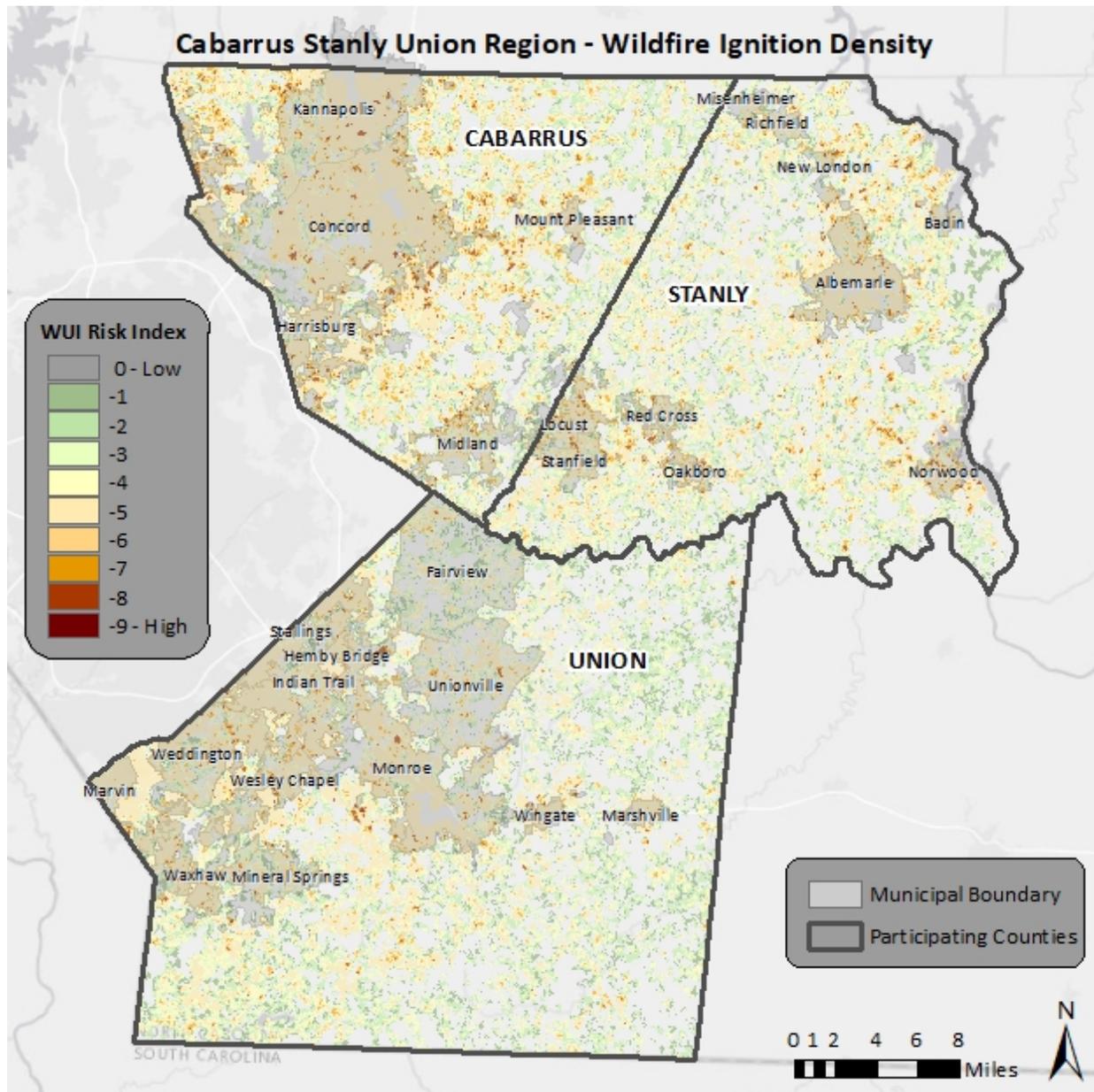
Source: National Flood Insurance Program

### 6.5.6 Wildfires

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

To estimate exposure to wildfire, the Wildland Urban Interface (WUI) Risk Index for the region was obtained through the Southern Wildfire Risk Assessment. The WUI uses a Response Function modeling approach and rates the potential impact of a wildfire on people and their homes. The index ranges from -1 to -9, with -9 being the most negative impact. For example, an area with high housing density and high flame lengths are rated -9, while an area with low housing density and low flame lengths are rated -1. At-risk areas fall within the range of -7 to -9. This index was layered with parcel data using GIS analysis. **Figure 6.7** shows the WUI Risk Index for the region below.

FIGURE 6.7: WILDLAND URBAN INTERFACE RISK INDEX



Source: Southern Wildfire Risk Assessment

The region contains some lands where the value falls into the at-risk category, though the region has somewhat less land labeled as at-risk compared to other regions of North Carolina. Overall, there is likely considerably less risk in this region than in other areas of the country.

### SOCIAL VULNERABILITY

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

**CRITICAL FACILITIES**

Although no county had many critical facilities in the at-risk area (-7 or higher) for wildfires, Union County had the most with 6 facilities. These facilities were five schools and one medical facility. Cabarrus County had 2 at-risk facilities, and Stanly County only had 1. This data reflects a slightly elevated risk in Union County for critical facilities to wildfires.

Table 6.19 shows the results of the GIS analysis.

**TABLE 6.19: CRITICAL FACILITIES IN THE AT-RISK WUI RISK INDEX AREA**

Location	Number of At-Risk Critical Facilities
Cabarrus County	2
Stanly County	1
Union County	6
<b>Cabarrus Stanly Union Regional Total</b>	<b>9</b>

Source: Southern Wildfire Risk Assessment, Local governments

Additional information was provided through the NCEM Risk Management Tool (RMT). This data describes vulnerability in both built and living environments and can be seen in below in Table 6.20 and Table 6.21.

**TABLE 6.20: BUILDING VULNERABILITY TO WILDFIRE HAZARDS**

Location	Pre-Firm Buildings at Risk	Residential Buildings at Risk		Commercial Buildings at Risk		Public Buildings at Risk		Total Buildings at Risk	
		Number	Damages	Number	Damages	Number	Damages	Number	Damages
<b>Cabarrus County</b>	<b>2,518</b>	<b>6,216</b>	<b>\$898,790,874</b>	<b>693</b>	<b>\$924,950,155</b>	<b>140</b>	<b>\$289,878,265</b>	<b>7,049</b>	<b>\$2,113,619,295</b>
Concord	31	518	\$76,855,980	57	\$83,552,232	9	\$44,881,589	584	\$205,289,802
Harrisburg	451	520	\$110,307,517	122	\$125,888,986	21	\$77,711,140	663	\$313,907,643
Kannapolis	498	657	\$90,327,032	53	\$203,448,863	20	\$43,186,961	730	\$336,962,856
Midland	250	374	\$42,194,682	32	\$33,974,879	14	\$24,313,375	420	\$100,482,936
Mount Pleasant	225	240	\$29,791,537	31	\$32,288,753	7	\$13,087,120	278	\$75,167,410
Unincorporated Area	1,063	3,907	\$549,314,126	398	\$445,796,442	69	\$86,698,080	4,374	\$1,081,808,648
<b>Stanly County</b>	<b>8,702</b>	<b>10,839</b>	<b>\$1,274,472,234</b>	<b>1181</b>	<b>\$765,971,600</b>	<b>231</b>	<b>\$286,453,591</b>	<b>12,251</b>	<b>\$2,326,896,638</b>
Albemarle	192	194	\$19,264,506	35	\$36,150,591	18	\$19,361,475	247	\$74,776,573
Badin	26	18	\$4,670,161	2	\$1,804,104	4	\$52,935,121	24	\$59,409,387
Locust	330	315	\$37,599,080	63	\$42,680,210	11	\$14,401,159	389	\$94,680,449
Misenhiemer	6	9	\$856,422	0	\$0	0	\$0	9	\$856,422
New London	131	116	\$11,422,579	19	\$50,834,010	1	\$933,660	136	\$63,190,249
Norwood	294	274	\$32,504,897	25	\$39,576,501	12	\$10,939,253	311	\$83,020,651
Oakboro	465	501	\$57,150,847	59	\$49,621,475	5	\$7,697,126	565	\$114,469,448
Red Cross	148	207	\$23,075,438	14	\$4,360,974	9	\$15,242,577	230	\$42,678,990
Richfield	133	134	\$36,512,497	14	\$4,203,170	5	\$2,495,809	153	\$43,211,476
Stanfield	545	557	\$66,659,044	68	\$60,132,862	9	\$4,313,895	634	\$131,105,801
Unincorporated Area	6,432	8,514	\$984,756,763	882	\$476,607,703	157	\$158,133,516	9,553	\$1,619,497,192
<b>Union County</b>	<b>14,277</b>	<b>34,281</b>	<b>\$5,608,212,890</b>	<b>2239</b>	<b>\$2,106,869,470</b>	<b>584</b>	<b>\$861,308,611</b>	<b>37,104</b>	<b>\$8,576,390,967</b>
Fairview	590	825	\$119,648,563	90	\$99,012,681	23	\$24,958,387	938	\$243,619,630

**SECTION 6: VULNERABILITY ASSESSMENT**

Location	Pre-Firm Buildings at Risk	Residential Buildings at Risk		Commercial Buildings at Risk		Public Buildings at Risk		Total Buildings at Risk	
		Number	Damages	Number	Damages	Number	Damages	Number	Damages
Hemby Bridge	264	419	\$38,592,247	46	\$23,644,267	20	\$7,586,379	485	\$69,822,893
Indian Trail	1,049	6,544	\$903,156,032	491	\$366,304,463	71	\$81,709,994	7,106	\$1,351,170,489
Lake Park	3	227	\$33,977,644	6	\$10,296,830	0	\$0	233	\$44,274,474
Marshville	715	803	\$95,893,273	59	\$48,916,014	21	\$46,726,435	883	\$191,535,721
Marvin	44	471	\$224,595,095	10	\$6,881,206	4	\$13,925,680	485	\$245,401,981
Mineral Springs	251	402	\$46,491,199	21	\$6,037,573	18	\$9,408,374	441	\$61,937,146
Monroe	573	1,814	\$225,772,357	128	\$92,266,357	18	\$13,168,962	1,960	\$331,207,675
Stallings	898	2,317	\$376,021,556	189	\$128,388,046	15	\$8,594,393	2,521	\$513,003,995
Unionville	1,334	2,220	\$358,230,869	165	\$239,020,176	59	\$82,979,294	2,444	\$680,230,339
Waxhaw	207	282	\$31,602,136	53	\$26,258,144	11	\$15,741,288	346	\$73,601,568
Weddington	199	1,086	\$300,827,038	56	\$36,066,642	14	\$12,797,855	1,156	\$349,691,535
Wesley Chapel	220	1,415	\$314,837,273	26	\$27,618,190	17	\$24,703,176	1,458	\$367,158,639
Wingate	108	280	\$38,240,704	15	\$7,086,273	5	\$10,249,184	300	\$55,576,160
Unincorporated Area	7,822	15,176	\$2,500,326,904	884	\$989,072,608	288	\$508,759,210	16,348	\$3,998,158,722
<b>Cabarrus Stanly Union Regional Total</b>	<b>25,497</b>	<b>51,336</b>	<b>\$7,781,475,998</b>	<b>4113</b>	<b>\$3,797,791,225</b>	<b>955</b>	<b>\$1,437,640,467</b>	<b>56,404</b>	<b>\$13,016,906,900</b>

Source: NCEM Risk Management Tool

**TABLE 6.21: POPULATION VULNERABILITY TO WILDFIRE HAZARD**

Incidence Level	Elderly at Risk	Children at Risk	Total at Risk
<b>Cabarrus County</b>	<b>1,574</b>	<b>1,010</b>	<b>13,848</b>
Concord	185	120	1,640
Harrisburg	220	143	1,952
Kannapolis	188	111	1,556
Midland	76	49	674
Mount Pleasant	47	31	419
Unincorporated Area	858	556	7,607
<b>Stanly County</b>	<b>2,682</b>	<b>1015</b>	<b>17,094</b>
Albemarle	77	29	489
Badin	10	4	63
Locust	107	42	693
Misenhiemer	6	2	41
New London	32	12	201
Norwood	74	28	470
Oakboro	153	58	978
Red Cross	47	18	300
Richfield	34	13	216
Stanfield	178	67	1,133
Unincorporated Area	1,964	742	12,510
<b>Union County</b>	<b>7,837</b>	<b>5,914</b>	<b>81,067</b>
Fairview	121	91	1,249
Hemby Bridge	74	56	769

Incidence Level	Elderly at Risk	Children at Risk	Total at Risk
Indian Trail	1,862	1,405	19,255
Lake Park	60	45	619
Marshville	150	113	1,552
Marvin	157	119	1,629
Mineral Springs	74	56	768
Monroe	531	401	5,491
Stallings	592	447	6,129
Unionville	405	306	4,191
Waxhaw	86	65	890
Weddington	283	214	2,930
Wesley Chapel	370	279	3,821
Wingate	100	75	1,033
Unincorporated Area	2,972	2,242	30,741
<b>Cabarrus Stanly Union Regional Total</b>	<b>12,093</b>	<b>7,939</b>	<b>112,009</b>

Source: NCEM Risk Management Tool

### 6.5.7 Hazardous Substances

Although historical evidence and existing Toxic Release Inventory sites indicate that the Cabarrus Stanly Union Region is susceptible to hazardous substance events, there are few reports of damage. Therefore, a calculated annualized loss figure may not be completely reliable.

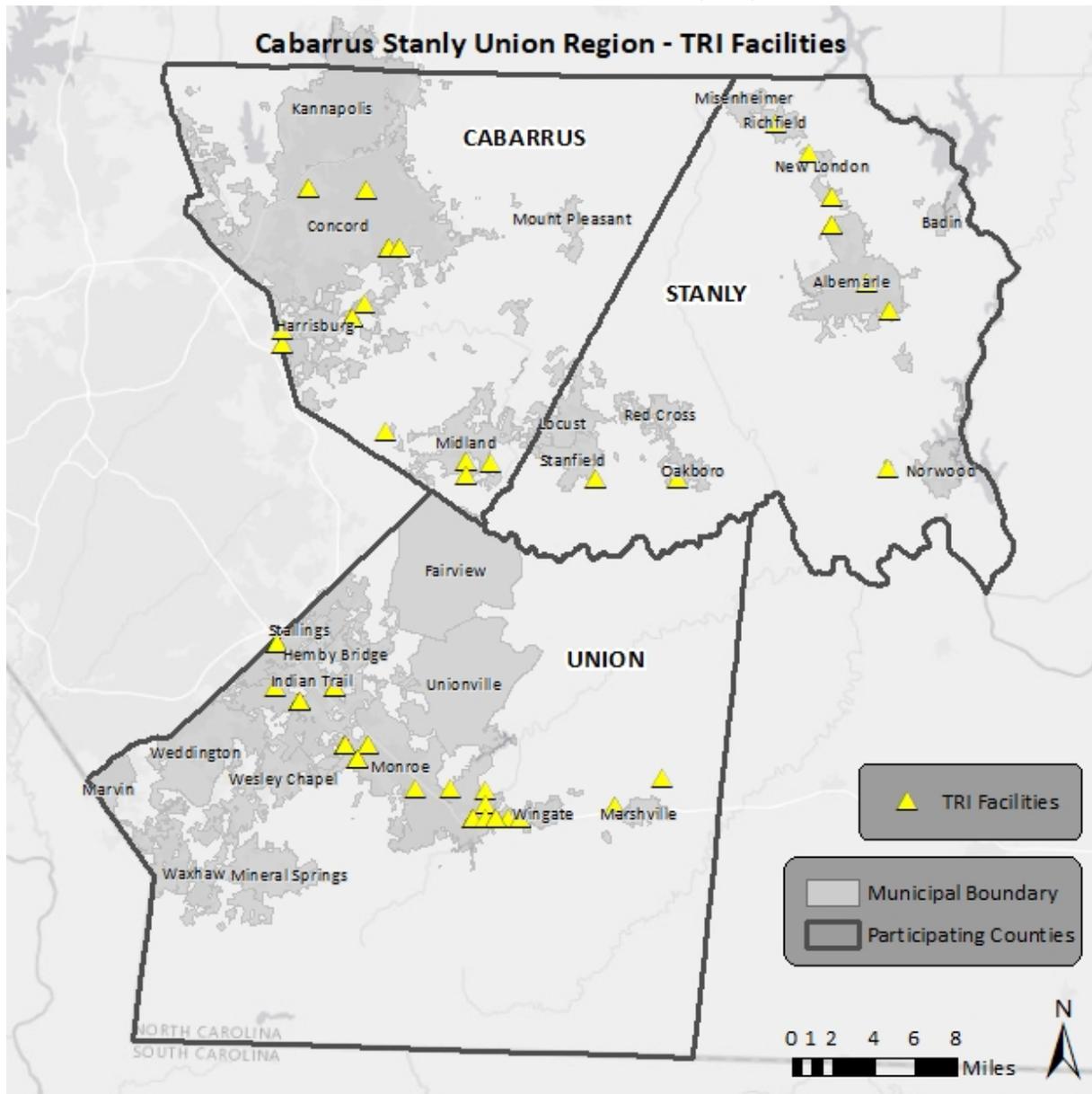
Most hazardous substance incidents that occur are contained and suppressed before destroying any property or threatening lives. However, they can have a significant negative impact. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent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

In order to conduct the vulnerability assessment for this hazard, GIS intersection analysis was used for fixed and mobile areas and parcels<sup>5</sup>. In both scenarios, two sizes of buffers—0.5 mile and 1 mile—were used. These areas are assumed to respect the different levels of effect: immediate (primary) and secondary. Primary and secondary impact sites were selected based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks against Buildings and engineering judgment. For the fixed site analysis, geo-referenced TRI listed toxic sites in the Cabarrus Stanly Union Region, along with buffers, were used for analysis as shown in **Figure 6.8**. For the mobile analysis, the major roads (Interstate highway, U.S. highway, and State highway) and railroads, where hazardous materials are primarily transported that could adversely impact people and buildings, were used for the GIS buffer analysis. **Figure 6.9** shows the areas used for mobile toxic release buffer analysis. The results indicate the approximate number of parcels, improved value, as shown in **Table 6.22** (fixed sites), **Table 6.23**

<sup>5</sup> This type of analysis will likely yield inflated results (generally higher than what is actually reported after an actual event).

(mobile road sites) and Table 6.24 (mobile railroad sites)<sup>6</sup>.

**FIGURE 6.8: TOXIC RELEASE INVENTORY (TRI) FACILITIES**



Source: EPA

**TABLE 6.22: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS SUBSTANCES (FIXED SITES) IN THE CABARRUS STANLY UNION REGION**

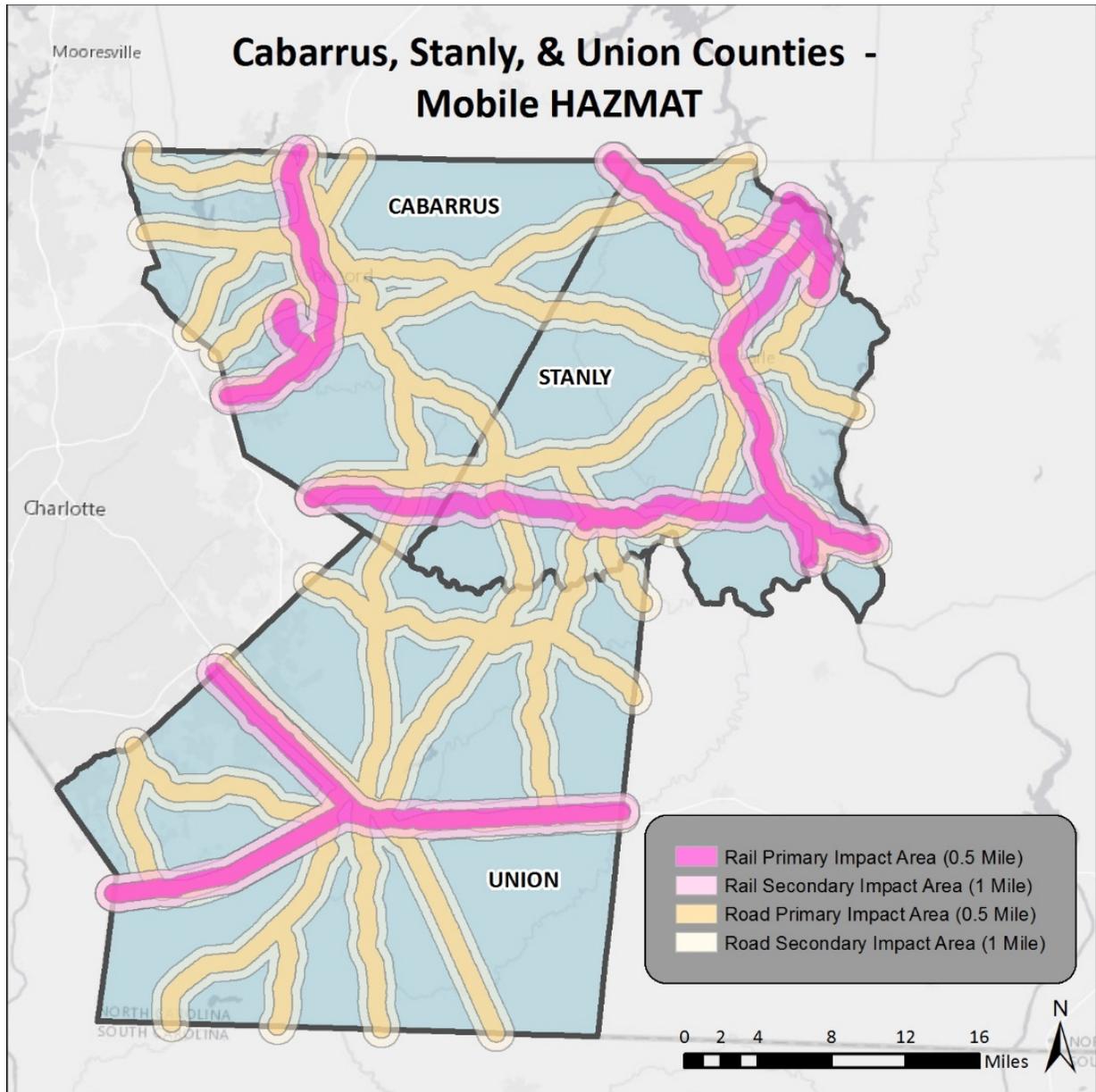
<sup>6</sup> Note that parcels included in the 1-mile analysis are also included in the 0.5-mile analysis.

SECTION 6: VULNERABILITY ASSESSMENT

Location	0.5 Mile Buffer			1.0 Mile Buffer		
	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
<b>Cabarrus County</b>	<b>3,520</b>	<b>2,225</b>	<b>\$583,662,250</b>	<b>12,386</b>	<b>8,842</b>	<b>\$1,785,641,060</b>
Concord	1,946	1,537	\$387,564,830	7,310	6,016	\$1,093,944,530
Harrisburg	465	408	\$126,551,010	1,561	1,384	\$313,859,010
Kannapolis	493	0	\$0	1,317	88	\$36,221,550
Midland	342	160	\$13,502,180	931	638	\$93,901,500
Mount Pleasant	0	0	\$0	0	0	\$0
Unincorporated Area	274	120	\$56,044,230	1,267	716	\$247,714,470
<b>Stanly County</b>	<b>2,190</b>	<b>1,592</b>	<b>\$249,167,625</b>	<b>6,879</b>	<b>5,013</b>	<b>\$806,328,280</b>
Albemarle	1,160	950	\$143,085,264	3,700	2,944	\$528,649,534
Badin	0	0	\$0	0	0	\$0
Locust	0	0	\$0	0	0	\$0
Misenhiemer	0	0	\$0	0	0	\$0
New London	185	131	\$33,249,290	505	355	\$56,389,911
Norwood	15	30	\$8,590,182	81	42	\$11,296,429
Oakboro	195	113	\$7,624,926	813	579	\$50,284,887
Red Cross	0	0	\$0	0	0	\$0
Richfield	245	152	\$27,891,398	525	320	\$41,105,050
Stanfield	36	24	\$3,967,444	117	84	\$15,032,427
Unincorporated Area	354	192	\$24,759,121	1,138	689	\$103,570,042
<b>Union County</b>	<b>5,216</b>	<b>4,202</b>	<b>\$3,231,201,862</b>	<b>16,550</b>	<b>14,486</b>	<b>\$5,013,172,251</b>
Fairview	0	0	\$0	0	0	\$0
Hemby Bridge	0	0	\$0	0	0	\$0
Indian Trail	1,907	1,627	\$880,803,838	5,025	4,391	\$1,405,302,638
Lake Park	3	2	\$617,600	416	377	\$73,358,000
Marshville	95	64	\$70,554,400	415	310	\$107,575,600
Marvin	0	0	\$0	0	0	\$0
Mineral Springs	0	0	\$0	0	0	\$0
Monroe	1,830	1,515	\$1,258,555,724	4,999	4,214	\$2,016,287,713
Stallings	468	323	\$142,247,900	1,546	1,167	\$317,099,200
Unionville	0	0	\$0	0	0	\$0
Waxhaw	0	0	\$0	0	0	\$0
Weddington	0	0	\$0	0	0	\$0
Wesley Chapel	0	0	\$0	0	0	\$0
Wingate	46	44	\$4,868,600	318	290	\$54,583,200
Unincorporated Area	867	627	\$873,553,800	3,831	3,737	\$1,038,965,900
<b>Cabarrus Stanly Union Regional Total</b>	<b>10,926</b>	<b>8,019</b>	<b>\$4,064,031,737</b>	<b>35,815</b>	<b>28,341</b>	<b>\$7,605,141,591</b>

Source: EPA, Local governments

**FIGURE 6.9: MOBILE HAZMAT BUFFERS IN THE CABARRUS STANLY UNION REGION**



Source: NC Department of Transportation

**TABLE 6.23: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS SUBSTANCES (MOBILE ANALYSIS – ROAD)**

SECTION 6: VULNERABILITY ASSESSMENT

Location	0.5 Mile Buffer			1.0 Mile Buffer		
	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
<b>Cabarrus County</b>	<b>39,334</b>	<b>25,582</b>	<b>\$6,426,725,352</b>	<b>65,570</b>	<b>48,090</b>	<b>\$9,822,917,312</b>
Concord	16,711	13,734	\$3,485,757,245	26,869	22,350	\$5,168,837,565
Harrisburg	2,065	1,656	\$408,575,100	4,283	3,549	\$821,536,020
Kannapolis	10,903	6,862	\$1,382,411,267	17,881	11,322	\$1,912,358,247
Midland	1,438	920	\$136,016,090	2,012	1,315	\$180,710,140
Mount Pleasant	650	515	\$68,436,320	751	614	\$85,729,600
Unincorporated Area	7,567	1,895	\$945,529,330	13,774	8,940	\$1,653,745,740
<b>Stanly County</b>	<b>20,972</b>	<b>14,287</b>	<b>\$1,810,469,285</b>	<b>29,406</b>	<b>19,914</b>	<b>\$2,410,154,542</b>
Albemarle	6,227	4,779	\$692,494,003	8,510	6,600	\$904,428,859
Badin	754	565	\$40,501,165	892	665	\$44,590,815
Locust	1,963	1,412	\$212,592,506	2,233	1,610	\$245,224,920
Misenhiemer	134	91	\$54,035,031	135	92	\$54,133,251
New London	640	439	\$63,464,559	702	487	\$70,025,940
Norwood	1,488	1,027	\$71,283,080	2,100	1,391	\$112,061,204
Oakboro	1,205	815	\$83,279,253	1,589	1,069	\$114,245,521
Red Cross	421	290	\$40,062,879	482	335	\$43,815,685
Richfield	668	402	\$48,243,655	821	503	\$57,242,279
Stanfield	533	409	\$63,530,531	719	540	\$79,789,174
Unincorporated Area	6,939	4,058	\$440,982,623	11,223	6,622	\$684,596,894
<b>Union County</b>	<b>33,236</b>	<b>26,703</b>	<b>\$9,179,435,090</b>	<b>56,078</b>	<b>45,142</b>	<b>\$13,841,394,201</b>
Fairview	946	730	\$163,216,800	1,429	1,107	\$237,552,200
Hemby Bridge	0	0	\$0	19	16	\$1,759,100
Indian Trail	1,759	1,359	\$888,840,400	3,685	2,831	\$1,154,573,951
Lake Park	0	0	\$0	186	176	\$53,198,100
Marshville	1,169	951	\$181,708,700	1,206	979	\$184,342,500
Marvin	316	293	\$98,629,400	490	438	\$156,434,400
Mineral Springs	560	423	\$77,035,500	949	733	\$115,919,300
Monroe	8,076	6,949	\$2,373,685,264	12,239	10,660	\$3,233,260,724
Stallings	1,478	1,318	\$398,149,326	3,523	2,952	\$802,256,826
Unionville	1,195	891	\$166,960,000	2,285	1,765	\$318,016,100
Waxhaw	3,536	2,974	\$647,602,200	5,666	4,559	\$1,050,279,200
Weddington	1,434	1,100	\$633,956,800	2,609	2,096	\$1,102,280,400
Wesley Chapel	919	819	\$296,510,100	1,515	1,339	\$425,564,600
Wingate	660	555	\$219,739,500	905	778	\$248,236,300
Unincorporated Area	11,188	8,341	\$3,033,401,100	19,372	14,713	\$4,757,720,500
<b>Cabarrus Stanly Union Regional Total</b>	<b>93,542</b>	<b>66,572</b>	<b>\$17,416,629,727</b>	<b>151,054</b>	<b>113,146</b>	<b>\$26,074,466,055</b>

Source: NC Department of Transportation, Local Governments

**TABLE 6.24: EXPOSURE OF IMPROVED PROPERTY TO HAZARDOUS SUBSTANCES (MOBILE ANALYSIS – RAILROAD)**

**SECTION 6: VULNERABILITY ASSESSMENT**

Location	0.5 Mile Buffer			1.0 Mile Buffer		
	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value	Approx. Number of Parcels	Approx. Number Improved	Approx. Improved Value
<b>Cabarrus County</b>	<b>17,568</b>	<b>11,940</b>	<b>\$2,380,781,177</b>	<b>33,419</b>	<b>24,114</b>	<b>\$4,377,785,502</b>
Concord	7,229	5,759	\$1,034,034,650	13,876	11,389	\$2,054,488,395
Harrisburg	1,594	1,359	\$393,302,190	3,728	3,324	\$783,323,710
Kannapolis	7,066	3,902	\$736,706,607	12,351	7,305	\$1,152,468,987
Midland	653	372	\$48,961,730	1,354	907	\$126,094,230
Mount Pleasant	0	0	\$0	0	0	\$0
Unincorporated Area	1,026	548	\$167,776,000	2,110	1,189	\$261,410,180
<b>Stanly County</b>	<b>11,492</b>	<b>7,828</b>	<b>\$985,079,038</b>	<b>18,881</b>	<b>12,891</b>	<b>\$1,487,276,831</b>
Albemarle	2,751	2,200	\$354,104,695	5,595	4,419	\$573,883,062
Badin	740	558	\$40,226,564	892	665	\$44,590,815
Locust	0	0	\$0	84	56	\$14,461,148
Misenhiemer	125	83	\$51,854,223	135	92	\$54,133,251
New London	445	308	\$51,651,674	570	399	\$61,440,072
Norwood	1,418	962	\$75,776,623	2,030	1,368	\$108,822,016
Oakboro	1,062	717	\$68,879,750	1,515	985	\$100,548,969
Red Cross	0	0	\$0	2	2	\$118,117
Richfield	451	271	\$37,310,241	628	381	\$47,347,777
Stanfield	557	431	\$55,371,469	851	647	\$93,035,712
Unincorporated Area	3,943	2,298	\$249,903,799	6,579	3,877	\$388,895,892
<b>Union County</b>	<b>12,972</b>	<b>10,635</b>	<b>\$5,356,008,760</b>	<b>24,980</b>	<b>20,401</b>	<b>\$8,364,606,004</b>
Fairview	0	0	\$0	0	0	\$0
Hemby Bridge	0	0	\$0	0	0	\$0
Indian Trail	1,140	920	\$374,804,800	3,448	2,808	\$1,510,113,391
Lake Park	0	0	\$0			
Marshville	1,134	916	\$179,151,900	1,206	979	\$184,342,500
Marvin	0	0	\$0	0	0	\$0
Mineral Springs	547	437	\$79,938,400	1,101	861	\$136,069,800
Monroe	5,274	4,587	\$2,296,898,860	9,283	8,151	\$3,269,623,513
Stallings	703	630	\$168,073,200	1,691	1,336	\$340,507,200
Unionville	0	0	\$0	0	0	\$0
Waxhaw	1,390	1,022	\$152,007,600	2,868	2,107	\$369,277,800
Weddington	0	0	\$0	0	0	\$0
Wesley Chapel	0	0	\$0	0	0	\$0
Wingate	743	632	\$227,211,700	948	820	\$252,210,600
Unincorporated Area	2,041	1,491	\$1,877,922,300	4,435	3,339	\$2,302,461,200
<b>Cabarrus Stanly Union Regional Total</b>	<b>42,032</b>	<b>30,403</b>	<b>\$8,721,868,975</b>	<b>77,280</b>	<b>57,406</b>	<b>\$14,229,668,337</b>

Source: NC Department of Transportation, Local Governments

**SOCIAL VULNERABILITY**

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

### CRITICAL FACILITIES

#### *Fixed Site Analysis:*

The critical facility analysis for fixed TRI sites revealed that there are 66 facilities located in a HAZMAT risk zone. The primary impact zone (0.5-mile buffer) includes 16 facilities throughout the region. Union County has the most facilities in the primary impact zone with 8 facilities, while Cabarrus County only has three facilities. Stanly County has 6 facilities in the 0.5-mile zone. The remaining facilities are in the secondary, 1-mile zone. A list of specific critical facilities and their associated risk can be found in **Table 6.26** at the end of this section.

#### *Mobile Analysis:*

The critical facility analysis for road and railroad transportation corridors revealed that there are 271 critical facilities located in the primary (0.5 mile) mobile HAZMAT buffer areas for roads and railroads throughout the region. Although this is a worst-case scenario model, it indicates that most of the critical facilities in the Cabarrus Stanly Union region are vulnerable to a potential mobile HAZMAT incident. Additionally, there are 356 critical facilities located in the secondary (1 mile) buffer area of both roads and railroads, accounting for over 75 percent of the total number of critical facilities in the region. This may be the result of many critical facilities being located near major roadways for ease of access, but it is nonetheless important to recognize what a large percentage of critical facilities in the region are located in the smaller buffer area. A list of specific critical facilities and their associated risk can be found in **Table 6.26** at the end of this section.

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

## 6.6 CONCLUSIONS ON HAZARD VULNERABILITY

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

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

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

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

**Table 6.25** presents a summary of potential annualized loss estimates for each hazard in the Cabarrus Stanly Union Region. Due to the reporting of hazard damages primarily at the county level, it was difficult to determine an accurate annualized loss estimate for each municipality. Therefore, an annualized loss was determined through the damage reported through historical occurrences at the county level. If no historical occurrences were reported, an accurate annualized loss estimate could not be obtained. These values should be used as an additional planning tool or measure risk for determining hazard mitigation strategies throughout the region.

**TABLE 6.25: POTENTIAL ANNUALIZED LOSSES FOR THE CABARRUS STANLY UNION REGION**

Hazard	Cabarrus County	Stanly County	Union County	Total
Drought	Negligible	Negligible	Negligible	Negligible
Excessive Heat	Negligible	Negligible	Negligible	Negligible
Hurricane and Coastal Hazards				
Tornadoes/Thunderstorms	\$6,179	\$21,143	\$37,598	\$80,911
Severe Winter Weather	\$722,244	Negligible	\$51,077	\$773,322
Earthquakes	Negligible	Negligible	Negligible	Negligible
Geological	Negligible	Negligible	Negligible	Negligible
Dam Failure	Negligible	Negligible	Negligible	Negligible
Flooding	\$549,600	\$11,914	\$15,488	\$738,461
Wildfires	Negligible	Negligible	Negligible	Negligible
Infectious Disease	Negligible	Negligible	Negligible	Negligible
Hazardous Substances	\$11,839	\$4,818	\$1,029	\$17,686
Radiological Emergency	Negligible	Negligible	Negligible	Negligible
Terrorism	Negligible	Negligible	Negligible	Negligible
Cyber	Negligible	Negligible	Negligible	Negligible
Electromagnetic Pulse	Negligible	Negligible	Negligible	Negligible

As noted previously, all existing and future buildings and populations (including critical facilities) are vulnerable to natural hazards including drought, hurricane and coastal hazards, tornadoes/thunderstorms, and severe winter weather. Some buildings may be more vulnerable to these hazards based on locations, construction, and building type. **Table 6.25** shows the critical facilities vulnerable to additional hazards analyzed in this section. The table lists those assets that are determined to be exposed to each of the identified hazards (marked with an “X”)

**TABLE 6.26: At-Risk Critical Facilities**

FACILITY NAME	FACILITY TYPE	Natural						Geological		Other								
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)	Mobile HAZMAT 1 Mile (Rail)
<b>Cabarrus County</b>																		
County Substation	Police Station	X	X	X	X	X	X			X					X	X		
County Substation	Police Station	X	X	X	X	X	X			X					X	X		
County Substation	Police Station	X	X	X	X	X	X			X		X			X	X		
Cabarrus County Sheriff Dept	Police Station	X	X	X	X	X	X			X					X	X		X
Concord Police	Police Station	X	X	X	X	X	X			X					X	X		X
Concord Adam	Police Station	X	X	X	X	X	X			X					X	X	X	X
Concord Charlie	Police Station	X	X	X	X	X	X			X		X	X		X			
Concord David	Police Station	X	X	X	X	X	X			X					X	X		
Concord Baker	Police Station	X	X	X	X	X	X			X					X	X	X	X
Kannapolis Police	Police Station	X	X	X	X	X	X								X	X	X	X
County Substation	Police Station	X	X	X	X	X	X								X	X		X
Mt Pleasant High	School	X	X	X	X	X	X			X					X	X		
A T Allen Elementary	School	X	X	X	X	X	X			X								
Rocky River Elementary	School	X	X	X	X	X	X			X			X		X	X	X	X
Harris Road Middle	School	X	X	X	X	X	X								X			
Cox Mill Elementary	School	X	X	X	X	X	X			X								
Stonewall Jackson School	School	X	X	X	X	X	X			X							X	X

**SECTION 6: VULNERABILITY ASSESSMENT**

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other							
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)	Mobile HAZMAT 1 Mile (Rail)
C C Griffin Middle School	School	X	X	X	X	X	X			X								
Patriots Elementary	School	X	X	X	X	X	X			X								
Cabarrus Education Center	School	X	X	X	X	X	X			X				X	X			
W R Odell Elementary	School	X	X	X	X	X	X							X	X			
Wincoff Elementary	School	X	X	X	X	X	X			X				X	X	X	X	
Concord High	School	X	X	X	X	X	X							X	X			
Beverly Hills Elementary	School	X	X	X	X	X	X							X	X			X
Concord Middle	School	X	X	X	X	X	X								X			
W M Irvin Elementary	School	X	X	X	X	X	X							X	X			
Long School	School	X	X	X	X	X	X			X			X		X	X	X	
Cox Mill High	School	X	X	X	X	X	X			X								
Glenn Center Environmental Studies	School	X	X	X	X	X	X			X				X	X	X	X	
Coltrane Webb Elementary	School	X	X	X	X	X	X			X				X	X			X
R Brown McAllister Elementary	School	X	X	X	X	X	X			X					X			
Wolf Meadow Elementary	School	X	X	X	X	X	X			X					X	X	X	
J N Fries	School	X	X	X	X	X	X			X				X	X	X	X	
Central Cabarrus High	School	X	X	X	X	X	X			X				X	X	X	X	
Jay M Robinson High	School	X	X	X	X	X	X			X				X	x			
Pitts School Road Elementary	School	X	X	X	X	X	X			X								
Carl A Furr Elementary	School	X	X	X	X	X	X			X								

**SECTION 6: VULNERABILITY ASSESSMENT**

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other						
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)
Cabarrus Co School Administration	School	X	X	X	X	X	X			X		X	X	X	X		X
Cannon School	School	X	X	X	X	X	X			X					X		
Barber Scotia College	School	X	X	X	X	X	X			X				X	X	X	X
Harold E Winkler Middle	School	X	X	X	X	X	X			X				X			
Performance Learning Center	School	X	X	X	X	X	X			X			X	X	X	X	X
Royal Oaks Elementary	School	X	X	X	X	X	X			X				X	X		X
Northwest Cabarrus Middle	School	X	X	X	X	X	X			X							
Jackson Park Elementary	School	X	X	X	X	X	X							X	X		X
Fred L Wilson Elementary	School	X	X	X	X	X	X							X	X		
A L Brown High	School	X	X	X	X	X	X							X	X	X	X
Kannapolis Intermediate School	School	X	X	X	X	X	X							X	X		X
Shady Brook Elementary	School	X	X	X	X	X	X										X
Rowan Cabarrus Community College	School	X	X	X	X	X	X							X	X		
Northwest Cabarrus High	School	X	X	X	X	X	X										
Charles E Boger Elementary	School	X	X	X	X	X	X			X							
Kannapolis Middle	School	X	X	X	X	X	X										
Early College High School	School	X	X	X	X	X	X							X	X		
Forest Park Elementary	School	X	X	X	X	X	X							X	X		
Harrisburg Elementary	School	X	X	X	X	X	X			X				X	X	X	X
Hickory Ridge High	School	X	X	X	X	X	X			X							X

SECTION 6: VULNERABILITY ASSESSMENT

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other						
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)
Hickory Ridge Middle	School	X	X	X	X	X	X			X					X		X
Bethel Elementary	School	X	X	X	X	X	X								X		X
Mt Pleasant Middle	School	X	X	X	X	X	X								X		
Mt Pleasant Elementary	School	X	X	X	X	X	X			X					X		
Mt Pleasant Senior Center	Other	X	X	X	X	X	X			X				X	X		
Governmental Center	Other	X	X	X	X	X	X			X				X	X		X
Courthouse	Other	X	X	X	X	X	X			X				X	X		X
Rotary Square	Other	X	X	X	X	X	X			X				X	X		X
Jail Annex	Other	X	X	X	X	X	X			X				X	X		X
Employee Health Clinic	Other	X	X	X	X	X	X			X			X	X	X	X	X
Concord Library	Other	X	X	X	X	X	X			X				X	X		X
Leased Warehouse	Other	X	X	X	X	X	X			X				X	X		X
Fleet Maintenance Bldg	Other	X	X	X	X	X	X			X				X	X		
Kannapolis Library	Other	X	X	X	X	X	X								X		X
Human Services Center	Other	X	X	X	X	X	X							X	X		X
Cabarrus EOC	EOC	X	X	X	X	X	X										
Harrisburg FS 3	Fire/EMS	X	X	X	X	X	X			X							
Harrisburg FS 2	Fire/EMS	X	X	X	X	X	X			X							
Midland FS 2	Fire/EMS	X	X	X	X	X	X							X	X		X
Midland FS 1	Fire/EMS	X	X	X	X	X	X						X	X	X		X

**SECTION 6: VULNERABILITY ASSESSMENT**

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other							
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)	Mobile HAZMAT 1 Mile (Rail)
Mt Pleasant FS	Fire/EMS	X	X	X	X	X	X			X					X	X		
EMS 3	Fire/EMS	X	X	X	X	X	X			X					X	X		
Odell FS 1	Fire/EMS	X	X	X	X	X	X							X	X			
Concord FS 10	Fire/EMS	X	X	X	X	X	X					X						
Cabarrus Rescue	Fire/EMS	X	X	X	X	X	X			X				X	X	X	X	
Kannapolis FS 4	Fire/EMS	X	X	X	X	X	X			X				X	X	X	X	
EMS 1	Fire/EMS	X	X	X	X	X	X			X				X	X	X	X	
CMC Northeast	Fire/EMS	X	X	X	X	X	X			X				X	X	X	X	
Concord FS 1	Fire/EMS	X	X	X	X	X	X			X				X	X		X	
Concord FS 2	Fire/EMS	X	X	X	X	X	X						X	X	X		X	
Concord FS 3	Fire/EMS	X	X	X	X	X	X			X				X	X		X	
Concord FS 4	Fire/EMS	X	X	X	X	X	X			X				X				
Concord FS 5	Fire/EMS	X	X	X	X	X	X			X					X			
Concord FS 6	Fire/EMS	X	X	X	X	X	X			X				X	X			
Concord FS 7	Fire/EMS	X	X	X	X	X	X			X		X	X		X			
Concord FS 8	Fire/EMS	X	X	X	X	X	X			X				X	X	X	X	
Concord FS 9	Fire/EMS	X	X	X	X	X	X			X				X	X			
EMS 2	Fire/EMS	X	X	X	X	X	X			X				X	X	X	X	
Concord FS 11	Fire/EMS	X	X	X	X	X	X			X				X	X			
Kannapolis FS 2	Fire/EMS	X	X	X	X	X	X							X	X	X	X	

SECTION 6: VULNERABILITY ASSESSMENT

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other							
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)	Mobile HAZMAT 1 Mile (Rail)
Kannapolis FS 3	Fire/EMS	X	X	X	X	X	X								X	X		X
EMS 4	Fire/EMS	X	X	X	X	X	X								X	X	X	X
Kannapolis FS 5	Fire/EMS	X	X	X	X	X	X			X					X	X		
Kannapolis FS 1	Fire/EMS	X	X	X	X	X	X								X	X	X	X
Harrisburg FS 1	Fire/EMS	X	X	X	X	X	X								X	X		X
Mt Mitchell FS	Fire/EMS	X	X	X	X	X	X									X		
Rimer FS	Fire/EMS	X	X	X	X	X	X											
Northeast Cabarrus FS	Fire/EMS	X	X	X	X	X	X			X					X	X		
Cold Water FS	Fire/EMS	X	X	X	X	X	X									X		
Allen FS	Fire/EMS	X	X	X	X	X	X			X					X	X		
Georgeville FS	Fire/EMS	X	X	X	X	X	X		X	X					X			
Flowes Store FS	Fire/EMS	X	X	X	X	X	X			X								
Odell FS 2	Fire/EMS	X	X	X	X	X	X											
Carolina Health Care System Northeast	Medical	X	X	X	X	X	X											
<b>STANLY COUNTY</b>																		
EMS Base 1	Fire/EMS	X	X	X	X	X	X			X								
EMS Base 2	Fire/EMS	X	X	X	X	X	X			X								
EMS Base 3	Fire/EMS	X	X	X	X	X	X			X								
EMS Base 4	Fire/EMS	X	X	X	X	X	X			X								
City of Albemarle Fire	Fire/EMS	X	X	X	X	X	X			X			X	X	X	X	X	X

**SECTION 6: VULNERABILITY ASSESSMENT**

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other						
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)
Bethany VFD	Fire/EMS	X	X	X	X	X	X			X		X	X	X	X		
Endy VFD Inc	Fire/EMS	X	X	X	X	X	X			X				X	X		
Southside VFD Dpt 2	Fire/EMS	X	X	X	X	X	X			X				X	X		X
Eastside VFD	Fire/EMS	X	X	X	X	X	X			X				X	X		
Albemarle	Fire/EMS	X	X	X	X	X	X			X				X	X		
Albemarle	Fire/EMS	X	X	X	X	X	X			X				X	X		
Albemarle	Fire/EMS	X	X	X	X	X	X							X			
Eastside VFD 2	Fire/EMS	X	X	X	X	X	X							X	X		
Southside VFD Dpt 1	Fire/EMS	X	X	X	X	X	X			X				X	X	X	X
Badin VFD	Fire/EMS	X	X	X	X	X	X							X		X	X
West Stanly Station 1	Fire/EMS	X	X	X	X	X	X							X	X		
Ridgecrest Fire	Fire/EMS	X	X	X	X	X	X			X							
New London VFD	Fire/EMS	X	X	X	X	X	X			X			X	X	X	X	X
Millington FFD Inc	Fire/EMS	X	X	X	X	X	X			X				X			
Center Rural VFD 1	Fire/EMS	X	X	X	X	X	X			X				X	X		
Center Rural VFD 2	Fire/EMS	X	X	X	X	X	X									X	X
Town of Norwood Fire	Fire/EMS	X	X	X	X	X	X			X				X	X	X	X
Aquadale Fire 1	Fire/EMS	X	X	X	X	X	X			X				X	X	X	X
Aquadale Fire 2	Fire/EMS	X	X	X	X	X	X			X							
Oakboro Rural Fire	Fire/EMS	X	X	X	X	X	X			X			X	X	X	X	X

**SECTION 6: VULNERABILITY ASSESSMENT**

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other						
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)
Richfield Misenheimer Fire	Fire/EMS	X	X	X	X	X	X					X	X	X	X	X	X
West Stanly Station 2	Fire/EMS	X	X	X	X	X	X										
Stanly Regional Medical Center 1	Medical	X	X	X	X	X	X			X			X	X	X	X	X
Stanly Regional Medical Center 2	Medical	X	X	X	X	X	X							X	X		
EOC	EOC	X	X	X	X	X	X			X				X	X		
Albemarle Correctional	Other	X	X	X	X	X	X						X				X
Stanly County Jail	Other	X	X	X	X	X	X						X	X		X	X
Albemarle Police	Police Station	X	X	X	X	X	X							X	X	X	X
Albemarle Satellite 1	Police Station	X	X	X	X	X	X							X	X	X	X
Albemarle Satellite 2	Police Station	X	X	X	X	X	X						X	X	X		
Albemarle Satellite 3	Police Station	X	X	X	X	X	X								X		
Sheriff's Office	Police Station	X	X	X	X	X	X							X	X		
Badin Police	Police Station	X	X	X	X	X	X							X	X	X	X
Locust Police	Police Station	X	X	X	X	X	X							X	X		
Misenheimer Police	Police Station	X	X	X	X	X	X							X	X	X	X
Sheriff Satellite	Police Station	X	X	X	X	X	X						X	X	X	X	X
Norwood Police	Police Station	X	X	X	X	X	X							X	X	X	X
Oakboro Police	Police Station	X	X	X	X	X	X						X	X	X	X	X
Stanfield Police	Police Station	X	X	X	X	X	X							X	X	X	X
Albemarle HS	School	X	X	X	X	X	X			X				X	X	X	X

SECTION 6: VULNERABILITY ASSESSMENT

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other							
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)	Mobile HAZMAT 1 Mile (Rail)
Central Albemarle ES	School	X	X	X	X	X	X			X					X	X	X	X
East Albemarle ES	School	X	X	X	X	X	X			X				X	X	X		
North Albemarle ES	School	X	X	X	X	X	X			X					X	X	X	X
Albemarle MS	School	X	X	X	X	X	X			X				X	X	X		
Millingport ES	School	X	X	X	X	X	X			X					X	X		
North Stanly MS	School	X	X	X	X	X	X			X								
North Stanly HS	School	X	X	X	X	X	X			X				X	X	X	X	X
Endy ES	School	X	X	X	X	X	X			X					X	X		
Badin ES	School	X	X	X	X	X	X								X	X	X	X
Locust ES	School	X	X	X	X	X	X			X					X	X		
Ridgecrest ES	School	X	X	X	X	X	X			X								
Running Creek ES	School	X	X	X	X	X	X			X						X		
Norwood ES	School	X	X	X	X	X	X			X					X	X	X	X
South Stanly HS	School	X	X	X	X	X	X			X		X	X		X	X	X	X
South Stanly MS	School	X	X	X	X	X	X			X			X			X	X	
Aquadale ES	School	X	X	X	X	X	X			X					X	X	X	X
Oakboro ES	School	X	X	X	X	X	X			X				X	X	X		X
West Stanly HS	School	X	X	X	X	X	X			X					X	X		
Richfield ES	School	X	X	X	X	X	X					X	X	X	X	X	X	X
Stanfield ES	School	X	X	X	X	X	X								X	X	X	X

SECTION 6: VULNERABILITY ASSESSMENT

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other							
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)	Mobile HAZMAT 1 Mile (Rail)
Lutheran Home	Other	X	X	X	X	X	X					X				X	X	X
Baptist Home	Other	X	X	X	X	X	X								X	X	X	X
Spring Arbor	Other	X	X	X	X	X	X							X	X	X	X	X
Britthaven Inc	Other	X	X	X	X	X	X							X				
Forest Oaks	Other	X	X	X	X	X	X								X	X		
Stanly Manor Inc	Other	X	X	X	X	X	X						X	X		X		
<b>UNION COUNTY</b>																		
Hillcrest Church Rest Home	Other	X	X	X	X	X	X									X		
Monroe Manor I and II	Other	X	X	X	X	X	X								X	X		
Woodridge Assisted Living Care	Other	X	X	X	X	X	X									X		
Christian Family Care I and II	Other	X	X	X	X	X	X									X	X	X
Monroe Square Assisted Living Care	Other	X	X	X	X	X	X							X	X	X		X
Rehab and Nursing Center of Monroe	Other	X	X	X	X	X	X									X		X
Brian Center Health & Retirement	Other	X	X	X	X	X	X					X	X	X	X	X	X	X
Union Park Assisted Living Care	Other	X	X	X	X	X	X								X			X
Piedmont Behavioral Healthcare	Other	X	X	X	X	X	X	X							X	X	X	X
Carolinas Medical Center Union	Other	X	X	X	X	X	X							X	X	X		X
Autumn Care of Marshville	Other	X	X	X	X	X	X								X	X	X	X
Elizabeth Gardens	Other	X	X	X	X	X	X								X	X	X	X
White Store Road Family Home Care	Other	X	X	X	X	X	X								X	X		

**SECTION 6: VULNERABILITY ASSESSMENT**

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other						
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)
Lake Park Nursing and Rehab Center	Other	X	X	X	X	X	X						X		X		
Helms Rest Home	Other	X	X	X	X	X	X							X	X	X	X
Fairview ES	School	X	X	X	X	X	X							X	X		
Metrolina Christian	School	X	X	X	X	X	X							X	X		X
Shiloh ES	School	X	X	X	X	X	X										
Sun Valley MS	School	X	X	X	X	X	X										
Sun Valley HS	School	X	X	X	X	X	X										X
Indian Trail ES	School	X	X	X	X	X	X					X	X			X	X
Hemby Bridge ES	School	X	X	X	X	X	X										
Village Park Traditional	School	X	X	X	X	X	X						X		X	X	X
Antioch ES	School	X	X	X	X	X	X										
Sun Valley ES	School	X	X	X	X	X	X				X						
Marshville ES	School	X	X	X	X	X	X							X	X	X	X
East Union MS	School	X	X	X	X	X	X					X	X	X	X	X	X
Marvin ES	School	X	X	X	X	X	X										
Western Union ES	School	X	X	X	X	X	X							X	X		X
Tabernacle Christian	School	X	X	X	X	X	X					X	X		X		X
Central Academy	School	X	X	X	X	X	X								X		X
Monroe HS	School	X	X	X	X	X	X							X	X		X
East ES	School	X	X	X	X	X	X							X	X	X	X

SECTION 6: VULNERABILITY ASSESSMENT

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other						
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)
Monroe MS	School	X	X	X	X	X	X								X		X
Benton Heights ES	School	X	X	X	X	X	X						X	X	X	X	X
First Assembly Christian	School	X	X	X	X	X	X								X	X	X
Sunset Park Christian	School	X	X	X	X	X	X							X	X		
Shining Light Christian	School	X	X	X	X	X	X								X	X	X
Union Academy Lower	School	X	X	X	X	X	X						X		X	X	X
Walter Bicket ES	School	X	X	X	X	X	X							X	X		X
Walter Bicket Ed. Center	School	X	X	X	X	X	X							X	X		X
Monroe Christian Academy	School	X	X	X	X	X	X					X	X		X	X	X
Wolfe School	School	X	X	X	X	X	X								X		X
Union County Early College	School	X	X	X	X	X	X					X	X			X	X
Rocky River ES	School	X	X	X	X	X	X								X		
Union Academy MS	School	X	X	X	X	X	X					X		X	X		X
Stallings ES	School	X	X	X	X	X	X							X	X		
Sardis ES	School	X	X	X	X	X	X						X				
Rea View ES	School	X	X	X	X	X	X								X		
Union ES	School	X	X	X	X	X	X										
Forest Hills ES	School	X	X	X	X	X	X							X	X	X	X
Prospect ES	School	X	X	X	X	X	X							X	X		
Parkwood MS	School	X	X	X	X	X	X							X	X		

**SECTION 6: VULNERABILITY ASSESSMENT**

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other							
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)	Mobile HAZMAT 1 Mile (Rail)
Parkwood HS	School	X	X	X	X	X	X								X	X		
New Salem ES	School	X	X	X	X	X	X								X	X		
Fellowship Christian	School	X	X	X	X	X	X								X	X	X	X
Rock Rest ES	School	X	X	X	X	X	X									X		
Porter Ridge ES	School	X	X	X	X	X	X											
Porter Ridge MS	School	X	X	X	X	X	X											
Porter Ridge HS	School	X	X	X	X	X	X											
Poplin ES	School	X	X	X	X	X	X					X						
Cuthbertson MS	School	X	X	X	X	X	X											
Cuthbertson HS	School	X	X	X	X	X	X											
Sandy Ridge ES	School	X	X	X	X	X	X					X						
Marvin Ridge MS	School	X	X	X	X	X	X											
Marvin Ridge HS	School	X	X	X	X	X	X											
Unionville ES	School	X	X	X	X	X	X											
Piedmont MS	School	X	X	X	X	X	X											
Piedmont HS	School	X	X	X	X	X	X											
Kensington ES	School	X	X	X	X	X	X					X						
South Providence	School	X	X	X	X	X	X								X	X	X	X
Waxhaw ES	School	X	X	X	X	X	X								X	X	X	X
Weddington HS	School	X	X	X	X	X	X								X	X		

**SECTION 6: VULNERABILITY ASSESSMENT**

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other							
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)	Mobile HAZMAT 1 Mile (Rail)
Weddington ES	School	X	X	X	X	X	X								X	X		
Weddington MS	School	X	X	X	X	X	X								X	X		
New Town ES	School	X	X	X	X	X	X											
Wingate ES	School	X	X	X	X	X	X							X	X	X	X	X
Union Regional Medical Center	Medical	X	X	X	X	X	X								X	X		X
Fairview Fire	Fire/EMS	X	X	X	X	X	X								X	X		
Hemby Bridge Fire	Fire/EMS	X	X	X	X	X	X											
Stallings Fire	Fire/EMS	X	X	X	X	X	X					X	X					X
Marshville Fire	Fire/EMS	X	X	X	X	X	X							X	X	X	X	
Mineral Springs Fire	Fire/EMS	X	X	X	X	X	X											
Monroe Fire	Fire/EMS	X	X	X	X	X	X							X	X	X	X	X
Lanes Creek Fire	Fire/EMS	X	X	X	X	X	X								X	X		
Allens Crossroads	Fire/EMS	X	X	X	X	X	X											
Stak Road	Fire/EMS	X	X	X	X	X	X											
Sandy Ridge	Fire/EMS	X	X	X	X	X	X											
Griffith Road	Fire/EMS	X	X	X	X	X	X									X		
Jackson	Fire/EMS	X	X	X	X	X	X								X	X		
Waxhaw Jaars	Fire/EMS	X	X	X	X	X	X											
Springs	Fire/EMS	X	X	X	X	X	X								X	X	X	X
New Salem	Fire/EMS	X	X	X	X	X	X								X	X		

**SECTION 6: VULNERABILITY ASSESSMENT**

FACILITY NAME	FACILITY TYPE	Natural							Geological		Other							
		Drought	Excessive Heat	Hurricane & Coastal Hazards	Tornadoes/Thunderstorms	Severe Winter Weather	Earthquakes	Flood 100-year	Flood 500-year	Landslide - High Incidence	Landslide - Mod. Incidence	Wildfires	Fixed HAZMAT 0.5 Mile	Fixed HAZMAT 1 Mile	Mobile HAZMAT 0.5 Mile (Road)	Mobile HAZMAT 1 Mile (Road)	Mobile HAZMAT 0.5 Mile (Rail)	Mobile HAZMAT 1 Mile (Rail)
Bakers	Fire/EMS	X	X	X	X	X	X							X			X	X
Unionville Fire	Fire/EMS	X	X	X	X	X	X											
Unionville	Fire/EMS	X	X	X	X	X	X								X	X		
Waxhaw	Fire/EMS	X	X	X	X	X	X								X	X		X
Wesley Chapel	Fire/EMS	X	X	X	X	X	X								X	X		
Providence	Fire/EMS	X	X	X	X	X	X											
Wingate	Fire/EMS	X	X	X	X	X	X								X	X	X	X
Monroe PD	Police Station	X	X	X	X	X	X								X	X	X	X
Sheriff's Office	Police Station	X	X	X	X	X	X						X	X	X	X	X	X
Marshville PD	Police Station	X	X	X	X	X	X								X	X	X	X
Wingate PD	Police Station	X	X	X	X	X	X								X	X	X	X
Waxhaw PD	Police Station	X	X	X	X	X	X								X	X	X	X
Stallings PD	Police Station	X	X	X	X	X	X							X			X	X



# SECTION 7

## CAPABILITY ASSESSMENT

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

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

### 7.1 WHAT IS A CAPABILITY ASSESSMENT?

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

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

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

---

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

## 7.2 CONDUCTING THE CAPABILITY ASSESSMENT

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

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

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

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

## 7.3 CAPABILITY ASSESSMENT FINDINGS

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

---

<sup>2</sup> The scoring methodology used to quantify and rank the region’s capability can be found in Appendix B.

### 7.3.1 Planning and Regulatory Capability

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

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

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

**TABLE 7.1: RELEVANT PLANS, ORDINANCES, AND PROGRAMS**

Planning / Regulatory Tool	CABARRUS COUNTY					STANLY COUNTY					UNION COUNTY																		
	Concord	Harrisburg	Kannapolis	Midland	Mount Pleasant	Albemarle	Badin	Locust	Misenheimer	New London	Norwood	Oakboro	Red Cross	Richfield	Stanfield	Fairview	Hemby Bridge	Indian Trail	Lake Park	Marshville	Marvin	Mineral Springs	Monroe	Stallings	Unionville	Waxhaw	Weddington	Wesley Chapel	Wingate
Hazard Mitigation Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Comprehensive Land Use Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Floodplain Management Plan	✓		✓			✓	✓			✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	
Open Space Management Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Stormwater Management Plan/Ordinance	✓	✓	✓	✓	✓										✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Natural Resource Protection Plan																													
Flood Response Plan	✓																												
Emergency Operations Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

**SECTION 7: CAPABILITY ASSESSMENT**

Planning / Regulatory Tool	CABARRUS COUNTY					STANLY COUNTY					UNION COUNTY																		
	Concord	Harrisburg	Kannapolis	Midland	Mount Pleasant	Albemarle	Badin	Locust	Misenhiemer	New London	Norwood	Oakboro	Red Cross	Richfield	Stanfield	Fairview	Hemby Bridge	Indian Trail	Lake Park	Marshville	Marvin	Mineral Springs	Monroe	Stallings	Unionville	Waxhaw	Weddington	Wesley Chapel	Wingate
Continuity of Operations Plan	✓	✓				✓					✓				✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Evacuation Plan						✓					✓	✓				✓	✓	✓	✓	✓		✓				✓	✓	✓	
Disaster Recovery Plan		✓				✓					✓	✓				✓		✓	✓			✓		✓		✓		✓	
Capital Improvements Plan	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓			✓	✓		✓					✓	✓		✓			
Economic Development Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Historic Preservation Plan								✓				✓				✓							✓			✓	✓		
Flood Damage Prevention Ordinance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Zoning Ordinance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Subdivision Ordinance	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Unified Development Ordinance	✓	✓	✓	✓	✓	✓	✓			✓						✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓
Post-Disaster Redevelopment Ordinance																✓	✓	✓	✓	✓		✓				✓	✓		
Building Code	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fire Code	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
National Flood Insurance Program (NFIP)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NFIP Community Rating System (CRS)	✓	✓																											

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

### 7.3.2 Emergency Management

Hazard mitigation is widely recognized as one of the four primary phases of emergency management. The three other phases include preparedness, response, and recovery. In reality, each phase is interconnected with hazard mitigation, as **Figure 7.1** suggests. Opportunities to reduce potential losses through mitigation practices are most often implemented before disaster strikes, such as the elevation of flood prone structures or the continuous enforcement of policies that prevent and regulate

development that is vulnerable to hazards due to its location, design, or other characteristics. Mitigation opportunities will also be presented during immediate preparedness or response activities, such as installing storm shutters in advance of a hurricane, and certainly during the long-term recovery and redevelopment process following a hazard event.

**FIGURE 7.1: THE FOUR PHASES OF EMERGENCY MANAGEMENT**



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

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

- ◆ All of the participating jurisdictions have previously adopted a hazard mitigation plan.

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

- ◆ Stanly County and Union County have each adopted a disaster recovery plan. The Towns of Norwood, Oakboro, Indian Trail, Mineral Springs, Stallings, and Waxhaw; the Villages of Lake Park and Wesley Chapel; and the City of Concord have also adopted disaster recovery plans.

**Emergency Operations Plan:** An emergency operations plan outlines responsibility and the means by

which resources are deployed during and following an emergency or disaster.

- ◆ Cabarrus County, Stanly County, and Union County each maintain emergency operations plans through their respective Emergency Management Departments.
- ◆ Cabarrus County municipalities, with the exception of Concord and Kannapolis, have signed onto the County Emergency Operations Plan and other emergency planning documents. The City of Concord and the City of Kannapolis each have a city emergency operation plan in place.
- ◆ Stanly County maintains a countywide Emergency Operations Plan that addresses emergency operations on behalf of all municipalities in the county. The Town of Badin, City of Locust, and Town of Oakboro have each adopted a municipal emergency operation plan as well.
- ◆ Union County Emergency Management maintains a countywide emergency operation plan that addresses emergency operations on behalf of all municipalities in the county. The City of Monroe also has an emergency operations plan that is administered by the city's Fire Department.

**Continuity of Operations Plan:** A continuity of operations plan establishes a chain of command, line of succession, and plans for backup or alternate emergency facilities in case of an extreme emergency or disaster event. In addition to general preparedness, communities can realize a number of benefits from having a COOP in place. For example, communities will have a greater capability to adapt to rapid changes in the operational environment and improve the overall effectiveness of their governance by identifying essential functions, processes, and communication methods among various agencies and people within the governing structure.

- ◆ Cabarrus County, the City of Concord, Stanly County, the Town of Oakboro, Union County, and all of the municipalities in Union County, excluding the Town of Indian Trail and the Village of Wesley Chapel, have adopted continuity of operations plans.

### 7.3.2 General Planning

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

**Comprehensive Land Use Plan:** A comprehensive land use plan establishes the overall vision for what a community wants to be and serves as a guide for future governmental decision making. Typically, a comprehensive plan contains sections on demographic conditions, land use, transportation elements, and community facilities. Given the broad nature of the plan and its regulatory standing in many

communities, the integration of hazard mitigation measures into the comprehensive plan can enhance the likelihood of achieving risk reduction goals, objectives, and actions.

- ◆ Cabarrus County has adopted individual small area plans that comprise a comprehensive land use plan. The Town of Harrisburg is utilizing a comprehensive plan partnered with the county. The County also has adopted two older area plans with Midland and Mount Pleasant who have also, more recently, developed their own comprehensive land use plans that Cabarrus County did not adopt. All of the remaining municipalities in Cabarrus County have adopted their own comprehensive land use plans.
- ◆ Stanly County has adopted a county land use plan. All of the municipalities in Stanly County, with the exception of the Towns of Badin, New London, and Richfield, have also adopted land use plans.
- ◆ Union County has also adopted a comprehensive land use plan which applies to the unincorporated county, and the Town of Hemby Bridge. All of the remaining municipalities in Union County have adopted comprehensive plans.

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

- ◆ Cabarrus County and all of its municipalities have each developed a capital improvements plan.
- ◆ Stanly County, the Cities of Albemarle and Locust, and the Towns of Norwood, Oakboro, and Stanfield each have a capital improvements plan in place.
- ◆ Union County, the Towns of Indian Trail, Stallings, and Waxhaw, the City of Monroe, and the Village of Wesley Chapel also have capital improvements plans to guide the schedule of spending on public improvements.

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

- ◆ Union County is the only participating county that has a historic preservation plan. The following municipalities also have historic preservation plans: the Town of Badin, the Town of Oakboro, the City of Monroe, the Town of Waxhaw, the Town of Weddington, and the Village of Wesley Chapel.

**Zoning Ordinance:** Zoning represents the primary means by which land use is controlled by local governments. As part of a community's police power, zoning is used to protect the public health, safety,

and welfare of those in a given jurisdiction that maintains zoning authority. A zoning ordinance is the mechanism through which zoning is typically implemented.

- ◆ All of the jurisdictions participating in this multi-jurisdictional plan have adopted zoning ordinances.
- ◆ The Cabarrus County Zoning ordinance does not allow development in the floodplain for new subdivisions and requires anything over five lots to incorporate floodplain into the required open space.

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

- ◆ All of the jurisdictions participating in this multi-jurisdictional plan, with the exception of the Town of Badin and the Village of Misenhiemer, have subdivision regulations in place.

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

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

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

In conducting the assessment, ISO collects information related to personnel qualification and continuing education as well as the number of inspections performed per day. This type of information combined with local building codes is used to determine a grade for that jurisdiction. The grades range from 1 to 10 with a BCEGS grade of 1 representing exemplary commitment to building code enforcement and a grade of 10 indicating less than minimum recognized protection.

### 7.3.4 Floodplain Management

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

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

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

---

<sup>3</sup>Participation in BCEGS is voluntary and may be declined by local governments if they do not wish to have their local building codes evaluated

Table 7.2 provides NFIP policy and claim information for each participating jurisdiction in the Cabarrus Stanly Union Region.

**TABLE 7.2: NFIP POLICY AND CLAIM INFORMATION**

Jurisdiction	Date Joined NFIP	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Closed Claims	Total Payments to Date
<b>CABARRUS COUNTY†</b>	05/05/81	11/16/18	184	\$ 50,142,700	80	\$1,819,530
Concord	03/04/80	11/16/18	138	\$ 40,265,700	8	\$85,365
Harrisburg	06/30/76	11/16/18	66	\$ 16,035,500	33	\$632,626
Kannapolis	03/25/91	11/16/18	70	\$ 17,049,700	8	\$740,979
Midland	06/01/09	11/16/18	2	\$ 299,000	0	\$0
Mount Pleasant	02/24/12	11/16/18	0	\$0	0	\$0
<b>STANLY COUNTY†</b>	12/01/81	11/16/18	26	\$ 7,383,700	4	\$29,767
Albemarle	12/01/81	06/16/09	42	\$ 6,885,800	25	\$351,636
Badin	09/24/02	06/16/09	1	\$ 175,000	0	\$0
Locust	05/29/03	11/16/18	1	\$ 350,000	0	\$0
Misenhiemer	02/17/10	06/16/09	1	\$ 269,100	0	\$0
New London	08/11/10	(NSFHA)	0	\$0	0	\$0
Norwood	09/21/00	06/16/09(M)	1	\$ 350,000	1	\$6,707
Oakboro	09/21/00	06/16/09	5	\$ 1,365,000	1	\$10,622
Red Cross	07/29/10	06/16/09	0	\$0	0	\$0
Richfield	01/31/12	06/16/09(M)	2	\$ 260,800	0	\$0
Stanfield	07/15/10	11/16/18	1	\$ 28,000	0	\$0
<b>UNION COUNTY†</b>	07/18/83	02/19/14	224	\$ 60,340,800	18	\$209,334
Fairview	06/09/09	11/16/18	4	\$ 1,175,600	0	\$0
Hemby Bridge	11/09/09	02/19/14	0	\$0	0	\$0
Indian Trail	03/21/80	02/19/14	91	\$ 25,683,300	5	\$39,610
Lake Park	08/17/99	03/02/09	4	\$ 1,260,000	0	\$0
Marshville	12/15/09	03/02/09	4	\$ 512,100	0	\$0
Marvin	12/28/98	02/19/14	17	\$ 5,665,100	0	\$0

**SECTION 7: CAPABILITY ASSESSMENT**

Jurisdiction	Date Joined NFIP	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Closed Claims	Total Payments to Date
Mineral Springs	05/17/00	03/02/09	1	\$ 350,000	0	\$0
Monroe	01/19/83	03/02/09	33	\$ 7,821,300	2	\$13,020
Stallings	04/05/94	02/19/14	27	\$ 6,681,000	1	\$11,357
Unionville	09/25/09	03/02/09	5	\$ 1,096,200	0	\$0
Waxhaw	12/28/98	03/02/09	29	\$ 8,002,400	0	\$0
Weddington	05/03/99	02/19/14	17	\$ 5,229,800	0	\$0
Wesley Chapel	03/12/00	03/02/09	13	\$ 4,235,000	0	\$0
Wingate	02/12/82	03/02/09	6	\$ 1,036,600	0	\$0

\*Includes unincorporated areas of county only  
(NSFHA) – No Special Flood Hazard Area – All Zone C  
(M) – No Elevation Determined, all Zone A, C and X  
Source: NFIP Community Status information as of 9/9/13; NFIP claims and policy information as of 6/30/13

All jurisdictions listed above that are participants in the NFIP will continue to comply with all required provisions of the program and will work to adequately comply in the future utilizing a number of strategies. For example, the jurisdictions will coordinate with NCEM and FEMA to develop maps and regulations related to special flood hazard areas within their jurisdictional boundaries and, through a consistent monitoring process, will design and improve their floodplain management program in a way that reduces the risk of flooding to people and property.

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

**TABLE 7.3: CRS PREMIUM DISCOUNTS, BY CLASS**

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

Source: FEMA

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

- ◆ Cabarrus County (Class 8) and the City of Concord (Class 8) are the only two jurisdictions that currently participate in the CRS. Participation in the CRS program should be considered as a mitigation action by the other counties and municipalities. The program would be most beneficial to Union County, which has 224 NFIP policies.

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

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

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

- ◆ Stanly County has adopted a floodplain management plan. The Towns of Badin, Norwood, and Oakboro have also adopted floodplain management plans.
- ◆ Union County has a floodplain management plan in place that also applies to the Town of Hemby Bridge since the county holds planning jurisdiction within that municipality. The Town of Indian Trail, Town of Marshville, Village of Marvin, Town of Mineral Springs, City of Monroe, Town of Stallings, Town of Waxhaw, Town of Weddington, and Village of Wesley Chapel also have floodplain management plans.

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

- ◆ Cabarrus County has developed the Livable Community Blueprint (parks and bicycle/pedestrian plan) for the unincorporated county and all of its municipalities, excluding Midland. The county and all of its municipalities have also adopted the Carolina Thread Trail Master Plan for Cabarrus County Communities and Cabarrus County has also developed a Parks and Recreation Plan through their Active Living and Parks Department.
- ◆ Stanly County has adopted the Stanly County Park, Recreation, and Trails Master Plan as well as the Carolina Thread Trail Master Plan for Stanly County Communities. The Town of Oakboro and the Town of Stanfield have also developed municipal-level plans.
- ◆ Union County has adopted the Union County Parks and Recreation Master Plan as well as the Carolina Thread Trail Master Plan for Union County Communities. All of the municipalities within the county have adopted these plans or developed municipal-level plans, with the exception of the Town of Unionville.

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

- ◆ Cabarrus County has adopted storm water management ordinance and is subject to Phase 2 Post Construction Permitting with the State.
- ◆ The Town of Stanfield is the only jurisdiction in Stanly County that has adopted a stormwater ordinance; however, the City of Albemarle, the City of Locust, and Town of Oakboro all include stormwater regulations in other local ordinances.
- ◆ Union County and all of its municipalities have a stormwater management plan and/or ordinance in place, with the exception of the Town of Hemby Bridge.

### 7.3.5 Administrative and Technical Capability

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

Technical capability can generally be evaluated by assessing the level of knowledge and technical

**SECTION 7: CAPABILITY ASSESSMENT**

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

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

**TABLE 7.4: RELEVANT STAFF / PERSONNEL RESOURCES**

Staff / Personnel Resource	CABARRUS COUNTY										STANLY COUNTY										UNION COUNTY									
	Concord	Harrisburg	Kannapolis	Midland	Mount Pleasant	Albemarle	Badin	Locust	Misenhiemer	New London	Norwood	Oakboro	Red Cross	Richfield	Stanfield	Fairview	Hemby Bridge	Indian Trail	Lake Park	Marshville	Marvin	Mineral Springs	Monroe	Stallings	Unionville	Waxhaw	Weddington	Wesley Chapel	Wingate	
Planners with knowledge of land development / land management practices	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Engineers or professionals trained in construction practices related to buildings	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Planners or engineers with an understanding of natural and/or human-caused hazards	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Emergency Manager	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Floodplain Manager	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Land Surveyors																														
Scientists familiar with the hazards of the community	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Staff with education or expertise to assess the community's vulnerability to	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Personnel skilled in GIS and/or Hazus	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Resource development staff or grant writers																	✓					✓	✓			✓	✓	✓	✓	

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

and Water Conservation Department. Credit was also given for having staff with education or expertise to assess the community’s vulnerability to hazards if a staff member from the jurisdiction was a participant on the existing hazard mitigation plan’s planning committee.

### 7.3.6 Fiscal Capability

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

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

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

TABLE 7.5: RELEVANT FISCAL RESOURCES

Fiscal Tool / Resource	CABARRUS COUNTY						STANLY COUNTY						UNION COUNTY																	
	Concord	Harrisburg	Kannapolis	Midland	Mount Pleasant		Albemarle	Badin	Locust	Misenhiemer	New London	Norwood	Oakboro	Red Cross	Richfield	Stanfield	Fairview	Hemby Bridge	Indian Trail	Lake Park	Marshville	Marvin	Mineral Springs	Monroe	Stallings	Unionville	Waxhaw	Weddington	Wesley Chapel	Wingate
Capital Improvement Programming	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓			✓	✓		✓	✓	✓		✓	✓		✓	✓	✓	✓	✓
Community Development Block Grants (CDBG)	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Special Purpose Taxes (or taxing districts)	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓				✓							✓						
Gas / Electric Utility Fees		✓													✓									✓						
Water / Sewer Fees		✓		✓			✓	✓	✓		✓	✓	✓	✓	✓	✓				✓				✓						✓
Stormwater Utility Fees		✓		✓					✓										✓	✓				✓	✓					
Development Impact Fees																														
General Obligation, Revenue, and/or Special Tax Bonds							✓										✓						✓	✓						
Partnering Arrangements or Intergovernmental Agreements	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Other: HMGP, FMAP, PDM, EMPG, PA, other Federal and state funding sources, etc.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

### 7.3.2 Political Capability

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

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

- ◆ The previous county hazard mitigation plans identified existing ordinances that address natural hazards or are related to hazard mitigation such as emergency management, flood damage prevention, watershed protection, soil erosion and sedimentation control, zoning, and subdivision.
- ◆ Cabarrus County is committed to incorporating hazard mitigation planning and activities into county operations. Many of the mitigation strategies are in effect through existing county ordinances, most notably the Flood Damage Prevention Ordinance.
- ◆ At this time, it is felt that political leadership in Stanly County would be hesitant to enact any policy that would limit industrial or business growth.
- ◆ Union County is committed to promoting safety and disaster readiness through a variety of existing ordinances and policies.

## 7.4 CONCLUSIONS ON LOCAL CAPABILITY

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

The overall capability to implement hazard mitigation actions varies among the participating jurisdictions. For planning and regulatory capability, the majority of the larger jurisdictions are in the high range and the majority of the smaller jurisdictions are in the moderate range. There is also some variation in the administrative and technical capability among the jurisdictions with larger jurisdictions generally having greater staff and technical resources. The majority of the jurisdictions are in the moderate range for fiscal capability.

**Table 7.6** shows the results of the capability assessment using the designed scoring methodology. The capability score is based solely on the information found in existing hazard mitigation plans and readily available on the jurisdictions’ government websites. According to the assessment, the average local capability score for all jurisdictions is 38.8, which falls into the moderate capability ranking.

**TABLE 7.6: CAPABILITY ASSESSMENT RESULTS**

Jurisdiction	Overall Capability Score	Overall Capability Rating
<b>CABARRUS COUNTY</b>	<b>45</b>	<b>High</b>
Concord	51	High
Harrisburg	34	Moderate
Kannapolis	44	High
Midland	35	Moderate
Mount Pleasant	32	Moderate
<b>STANLY COUNTY</b>	<b>51</b>	<b>High</b>
Albemarle	36	Moderate
Badin	33	Moderate
Locust	38	Moderate
Misenhiemer	24	Moderate
New London	23	Moderate
Norwood	34	Moderate
Oakboro	43	High
Red Cross	25	Moderate
Richfield	26	Moderate
Stanfield	30	Moderate
<b>UNION COUNTY</b>	<b>56</b>	<b>High</b>
Fairview	44	High
Hemby Bridge	30	Moderate
Indian Trail	48	High
Lake Park	38	Moderate

<b>Jurisdiction</b>	<b>Overall Capability Score</b>	<b>Overall Capability Rating</b>
Marshville	45	High
Marvin	40	High
Mineral Springs	44	High
Monroe	53	High
Stallings	45	High
Unionville	32	Moderate
Waxhaw	48	High
Weddington	44	High
Wesley Chapel	43	High
Wingate	33	Moderate

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

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

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

# SECTION 8

## MITIGATION STRATEGY

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

- ◆ 8.1 Introduction
- ◆ 8.2 Mitigation Goals
- ◆ 8.3 Identification and Analysis of Mitigation Techniques
- ◆ 8.4 Selection of Mitigation Techniques for the Cabarrus Stanly Union Region
- ◆ 8.5 Plan Update Requirement

### 8.1 INTRODUCTION

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

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

The first step in designing the Mitigation Strategy includes the identification of mitigation goals. Mitigation goals represent broad statements that are achieved through the implementation of more specific mitigation actions. These actions include both hazard mitigation policies (such as the

regulation of land in known hazard areas through a local ordinance) and hazard mitigation projects that seek to address specifically targeted hazard risks (such as the acquisition and relocation of a repetitive loss structure).

The second step involves the identification, consideration, and analysis of available mitigation measures to help achieve the identified mitigation goals. This is a long-term, continuous process sustained through the development and maintenance of this Plan. Alternative mitigation measures will continue to be considered as future mitigation opportunities are identified, as data and technology improve, as mitigation funding becomes available, and as this Plan is maintained over time.

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

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

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

### **8.1.1 Mitigation Action Prioritization**

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

- ◆ Effect on overall risk to life and property
- ◆ Ease of implementation
- ◆ Political and community support

- ◆ A general economic cost/benefit review<sup>1</sup>
- ◆ Funding availability
- ◆ Continued compliance with the NFIP

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

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

As the actions were reviewed as part of the 2020 update of the plan, each community was asked to review the priority assigned to each action and ensure that the priority had not changed. If the priority of a particular action did change, the participating jurisdictions were asked to revise those priorities accordingly using same criteria as defined above.

## 8.2 MITIGATION GOALS

### 44 CFR Requirement

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

The primary goal of all local governments is to promote the public health, safety, and welfare of its citizens. In keeping with this standard, Cabarrus, Stanly and Union counties and the participating municipalities have developed four goal statements for local hazard mitigation planning in the region. In developing these goals, the project consultant reviewed the goals from the previous plan and discussed them with the Regional Planning Committee.

The proposed regional goals were presented, reviewed, voted on, and accepted by the Planning Committee at their second meeting. Minimal revisions to the wording of the goals were made. Each goal, purposefully broad in nature, serves to establish parameters that were used in developing more mitigation actions. The Cabarrus Stanly Union Regional Mitigation Goals are presented in Table 8.1. Consistent implementation of actions over time will ensure that community goals are achieved.

---

<sup>1</sup> Only a general economic cost/benefit review was considered by the Regional Hazard Mitigation Planning Committee through the process of selecting and prioritizing mitigation actions. Mitigation actions with “high” priority were determined to be the most cost effective and most compatible with the participating jurisdictions’ unique needs. “Medium” and “Low” priority actions were labeled as such because they had a medium and lower qualitative benefit respectively when evaluated against the six factors used to determine action priority. A more detailed cost/benefit analysis will be applied to particular projects prior to the application for or obligation of funding, as appropriate

**TABLE 8.1: CABARRUS STANLY UNION REGIONAL MITIGATION GOALS**

Goal	
Goal #1	Decrease the community’s vulnerability to impacts from future hazard events.
Goal #2	Increase the community’s resiliency and internal capabilities so that response and recovery can be quicker and more cost-effective.
Goal #3	Enhance existing county ordinances, regulations, and policies that will reduce the potential damage from hazards.
Goal #4	Protect public health, safety, and welfare.

## 8.3 IDENTIFICATION AND ANALYSIS OF MITIGATION TECHNIQUES

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

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

### 8.3.1 Prevention

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

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

### 8.3.2 Property Protection

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

- ◆ Acquisition
- ◆ Relocation
- ◆ Building elevation
- ◆ Critical facilities protection
- ◆ Retrofitting (e.g., windproofing, floodproofing, seismic design techniques, etc.)
- ◆ Safe rooms, shutters, shatter-resistant glass
- ◆ Insurance

### **8.3.3 Natural Resource Protection**

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

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

### **8.3.4 Structural Projects**

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

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

### **8.3.5 Emergency Services**

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

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

### **8.3.6. Public Education and Awareness**

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

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

## 8.4 SELECTION OF MITIGATION TECHNIQUES FOR THE CABARRUS STANLY UNION REGION

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

## 8.5 PLAN UPDATE REQUIREMENT

In keeping with FEMA requirements for plan updates, the Mitigation Actions identified in the previous Version of the regional hazard mitigation plan were evaluated to determine their 2020 implementation status. Updates on the implementation status of each action are provided. Any changes to the relative priority of the actions are noted as well. The mitigation actions provided in Section 9: *Mitigation Action Plan* include the mitigation actions from the previous plans as well as any new mitigation actions proposed through the 2020 planning process. Actions identified as completed in the 2014 version of the plan have been moved to Appendix E.

# SECTION 9

## MITIGATION ACTION PLAN

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

- ◆ 9.1 Overview
- ◆ 9.2 Mitigation Action Plans

### 44 CFR Requirement

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

## 9.1 OVERVIEW

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

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

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

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

- ◆ Implementation Status (2020)—Indication of completion, progress, deferment, or no change since the previous plan. If the action is new, that will be noted here.

## 9.2 MITIGATION ACTION PLANS

The mitigation actions proposed by each of the participating jurisdictions are listed in 32 individual MAPs on the following pages. **Table 9.1** shows the location of each jurisdiction's MAP within this section as well as the number of mitigation actions proposed by each jurisdiction.

**TABLE 9.1: INDIVIDUAL MAP LOCATIONS**

Location	Page	Number of Mitigation Actions
Cabarrus County	9:4	30
Concord	9:12	26
Harrisburg	9:19	18
Kannapolis	9:31	24
Midland	9:34	18
Mount Pleasant	9:38	15
Stanly County	9:43	3
Albemarle	9:51	19
Badin	9:61	5
Locust	9:63	4
Misenhiemer	9:64	2
New London	9:65	2
Norwood	9:66	5
Oakboro	9:67	6
Red Cross	9:70	2
Richfield	9:71	2
Stanfield	9:72	3
Union County	9:73	9
Fairview	9:76	4
Hemby Bridge	9:81	4
Indian Trail	9:83	6
Lake Park	9:84	7
Marshville	9:86	3
Marvin	9:87	3
Mineral Springs	9:88	5
Monroe	9:89	8
Stallings	9:101	5
Unionville	9:102	3
Waxhaw	9:103	10
Weddington	9:106	8
Wesley Chapel	9:107	7
Wingate	9:108	5

## Cabarrus County Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Review plan for debris removal and disposal.	Winter Storm	High	Emergency Management, County General Services	Local, EMPG	2025, Annually	Deferred. The plan was updated in February 2018 and will continue to be reviewed on an annual basis.
P-2	Review inclement weather plan for county transportation system.	Winter Storm	High	Emergency Management, Transportation	Local	2025, Annually	Deferred. The plan is reviewed annually and after each major incident and will continue to be reviewed on an annual basis.
P-3	Maintain Flood Damage Prevention Ordinance that is in compliance with state and federal regulations for floodplain management and best practices.	Severe Thunderstorm, Hurricane and Tropical Storm, Flood	High	Planning and Development, Board of Commissioners, Construction Standards	Local	2025	Adopted new maps and updated state model ordinance on October 15, 2018.
P-4	Maintain freeboard of minimum 2' above BFE which exceeds model ordinance requirement of 1'.	Severe Thunderstorm, Hurricane and Tropical Storm, Flood	High	Planning and Development, Board of Commissioners, Construction Standards	Local	The ordinance will remain as it is until changes occur at state or federal level and/or county is advised to change.	Deferred. Current Flood Damage Prevention Ordinance is in compliance and will remain until changes occur at state or federal level. Requirement for 2' freeboard exceeds minimum 1' requirement established in model ordinance. Updated Fall 2018.
P-5	Adopt revised floodplain maps in a timely manner when received from FEMA.	Severe Thunderstorm, Hurricane and Tropical Storm, Flood	High	FEMA, NCEM, Planning and Development, Board of Commissioners	Local	When new maps are provided.	Deferred. Updated maps were provided by FEMA in November of 2018. Revised maps will be adopted and FDPO language revised to reflect new dates as needed.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding	Implementation Schedule	Implementation Status (2020)
P-6	Continue participation in the Community Rating System to assist with insurance rates for unincorporated Cabarrus County properties subject to maintaining flood insurance.	Severe Thunderstorm, Hurricane and Tropical Storm, Flood	Moderate	Planning and Development	Local	2025, The County completes recertification forms on an annual basis.	Deferred. Cabarrus County continues to participate in the NFIP CRS Program which applies to unincorporated county properties. Recertification is required each year with the next scheduled on site audit for Cabarrus County to take place in 2021. Yearly recertification required through ISO and due by August to maintain CRS Program status.
P-7	Maintain policies that discourage growth in flood hazard areas.	Flood	Moderate	Board of Commissioners, Municipalities	Local	2025, Policies will be reviewed and updated annually.	Deferred. In 2005, the Cabarrus County zoning ordinance regulations were updated to include a requirement that for any new subdivisions, the floodplain must be included as part of the new space for new subdivisions over 5 lots. As part of the permitting process, staff provides guidance to applicants regarding alternate placement of structures to avoid locating in regulated floodplain.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding	Implementation Schedule	Implementation Status (2020)
P-8	Set up centralized, coordinated permitting process, including effective filing/permitting system to ensure compliance with floodplain regulations. Count building improvements cumulatively (maintain permit history so when cumulative improvements equal 50% of building value, (substantial improvement) building must be brought up to flood protection standards for new construction). Goal to eventually have all flood hazard endangered buildings brought up to flood protection standards.	Flood	High	Information Technology Systems	Local	2025, This action will be reviewed annually to document progress.	Deferred. Each jurisdiction is responsible for its own floodplain development permitting. If a building is considered a substantial improvement, the current construction code must be used. Centralized building permitting and inspections.
P-9	Amend Recreation Plan to provide for integration of publicly acquired land into park or greenway system so hazardous areas remain undeveloped in perpetuity (much more effective than removing structures from isolated parcels).	Flood	Moderate	Planning and Development, FEMA, DENR, NC Parks and Recreation	Local	2025	Deferred. Both County and School System sites typically include ball fields/park areas in floodplain areas.
P-10	Review and update hazard mitigation plan.	Flood	Moderate	Planning and Development, Emergency Management, Board of Commissioners, Municipalities, FEMA, DENR	Local	2025	Deferred. Currently underway, plan is reviewed and updated annually and after each major incident, complete update performed every 5 years.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding	Implementation Schedule	Implementation Status (2020)
P-11	Monitor hazard mitigation plan to ensure schedules met.	All Hazards	Moderate	Planning and Development, Emergency Management	Local	2025, Annually	Deferred. The County has reviewed the Mitigation Action Plan using the procedures prescribed in the Plan Maintenance Procedures. These procedures will be used to review and update the hazard mitigation plan on an annual basis.
P-12	Develop tracking system to evaluate progress and revise mitigation strategies as necessary.	All Hazards	Moderate	Planning and Development, Emergency Management	Local	2025, Annually	Deferred. The County has reviewed the Mitigation Action Plan using the procedures prescribed in the Plan Maintenance Procedures. These procedures will be used to monitor the hazard mitigation plan on an annual basis. Mitigation strategies and action plan review required as part of annual CRS program renewal process.
<b>Property Protection</b>							
PP-1	Consider prohibiting construction or substantial improvement of buildings within the 100 year floodplain.	Flood	Moderate	Board of Commissioners, Municipalities, Construction Standards	Local	1-2 years	Deferred: Ordinance currently permits development in the 100 year floodplain, if it is an existing subdivision lot or part of a minor subdivision, and if there is zero net loss in the end. For any new lots in major subdivisions, 100 year would have to be included in the open space for the development. New subdivisions submitted with over 10 lots will be required to include floodplain in open space for development.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding	Implementation Schedule	Implementation Status (2020)
PP-2	Acquire properties susceptible to flood damage (voluntary program).	Flood	Low	Planning and Development, Parks, DENR, NCEM	Federal, State, Local	As funds are available, 2025	Deferred. No properties qualify for SRL in unincorporated areas of the County. There are 8 repetitive loss properties in the County which should be considered for mitigation. This action will be revisited during the 2024 update of the hazard mitigation plan.
PP-3	Identify properties for public acquisition.	Flood	Low	Planning and Development, FEMA, NCEM, DENR	Federal, State, Local	2025	Deferred. No properties have been acquired as of 2019. This action will be revisited during the 2025 update of the hazard mitigation plan.
PP-4	Establish a list of priority properties for acquisition in the event of a future natural disaster.	Flood	Low	Planning and Development, FEMA, NCEM, DENR	Federal, State, Local	2025	Deferred. Properties have been identified, will monitor events and update list as applicable. This action will be revisited during the 2025 update of the hazard mitigation plan.
PP-5	Evaluate safety and security of critical services (public and private) and facilities—roads, bridges, water, sewer, electricity, etc.—and critical facilities— fire, rescue, medical, etc.	Flood	High	Board of Commissioners, Emergency Management, WSACC, Power and Gas Companies, Carolinas	Local	2025	Deferred. Due to growth of county, continual review required because of changes to streams and flow.
PP-6	Evaluate flood or access problems for critical facilities; develop recommendations for protecting critical sites, e.g., law enforcement, EMS, and fire service facilities, and command centers. Identify alternate command posts.	Flood	High	Emergency Management, Municipalities, Sheriff, EMS	Local	2025	Deferred. Due to growth of county, continual review required because of changes to streams and flow.
<b>Structural Projects</b>							

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding	Implementation Schedule	Implementation Status (2020)
SP-1	Debris removal program/problem site corrections.	Flood	Moderate	Emergency Management	Local	2025, Debris plan reviewed annually.	Deferred. Will review debris plan annually and after major events, formalize use of temporary debris sites with municipalities. Plan reviewed and updated in 2018.
<b>Emergency Services</b>							
ES-1	Evaluate access problems caused by snow or ice for critical facilities; develop recommendations for clearing critical sites, e.g., law enforcement, EMS, and fire service facilities/command centers. Identify alternate command posts.	Winter Storm	High	Emergency Management, County General Services	Local	2025	Deferred facilities evaluation. Will monitor those after each major event, and will evaluate new facilities as they are developed, as new hazards arise.
ES-2	Ensure adequate evacuation time in case of major hazard event, when feasible and county is alerted in a timely manner.	All Hazards	Moderate	Emergency Management, Municipalities, Sheriff	Local	2025	Deferred evaluation, evacuation plans developed and will be reviewed annually and after major events.
ES-3	Evaluate areas with limited evacuation capacity and develop methods for improving evacuation routes and methods.	Flood	Moderate	Emergency Management, Municipalities, NCDOT	Local	2025	Deferred evaluation, evacuation plans developed and will be reviewed annually and after major events.
ES-4	Continue development of Hazard Warning and Response procedures— warning and evacuation of critical facilities, getting persons out of flood prone or isolated areas, controlling vehicles on evacuation routes, evacuation of hazard materials.	Flood	High	Emergency Management, Municipalities, Sheriff	Local	2025	Deferred due to growth and changing environmental hazards.
<b>Public Education and Awareness</b>							

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding	Implementation Schedule	Implementation Status (2020)
PEA-1	Increase public awareness of the effects of winter weather on structures, power lines, trees, and how to prepare for this hazard.	Winter Storm	Moderate	Emergency Management, Red Cross	Local	1-2 years	Deferred. County and EM has social media presence on various platforms to disseminate information.
PEA-2	Increase public awareness of pending weather events through use of CTY system, media, county website, and local social media sites.	All Hazards	High	Emergency Management, Planning and Development, Communications	Local	2025	Deferred. County and EM has social media presence on various platforms to disseminate information.
PEA-3	Keep citizens informed of changing conditions and behavioral cautions during weather events.	Severe Thunderstorm, Hurricane and Tropical Storm, Winter Storm, Tornado	High	Emergency Management, Planning and Development, Communications	Local	2025	Deferred. Continue coordination with PIO to push information out to citizens in a timely manner.
PEA-4	Work through Water and Sewer Authority of Cabarrus County to ensure the public is fully informed of and the building permit process incorporates restrictions on providing service within the 100 year floodplain.	Flood	Moderate	Planning and Development, WSACC	Local	2025	Deferred. WSACC not subject to zoning or building permitting for building lines. Sewer is typically built near the streams and in the floodplain. CHA does not allow septic systems to be permitted in floodplain.
PEA-5	Maintain hazard awareness program materials in office and on website and include links to FEMA and NCEM related resources.	Severe Thunderstorm, Hurricane and Tropical Storm, Winter Storm, Tornado	Moderate	Emergency Management, Planning and Development, Communications	Local	2025	Deferred. Materials available in various office locations throughout the County as well as informational literature on flooding in the Public Library.
PEA-6	Participate in FEMA, National Weather Service, NCEM, and Ready.gov yearly Awareness Campaigns for Severe Weather, including Flood Safety Awareness week, Lightning Safety Awareness week, and Severe Weather Awareness week.	Severe Thunderstorm, Hurricane and Tropical Storm, Winter storm, Tornado	High	Emergency Management, Planning and Development, Communications	Local, State, Federal	2025	Deferred. Publicize information in a timely manner via media, county website, and social media sites and to encourage participation in various activities.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding	Implementation Schedule	Implementation Status (2020)
PEA-7	Establish locations for flood awareness signs. Show elevations of high water in areas that flood; the base flood plus two feet. Signs should be surveyed to serve as elevation reference marks.	Flood	Low	Planning and Development, Municipalities, Emergency Management, FEMA, DENR, NCDOT	Local	2025	Deferred. Pending Funding. Will work with state agencies to complete sign placement if funding becomes available.

## City of Concord Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Integrate the goals and action items from the Hazard Mitigation Plan into existing regulatory documents and programs where appropriate.	All Hazards	Moderate	All Departments	Local	2025	Mitigation goals and action items continue to be integrated into municipal plans and policies such as the latest revision to the floodplains.
P-2	Continue the role of the City of Concord Emergency Planning Committee in monitoring the process for implementing, monitoring, and evaluating citywide mitigation activities.	All Hazards	Moderate	Emergency Management	Local	2025	The CEPC is no longer functional and recommendations have been made to re-convene the Committee or establish an Incident Management Team. The goal of either is to assist in the coordination and development of municipal emergency plans.
P-3	Develop public and private partnerships to foster natural hazard mitigation program and collaboration in the City of Concord.	All Hazards	Moderate	Emergency Management	Local	2025	The Recognized Neighborhood program continues to grow with 69 neighborhoods. EM continues to participate in national/state programs such as National Prevention Month, Cyber Security Month, and Severe Weather awareness month.
P-4	Develop inventories of at-risk buildings and infrastructure and prioritize mitigation projects.	All Hazards	High	Emergency Management, Building and Grounds	Local	2025	The recent FEMA revision to the floodplain has incorporated the Old South Area. Inventories of at-risk structures are identified through the flood plain mapping and is available.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
P-5	Drainage basin master planning to establish system capacities, flood vulnerability, and establish CIP needs.	Flood	High	Stormwater	Local, Stormwater fees	Annually	Flood vulnerability has incorporated the new flood study and incidents are documented annually. Identified problems are reported, evaluated and corrected as needed.
P-6	Review all development codes and ordinances to ensure that they include appropriate flood and natural hazard mitigation strategies.	All Hazards	Moderate	Business and Neighborhoods, Code Enforcement, Police	N/A	Annually	Recommend keeping this item in progress to address future changes in flood and mitigation strategies are appropriately incorporated into development codes and ordinances.
P-7	Provide disaster preparedness training for city employees.	All Hazards	Moderate	Emergency Management	Department of Fire and Life Safety, Department of Justice, FEMA, DHS, Citizen Corps, CERT	Annually	This has been implemented with various classes, assessments and exercises given to and incorporating all city departments. Continuing preparedness training is important to meet the ever changing risk environment and we recommend keeping this as an in progress action.
P-8	Conduct Emergency and Disaster Drills and Exercises for Departments.	All Hazards	Moderate	Emergency Management	Department of Justice, FEMA, DHS	Annually	Recommendation to maintain this as in progress. During 2019, the City conducted or participated in 11 exercises/drills including the National Tabletop Exercise program. Drills/Exercises were HSEEP compliant.
<b>Property Protection</b>							

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PP-1	Conduct annual risk assessment of critical facilities.	All Hazards	High	Emergency Management, Fire	Local	Annually	129 risk assessments were conducted by Emergency Management for various facilities in the City including the electrical and water infrastructure. The fire department conducts inspections of schools and each school is evaluated in March for the Statewide tornado drill.
PP-2	Identify structures in new floodplain area (based on mapping above) and initiate mitigation efforts for repetitive loss.	Flood	High	Emergency Management, Business and Neighborhoods, Stormwater	Local	Annually	With the incorporation of new areas in the Floodplain continue this process to address the feasibility and cost/benefit of implementing mitigation measures for repetitive loss.
PP-3	Evaluate the feasibility of acquisition or elevation of flood prone structures.	Flood	High	Stormwater, Emergency Management, Water Resources	PDM, HMGP, FMA, CDBG, NFIP ICC	Annually	Maintain this item as the property listed has been included in the recent floodplain study.
<b>Natural Resource Protection</b>							
NRP-1	Use technical knowledge of natural hazards and events to link natural resource management and land use organizations to mitigation activities and technical assistance.	All Hazards	Moderate	Business and Neighborhoods, Environmental	Business and Neighborhoods, NOAA, FMA, HMGP, PDM	2025	New Greenway areas continue to be identified and developed. The City has implemented the NWS "Turn-Around-Don't Drown program to raise awareness of flood prone transportation infrastructure.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Structural Projects</b>							
SP-1	Develop a plan to identify and address cleaning of problematic street drainage sites, including the creation of an emergency response team.	Flood	High	Stormwater	Local, Stormwater Services	Annually	Proactive maintenance program is in place. Routine video inspection and vacuum cleaning occurs daily.
<b>Emergency Services</b>							
ES-1	Maintain resources to adequately control traffic such as barricades, barriers, cones, and signs.	All Hazards	Moderate	Transportation Fire PD	Transportation	Annually	While this action is in progress, it has been several years since the I-85 detour routes have been updated. I-85 has changed along with the associated transportation infrastructure. Recommend keeping this active until all changes associated with I-85 have been completed and if new detour routes are needed.
ES-2	Develop Emergency Operations Plans for dams.	Flood	Moderate	Water Res. EM WSAAC	Local	Annually	The current plans are in need of revision. This was identified in a Regional Dam exercise conducted in 2018. Items identified in the After Action Report need to be addressed and mitigation items such educating property owners within the inundation area completed.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
ES-3	Develop evacuation and detour routes.	All Hazards	High	Trans PD Fire	N/A	2025	Concord is in the process of developing an evacuation annex though not specific to floods. The annex identifies the concept of operation and responsibilities for any evacuation. Four site specific routes are being developed for the downtown area, Carolina Mall, Concord Mills Mall, and Charlotte Motor Speedway.
ES-4	Equip Concord Fire and Life Safety for flood emergencies including swift water rescue.	Flood	Moderate	Fire	HMGP, Firefighter grants	2025	Concord Fire Department has developed and implemented a swift water rescue team. A listing of the available swift water rescue resources including barricades are maintained in Emergency Management.
ES-6	Develop automated flood warning system to include forecasting and warning.	Flood	High	Storm Water Transportation EM Engineering	Stormwater Services, NOAA, FMA, HGMP, PDM	2025	Maintain as per the comments listed. Cabarrus County is currently attempting to acquire a gage.
ES-7	Suggest implementing a program to identify local stream by signs located on bridges. This will assist in rescue situations and identifying run-off from hazardous material spills that have entered the water-way.	Flood, Hazardous Substances	High	EM Transportation Fire	EM Transportation Storm Water	2025	This is a new action.
<b>Public Education and Awareness</b>							

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PEA-1	Identify, improve, and sustain collaborative programs focusing on disaster education for public and private sector organizations and individuals to avoid activity that increases risk to natural hazards.	All Hazards	High	EM	Local	2025	Public safety education programs are still provided during Concord 101 and Public Safety Academy. A Ready Kids Camp has also been implemented and is a continuing success. New programs continue to be developed to address new risks such as Active Violence.
PEA-2	Implement spring public information campaign aimed at tornado, flood, and severe weather awareness to include information on safe rooms.	Tornado, Flood, Severe Thunderstorm	High	EM	Local, Stormwater Services, Emergency Management, Planning	Annually	The City continues to participate in Severe Weather awareness coinciding with North Carolina Severe Weather Awareness Month. This includes weekly information provided on Social Media and continuing the assessments of schools and facilities.
PEA-3	Evaluate "Turn around, don't drown" warning program.	Flood	High	Transportation	Local, Transportation	1 Year	Signs were implemented at several locations in the City. Several of these were on State Roads which have been removed and will need to be re-installed.
PEA-4	Strengthen emergency services preparedness and response by linking emergency services with hazard mitigation programs, enhancing public education on a citywide scale.	All Hazards	Moderate	Fire PD Storm Water EM	Local, Stormwater, Planning, FMA, HMGP	2025	Continue to monitor each flood event and identify any areas outside of the mapped flood plain. Recommend maintaining this program as in progress in order to identify potential new risk areas.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PEA-5	Develop public information and alerting system for dam failure based on plans.	Flood	High	Water Res. PIO EM	Local	Annually	Change status to new or in progress based on the results of the 2018 Regional Dam Failure Exercise, specifically the public education portion which was identified as lacking.
PEA-6	Continue emergency notification system (Connect CTY) to notify citizens of hazards and emergencies	All Hazards	Moderate	PIO	Local	Annually	Consideration of maintaining this as a new system is currently being considered in the area.
PEA-7	Improve the dissemination of hazard information, including maps, broadcasts, websites, list serves, and blogs.	All Hazards	Moderate	EM PIO	FEMA, ARC, Concord 101 and Public Safety Academy	2025	During Hurricanes Florence and Michael, social media was successfully used to disseminate information about the developing situation, including tracking charts and weather forecasts. During the event, status reports were provided to keep the community aware of the local impact and provide incident specific safety information such as detours.

## Town of Harrisburg Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
P-3	In conjunction with Cabarrus County Planning and Development Department, review/update flood damage prevention ordinance to ensure maximum protection from flood hazard events.	Flood	High	Town Council	Local	The ordinance will remain as it is until changes occur at state or federal level and/or county is advised to change.	Town Ordinance is in compliance with State/Federal requirements, Flood Plain Ordinance was recently changed to reflect the new FIRM maps that went to effect on November 2018.
P-5	Continue participation in the Community Rating System.	Flood	Moderate	Town Council	Local	2025	The Town is looking into the CRS requirements and possibly participating in the Program.
P-6	Review Town's zoning plan. As needed, adopt zoning in floodplain areas to better control future development in these areas.	Flood	High	Town Council, Planning and Zoning	Local	Annually	The Town updated its Land Use Plan and adopted in June of 2018, the plan identifies areas that needs to be protected. Town will initiate update of its Unified Development Ordinance (UDO) in 2019 and complete in 2020. Floodplain requirements will be revisited as part of UDO updates.
P-7	Update Small Area Plans. Delineate preferred growth areas and develop area plans for target locations.	Flood	High	Town Council, Planning and Zoning Board	Local	Annually	The Town's Land Use Plan (HALUP) illustrates the growth vision and preferred land use throughout the town. Moorehead Area Small Area Plan was completed in 2018 which was folded into the Harrisburg Area Land Use Plan (HALUP) update. HALUP also identifies few focus areas for growth and outlines growth vision and strategy.
P-9	Participate in the review of the county hazard mitigation plan. Ensure that all hazards and mitigation efforts for Harrisburg are addressed within the plan.	Flood	Moderate	Town Council	Local	Annually	The Town participated in the development of the regional hazard mitigation plan in the past and will continue its participation in the County's Hazard Mitigation Planning Process.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
P-10	Monitor hazard mitigation plan implementation to ensure schedules met.	All Hazards	Moderate	Town Council	Local	Annually	The Town continues to monitor its mitigation action plans and update as needed. Industrial sites hazard mitigation/prevention visits are made by Fire Safety Personnel periodically to ensure these industries have plans in place in case of emergency.
P-11	Coordinate with County Planning and Development Department in tracking repetitive loss in Harrisburg and Cabarrus County	Flood	Moderate	Town Council	Local	2025	Deferred. The Town continues to work on developing mitigation strategies for these properties. This action will be revisited during the 2025 update of the hazard mitigation plan.
<b>Property Protection</b>							
PP-5	Develop an open space plan, target properties for acquisition and fund acquisition program.	Flood	Moderate	Town Council, Planning and Zoning Board	State	As funds are available,	The Town's recently adopted Land Use Plan and the UDO emphasizes Open Space requirements as part of any new development, such requirements are outlined in the UDO for different land uses. Town reviews the opportunity of acquiring frequently flooded properties and determines actions on a case-by-case basis.
PP-6	Coordinate with Cabarrus County to establish list of priority properties and secure a funding source for acquisition in the event of a future natural disaster.	Flood	Moderate	Town Council, Planning and Zoning Board	Federal, State, Local	Annually	The Town is continuing outreach to these property owners to offer assistance as needed.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PP-7	Establish program for evaluation and improvement of critical services (public and private) water, sewer, electricity, etc.- and critical facilities- fire, rescue, medical, etc.	Flood	Low	Town Council, Harrisburg Fire Department, Harrisburg Emergency Coordinator, Harrisburg Public Works	Local	2025	The Town completed the Construction of Fire Station 3 in 2015 and Fire Station 2 construction completed in June 2019, this will ensure critical services are provided. Town is undertaking the construction of a new (2nd in Town) water tower in 2019 which will ensure required level of water need to provide fire services.
PP-8	Evaluate flood or access problems for critical facilities; develop recommendations for protecting critical sites, e.g., law enforcement, EMS, and fire service facilities, and the town hall. Identify alternate locations to direct response operations.	Flood	Moderate	Town Council, Harrisburg Fire Department	Local	2025	A DRAFT plan is in place, it will be reviewed and adopted by the Town in 2019.
<b>Emergency Services</b>							
ES-1	Evaluate access problems caused by snow or ice for critical facilities; develop recommendations for clearing critical sites, e.g. law enforcement, EMS, and fire service facilities and the town hall. Identify alternate sites to control response operations.	Winter Storm	High	Harrisburg Fire Department	Local	Annually	Access plan is in place, Town's Public Works crew assist the Fire Department to clear sites for access.
ES-2	Determine if there are any areas with limited evacuation capacity and develop methods for improving early warning and evacuation routes and methods.	Flood	Moderate	Harrisburg Fire Department, Town Council	Local	2025	The Town's Fire Department has several monitors installed on streams, more added as needed. Early warning and evacuation messages are released through town media personnel, social media and websites.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
ES-3	Evaluate early warning and response action. In the event of flooding, how will critical facilities be evacuated; how will the town government react to get persons out of flood-prone or isolated areas; how will vehicles on evacuation routes be controlled; and how will hazards materials be protected or evacuated.	Flood	High	Town Council, Harrisburg Fire Department, Harrisburg Emergency Coordinator	Local	2025	The Town utilizes tools such as Everbridge Mass Communication System and Reverse 911 system. Fire Department assist with response action for government and critical facilities, Sherriff's office maintains and control evacuation routes and Public Work staff monitors Pump Stations.
<b>Public Education and Awareness</b>							
PEA-1	Maintain current Early Warning System/Dissemination of information alerting town residents when to seek shelter when high winds or other hazards are expected.	All Hazards	Moderate	Town Council	Local	1-2 years	Town's IT system is upgraded to allow us to work remotely in case of emergency. The Everbridge Communication system, Fire Safety Education, Social Media and Town website are some of the tools utilized for early warning information dissemination.
PEA-2	Increase public awareness of the effects of winter weather on structures, power lines, trees, and how to prepare for this hazard.	Winter Storm	Moderate	Town Council, Harrisburg Fire Department	Local	1-2 years	Town's IT system is upgraded to allow us to work remotely in case of emergency. The Everbridge Communication system, Fire Safety Education, Social Media and Town website are some of the tools utilized for early warning information dissemination.
PEA-6	Establish locations for flood awareness signs, specifically where high risk flood areas intersect with public roadways.	Flood	Low	Town Council	Local	2025	The Town's Public Works crew will identify and install signs at high risk flood areas.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PEA-7	Increase public awareness of pending weather events through use of CTY system, media, county website, and local social media sites.	All Hazards	High	Emergency Management, Planning and Development, Communications	Local	2025	The Town's Communication Manager and Fire Dept. PIO work hand-in hand to ensure public is receiving accurate and timely information on weather events. Town's website and social media tools are utilized on a daily basis. Town Departments have plan in place for Emergency Evacuation and Town will soon embark on creating a Town wide Emergency Management Plan.

## City of Kannapolis Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Maintain stormwater management program as part of required NPDES Phase 2 permitting.	Flood	High	Public Works, Planning	Local	2025	This program is being implemented in conjunction w/ Woolpert Inc. & City Stormwater Maint. Staff
P-2	Preserve emergency water supply through existing planning process and agreements.	All Hazards	High	City Manager	Local	2025	New action for 2019, to be coordinated
P-3	Maintain comprehensive policy regarding drought management and response as part of local water supply planning process.	Drought	Moderate	City Manager, Public Works	Local	2025	New action for 2019, to be coordinated
P-4	Maintain current floodplain regulation standards.	Flood	Moderate	Public Works, Planning	Local	2025	This is implemented through the plan review & approval process
P-5	Restrict new construction to outside the 100 year flood area of a minimum 100 feet from the top of bank from perennial streams, whichever is greater.	Flood	Moderate	Public Works, Planning	Local	Mid 2020	UDO re-write currently in progress. Anticipated adoption date is Mid-2020
<b>Property Protection</b>							
PP-1	Maintain maps of mobile home parks as part of planning activities.	All Hazards	High	Planning, Public Works	Local	2025	This is implemented through the Planning and Public Works Departments
PP-2	Identify emergency shelters in Kannapolis.	All Hazards	High	Planning, Public works, Fire, Police	Local	2025	This is implemented through the Planning, Public Works, Fire and Police Departments
PP-3	Identify properties that can be utilized as temporary storage sites for debris.	All Hazards	High	Public Works, Planning	Public Works	2025	This is implemented through the Planning and Public Works Departments
PP-4	Establish on call contract agreements with qualified contractors for collection and removal of debris on affected areas.	All Hazards	High	Public Works	Public Works	2025	This is implemented through the Public Works Department

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PP-5	Maintain program for clearing debris from culverts and storm drains in priority areas as part of NPDES Phase 2 stormwater control standards.	Flood	Moderate	Public Works	Publics Works	2025	This is implemented by City Stormwater Maintenance staff
PP-6	Maintain maps of properties in floodplain as part of planning activities.	Flood	High	Planning, Public Works	Local, State	2025	This is implemented through the Planning and Public Works Departments

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Natural Resource Protection</b>							
NRP-1	Use comprehensive planning process to identify and preserve environmentally sensitive areas, such as natural wetlands, conservation areas, streams, lakes, other water bodies, etc.	All Hazards	Moderate	Public Works, Planning	Local	2025	This is implemented This is implemented through the Planning and Public Works Departments through zoning and future land use map.
<b>Structural Projects</b>							
SP-1	Improve drainage of flood prone roadways that cross streams.	Flood	Moderate	Public Works	Public Works	2025	This is implemented by City Stormwater Maintenance staff
<b>Emergency Services</b>							
ES-1	Create a mobilization plan for response to an emergency.	All Hazards	High	Emergency Management, All City Departments	Local	2025	This is implemented through all City Departments
ES-2	Identify and map critical facilities within Kannapolis. Enter this information into CAD for all emergency responders.	All Hazards	High	Emergency Management, Fire, Planning	Local	2025	This is implemented through the use of GIS.
ES-3	Fully assess vulnerability of each identified critical facility to natural hazards.	All Hazards	Moderate	Emergency Management, Fire, Police, Planning	Local	2025	This will be implemented through Emergency Management, Fire, Police and Planning Departments
ES-4	Provide stand by emergency generators with transfer switch and a 72 hour fuel capacity at all existing city owned critical facilities.	All Hazards	Moderate	Emergency Management, Fire	CIP, Grants	2025	Updated. Would need to be planned and budgeted accordingly.
ES-5	Provide stand by emergency generators with transfer with transfer switch and a 72 hour fuel capacity at any new city owned critical facility constructed, remodeled, or reconstructed.	All Hazards	Moderate	Emergency Management, New Facility Director	CIP	2025	Updated. Shall be included in project construction fund.
ES-6	Establish predefined street detour plans and disbursement of MUTCD measures in response to a major emergency or disaster.	All Hazards	Moderate	Public Works, Police, Fire, Planning, Engineering	General Fund, CIP	2025	New action. Requires budgeting for signs.
<b>Public Education and Awareness</b>							
PEA-1	Provide tours of city's water treatment plant facility as part of Kannapolis Citizen's and Employee Academy.	Flood, Storm	Moderate	Public Works	Local	Annually	This has been implemented and is underway annually. This action will be removed from the 2025 plan.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PEA-2	Conduct classroom presentations on environmental issues to Kannapolis City and Cabarrus County school children.	All Hazards	Moderate	Public Works	Local	Annually	This has been implemented and is underway annually for all third graders in the Kannapolis School System. This action will be removed from the 2025 plan.
PEA-3	Clean up streams as part of Kannapolis Kares Day and volunteer stream cleanups.	Flood	Moderate	Public Works	Public Works	Annually	We coordinate this with the NCDOT.
PEA-4	Use social media to educate citizens on environmental issues.	Flood	Moderate	Public Works	Local	Annually	Specific environmental posts are placed on all social media outlets including Instagram, Facebook, Twitter monthly.
PEA-5	Use Kannapolis Matters newsletter to educate citizens on environmental issues.	Flood	Moderate	Public Works	Local	Annually	Specific environmental posts are placed in the newsletter monthly. We also use the e-mail newsletter to disperse this information.

## Town of Midland Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-5	Continue participation in the Community Rating System.	Flood	Moderate	Town Council	Local	2025	Action deferred. The Town does not participate in the CRS. Town staff will need to determine whether or not it is feasible to participate in the program. There are only 2 NFIP policies currently in place in the Town.
P-6	Review Town's zoning plan. As needed, adopt zoning in floodplain areas to better control future development in these areas.	Flood	High	Town Council, Planning and Zoning Commission	Local	2025	Updated. The Town has been reviewing the zoning plan as needed. The Town's flood damage prevention ordinance regulates development in the floodplain within the municipal limits. The County's flood damage prevention ordinance regulates development in the unincorporated areas.
P-7	Update Small Area Plans. Delineate preferred growth areas and develop area plans for target locations.	Flood	High	Town Council, Planning and Zoning Commission	Local	2025	Updated, the Town has been reviewed and updated its Future Land Use Map, October 2016. The County's flood damage prevention ordinance regulates development in the floodplain in the unincorporated area of the County.
P-9	Participate in the review of the county hazard mitigation plan. Ensure that all hazards and mitigation efforts for Midland are addressed within the plan.	Flood	Moderate	Town Council	Local	2025	The Town plans to participate in the 2025 plan.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
P-10	Monitor hazard mitigation plan implementation to ensure schedules met.	All Hazards	Moderate	Town Council	Local	2025	The Town will help monitor the implementation of the hazard mitigation plan and will help ensure that mitigation actions for the Town are implemented according to schedule or will provide updates on actions to determine impediments towards implementation.
P-11	Assist County Planning and Development Department in tracking benefits in flood loss reduction.	Flood	Moderate	Town Council	Local	2025	There are no repetitive loss properties in Midland. This action will be revisited during the 2025 hazard mitigation plan update.
P-12	Consider adopting temporary moratorium on new construction and new subdivisions within flood hazard area until Flood Damage Prevention has been updated.	Flood	Low	Town Council	Local	The ordinance will remain as it is until changes occur at state or federal level and/or county is advised to change.	As of 2019, no moratorium has been adopted. In November 2018 the Town adopted the updated Flood Damage Prevention Ordinance recommended by the State.
<b>Property Protection</b>							
PP-5	Develop an open space plan, target properties for acquisition and fund acquisition program.	Flood	Moderate	Town Council, Planning and Zoning	State	As funds are available.	As of 2019, an open space plan has not been developed due to limited funding and staff time.
PP-6	Coordinate with Cabarrus County to establish list of priority properties and secure a funding source for acquisition in the event of a future natural disaster.	Flood	Moderate	Town Council, Planning and Zoning	Federal, State, Local	2025	Properties have been identified, will monitor events and update list as applicable.
PP-7	Establish program for evaluation and improvement of critical services (public and private) water, sewer, electricity, etc.- and critical facilities- fire, rescue, medical, etc.	Flood	Low	Town Council, Midland Volunteer Fire Department	Local	2025	This action will be revisited during the update of the hazard mitigation plan.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PP-8	Evaluate flood or access problems for critical facilities; develop recommendations for protecting critical sites, e.g., law enforcement, EMS, and fire service facilities, and the town hall. Identify alternate locations to direct response operations.	Flood	Moderate	Town Council, Midland Volunteer Fire Department	Local	2025	This action will be revisited during the 2025 update of the hazard mitigation plan.
<b>Emergency Services</b>							
ES-1	Evaluate access problems caused by snow or ice for critical facilities; develop recommendations for clearing critical sites, e.g. law enforcement, EMS, and fire service facilities and the town hall. Identify alternate sites to control response operations.	Winter Storm	High	Midland Volunteer Fire Department	Local	Annually	In progress. Current facilities have been evaluated, will monitor those after each major event, and will evaluate new facilities as they are developed.
ES-2	Determine if there are any areas with limited evacuation capacity and develop methods for improving early warning and evacuation routes and methods.	Flood	Moderate	Midland Volunteer Fire Department , Town Council	Local	2025	Will continue to evaluate alerts and warnings and push out information and notices as soon as possible.
ES3	Evaluate early warning and response action. In the event of flooding, how will critical facilities be evacuated; how will the town government react to get persons out of flood-prone or isolated areas; how will vehicles on evacuation routes be controlled; and how will hazards materials be protected or evacuated.	Flood	High	Town Council, Midland Volunteer Fire Department	Local	2025	WEA and IPAWS will enhance notification for evaluation.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Public Education and Awareness</b>							
PEA-1	Maintain current Early Warning System/Dissemination of information alerting town residents when to seek shelter when high winds or other hazards are expected.	All Hazards	Moderate	Town Council	Local	2025	Deferred pending funding and staff time.
PEA-2	Increase public awareness of the effects of winter weather on structures, power lines, trees, and how to prepare for this hazard.	Winter Storm	Moderate	Town Council, Midland Volunteer Fire Department	Local	2025	Deferred pending funding and staff time.
PEA-6	Establish locations for flood awareness signs. Show elevations of high water in areas that flood, the base flood and the base flood plus two feet. Signs should be surveyed to serve as elevation reference marks.	Flood	Low	Town Council	Local	2025	Action deferred pending funding. Will work with state agencies to complete sign placement if funding becomes available.
PEA-7	Increase public awareness of pending weather events through use of CTY system, media, county website, and local social media sites.	All Hazards	High	Emergency Management, Planning and Development, Communications	Local	2025	Coordinate with PIO and Town Manager to push information out to citizens in a timely manner.

## Town of Mount Pleasant Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-2	Continue participation in the Community Rating System.	Flood	Moderate	Town Council	Local	2025	The Town adopted an updated Flood Damage Prevention Ordinance in November of 2018, utilizing higher standards than the minimum NFIP standards, including a 2-foot freeboard above BFE.
P-5	Establish reserve fund for relocating damaged infrastructure after a natural disaster.	Flood	Low	Town Council	Local	2024	There is no designated reserve fund, however, the Town maintains a fund balance in both the general fund and water and sewer fund for relocating damaged infrastructure in the event of a natural disaster.
p-7	Participate in the review of the county hazard mitigation plan. Ensure that all hazards and mitigation efforts for Mount Pleasant are addressed within the plan.	Flood	Moderate	Town Staff	Local	2024	The Town was notified about the kick-off meeting that was held in November of 2018, but could not participate.
p-8	Monitor hazard mitigation plan implementation to ensure schedules met.	All Hazards	Moderate	Town Staff	Local	2025	The Town does not have a complete copy of the adopted plan, nor could it be found on the Cabarrus County website. By completing this matrix, the Town of Mount Pleasant is participating in tracking implementation of actions.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Property Protection</b>							
PP-4	Develop an open space plan, target properties for acquisition and fund acquisition program.	Flood	Moderate	Town Staff, Consultant, Town Council, Town Planning Board	Local	Complete (with planned updates every 5 years)	In December of 2017, the Town of Mount Pleasant adopted a Comprehensive Plan with a Future Land Use Map designating areas within floodplains as open space. Also, in 2017 the Town updated its open space requirements for new residential development to conserve primary, secondary, and tertiary conservation areas.
PP-5	Coordinate with Cabarrus County to establish list of priority properties and secure a funding source for acquisition in the event of a future natural disaster.	Flood	Moderate	Town Staff, Town Council	Federal, State, Local	2025	With only one property in with NFIP, and no reported flood events involving structures, acquisition of property does not appear necessary. Town will continue to monitor properties during natural disaster events.
PP-6	Establish program for evaluation and improvement of critical services (public and private) water, sewer, electricity, etc.- and critical facilities- fire, rescue, medical, etc.	Flood	Low	Town Staff, Mount Pleasant Fire Department, Town Council	Local	2025	In December of 2017, the Town of Mount Pleasant adopted a Comprehensive Plan with strategies for infrastructure improvements including transportation, water and sewer, and emergency services. The Town is also in the process of updating its Water and Sewer Master Plan in the context of a Capital Improvements Program. In 2017, the Town received its Public Protection Classification Summary Report from the Department of Insurance, lowering the ISO rating in the Town Limits from 6 to 4 and in the rural fire district from 9 to 5.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PP-7	Evaluate flood or access problems for critical facilities; develop recommendations for protecting critical sites, e.g., law enforcement, EMS, and fire service facilities, and the town hall. Identify alternate locations to direct response operations.	Flood	High	Town Council, Town Staff, Mount Pleasant Fire Department	Local	2025	The only facility identified to have flood or access problems is the raw water intake site located on Dutch Buffalo Creek, at the end of Meadowood Lane. During Hurricane Florence, the coffer dam sustained significant damage, and the Town is in the process of working with FEMA to facilitate repairs.
<b>Emergency Services</b>							
ES-1	Evaluate access problems caused by snow or ice for critical facilities; develop recommendations for clearing critical sites, e.g. law enforcement, EMS, and fire service facilities and the town hall. Identify alternate sites to control response operations.	Winter Storm	High	Town Staff, Mount Pleasant Fire Department	Local	2025	The Town purchased two snow plows in 2015 and 2018 to facilitate snow removal. Current facilities have been evaluated and will be monitored after each major event and as new facilities are developed.
ES-2	Determine if there are any areas with limited evacuation capacity and develop methods for improving early warning and evacuation routes and methods.	Flood	Moderate	Town Staff, Mount Pleasant Fire Department , Town Council	Local	2025	In June of 2019, the Town Board approved an interlocal agreement with Cabarrus County for a County-wide mass communications alert system. Town will work to identify areas with limited evacuation capacity.
ES-3	Evaluate early warning and response action. In the event of flooding, how will critical facilities be evacuated; how will the town government react to get persons out of flood-prone or isolated areas; how will vehicles on evacuation routes be controlled; and how will hazards materials be protected or	Flood	High	Town Staff, Town Council, Mount Pleasant Fire Department	Local	2025	In June of 2019, the Town Board approved an interlocal agreement with Cabarrus County for a County-wide mass communications alert system. Town will work to identify areas with limited evacuation capacity.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Public Education and Awareness</b>							
PEA-1	Maintain current Early Warning System/Dissemination of information alerting town residents when to seek shelter when high winds or other hazards are expected.	All Hazards	Moderate	Town Staff	Local	2025	In June of 2019, the Town Board approved an interlocal agreement with Cabarrus County for a County-wide mass communications alert system. The Town has also enhanced its use of social media platforms (such as Facebook and Twitter) to inform the public of emergencies.
PEA-2	Increase public awareness of the effects of winter weather on structures, power lines, trees, and how to prepare for this hazard.	Winter Storm	Moderate	Town Staff, Mount Pleasant Fire Department	Local	2025	In June of 2019, the Town Board approved an interlocal agreement with Cabarrus County for a County-wide mass communications alert system. The Town has also enhanced its use of social media platforms (such as Facebook and Twitter) to inform the public of emergencies and best practices.
PEA-6	Establish locations for flood awareness signs. Show elevations of high water in areas that flood, the base flood and the base flood plus two feet. Signs should be surveyed to serve as elevation reference marks.	Flood	Moderate	Town Staff, Town Council, NCDOT	State, Local	2024	Action deferred pending funding. Will work with state agencies to complete sign placement if funding becomes available. This action will be revisited during 2024 hazard mitigation plan update.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PEA-7	Increase public awareness of pending weather events through use of CTY system, media, county website, and local social media sites.	All Hazards	High	Emergency Management, Town Staff	Local	2025	In June of 2019, the Town Board approved an interlocal agreement with Cabarrus County for a County-wide mass communications alert system. The Town has also enhanced its use of social media platforms (such as Facebook and Twitter) to inform the public of emergencies.

## Stanly County Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-2	Develop Stormwater Plan.	Flood	Low	Planning	Local	1 year after funding received	Deferred-Since this is not required, development of a plan has not been funded or made a priority. Best management practices are followed.
<b>Property Protection</b>							
PP-1	Utilize acquisition, elevation, or retrofitting to protect personal properties from hazards.	All Hazards	High	Emergency Management	State, Local	2025, pending funding	Deferred/on-going, still investigating and following best management practices.
<b>Public Education and Awareness</b>							
PEA-1	Educate public for all hazards.	All Hazards	High	Red Cross, Emergency Management	Red Cross	2025	Deferred / On-going public education.

## City of Albemarle Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Identify flood area within the community.	Flood	Moderate	Planning	Local	2025, annually revise	Work is still being done to create a GIS layer that identifies structures and infrastructure that regularly flood and are not located on FIRM maps.
P-11	Identify and map roads that were flooded or damaged by past flooding. Apply to GIS.	Flood	Moderate	Planning, Engineering	Local	2024	Staff now hired to complete this, estimated goal of completion deferred to 2024. Update as needed.
P-12	Determine the reason why each road was damaged (i.e. debris in adjacent stream leading to blockage and overflow, overwhelmed storm drain, road in ASFH).	Flood	Moderate	Fire Department	Local	1 year	Deferred - Coordinating with Public Works and Planning to collect data as needed. Will revisit in 2024.
P-13	Identify potential mitigation activities based on damage assessment and prioritize locations for mitigation.	Flood	Moderate	Planning	Local	1 year	No action taken. Data and staff not available. This action will be revisited during 2025.
P-14	Identify areas that may be damaged by future flooding events and locate alternative transportation routes to minimize disruption.	Flood	Moderate	Planning	Local	1 year	No action taken. Data and staff not available. This action will be revisited during 2025.
P-15	Ensure that new roads are not located in the ASFH.	Flood	Moderate	Planning	Local	2025	Collecting data on newly adopted roads and mapping in GIS.
P-17	Participate in the Community Rating System	Flood	Moderate	Planning	Local	2 years	Deferred – working to achieve CRS with DPS and FEMA

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
P-20	Develop a fire management plan that includes a clear statement of objectives and that incorporates information on land, threatened structures, degree of fire risk, fire history and fire management measures.	Wildfire	Moderate	Fire Department	Local	1 year	Deferred – no action has been taken. Staff not available.
P-25	Monitor water resource facilities. Audit and training employees on security and response procedures in the event of a chemical spill that may impact the drinking water supply.	Hazardous Materials Incident	Moderate	Public Utilities	Local	2024	Deferred – waiting to be updated by Public Utilities
P-26	Partner with the North Carolina Department of Environment and Natural Resources as well as Yadkin River stakeholders (e.g. emergency management agencies, and water resource providers) to monitor Yadkin River conditions and the reporting/monitoring of chemical spills in other jurisdictions that would impact the Yadkin River basin.	Hazardous Materials Incident	Moderate	Public Utilities	Local	2024	Deferred – waiting to be updated by Public Utilities
<b>Property Protection</b>							
PP-3	Pursue projects to install shatter-resistant glass in home and/or businesses.	All Hazards	Moderate	Administration	Local	2025	Deferred - action has not been completed due to funding constraints and limited staff availability. This action will be revisited by 2024.
<b>Emergency Services</b>							
ES-5	Obtain and install a second source of power for critical facilities and other public buildings to operate despite the negative effect of hazards on the main power source.	All Hazards	Moderate	Administration	Local	2025	Deferred this action has not been completed due to funding constraints and limited staff availability. Most stations have back-up generators. Coordinating with Administration

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Public Education and Awareness</b>							
PEA-6	Provide safety recommendations for mobile home residents based on modern research.	Tornado	Moderate	Planning	Local	2025	As of 2019, this action has not been completed due to funding constraints and limited staff availability. This action will be completed by 2025.
PEA-9	Sponsor a "Helping your Neighbors" program at local schools to encourage children to think of those persons who require special assistance, such as elderly people, infants, or people who live with disabilities.	Tornado	Moderate	Fire Department	Local	2024	Deferred not completed due to funding constraints and limited staff. Action will be reviewed in 2024.
PEA-10	Conduct a series on how to protect yourself during a tornado in case you are at home, in a car, at the office or outside.	Tornado, Severe Thunderstorm	Moderate	Fire Department	Local	2024	Deferred not completed due to funding constraints and limited staff. Action will be reviewed in 2024.
PEA-11	Compile tornado mitigation information and make it available to Albemarle residents and business owners.	Tornado	Moderate	Fire Department	Local	2024	Deferred not completed due to funding constraints and limited staff. Action will be reviewed in 2024.
PEA-13	Update the internet based emergency information website to inform and educate citizens about potential risks from hazards and potential ways to mitigate them.	All Hazards	Moderate	Administration	Local	2024	Deferred not completed due to funding constraints and limited staff. Action will be reviewed in 2024.
PEA-14	Conduct school educating programs to educate students about potential risks from hazards and potential ways to mitigate them.	Tornado, Earthquake, Winter Storm	Moderate	Administration	Local	2024	Deferred not completed due to funding constraints and limited staff. Action will be reviewed in 2024.
PEA-15	Erect signs that convey local wildfire conditions and place in obvious locations.	Wildfire	Moderate	Fire Department	Local	2024	Deferred not completed due to funding constraints and limited staff. Action will be reviewed in 2024.

## Town of Badin Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Identify areas prone to flooding.	Flood	Moderate	Badin Public Works	Local	2025, Annually as necessary	The State of North Carolina, as one of FEMA's Cooperating Technical Partner states, maintains the regulatory flood maps for the County. The County, and thus its jurisdictions, participates in identifying and remapping efforts as requested and will continue to do so when the State updates the maps next. The current effective date for the town's flood maps is 06/06/09.
<b>Property Protection</b>							
PP-1	Develop a stormwater management plan (clean ditches, check pipe flow).	Flood	High	Badin Public Works	Local, Grants	2025, pending funding	Deferred -Due to staff and funding constraints, a stormwater management plan has not yet been developed. update.
PP-2	Utilize acquisition, elevation, or retrofitting to protect personal properties from hazards.	All Hazards	High	Emergency Management	State, Local	2025, pending funding	Deferred – Will continue pending funding
<b>Emergency Services</b>							
ES-1	Develop an Emergency Warning Plan.	All Hazards	Moderate	Badin Fire/Public Safety	Local	2025	Deferred - Due to staff and funding constraints, an Emergency Warning Plan has not yet been developed.

**SECTION 9: MITIGATION ACTION PLAN**

Public Education and Awareness							
Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PEA-1	Educate public for all hazards.	All Hazards	High	Red Cross, Emergency Management	Red Cross	2025, annually as necessary	Deferred – will continue with education with assistance from County Emergency Management

## City of Locust Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Property Protection</b>							
PP-1	Utilize acquisition, elevation, or retrofitting to protect personal properties from hazards.	All Hazards	High	Emergency Management	State, Local	2025	City identified and raised a number of manholes to prevent inflow and infiltration. Manhole rehab continues to be a priority to prevent flooding and City will continue to upfit and raise manholes as funding allows.
<b>Structural Projects</b>							
SP-1	Upgrade existing stormwater pipes, ditches, and drainage on city streets.	Flood	Moderate	Transportation	Power bill, General Fund	2025, annually revise	City of Locust does not own/operate a storm water system. But ordinances are in place to provide adequate construction of stormwater systems within subdivisions to prevent flooding and to achieve soil/erosion control.
<b>Emergency Services</b>							
ES-2	Early warning siren system.	All Hazards	Moderate	Public Safety	Grant, General fund	2025	This action will be revisited during the 2025 mitigation plan update and will be implemented as funding allows.
<b>Public Education and Awareness</b>							
PEA-1	Educate public for all hazards.	All Hazards	High	Red Cross, Emergency Management	Red Cross	2025	Deferred. Will continue with education with assistance from Emergency Management

## Village of Misenheimer Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Property Protection</b>							
PP-1	Utilize acquisition, elevation, or retrofitting to protect personal properties from hazards.	All Hazards	High	Emergency Management	State, Local	2025, pending funding	Deferred. Will continue pending funding sources.
<b>Public Education and Awareness</b>							
PEA-1	Educate public for all hazards.	All Hazards	High	Village of Misenheimer	Local	2025	Deferred. Will continue with education with assistance from Emergency Management

## Town of New London Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Property Protection</b>							
PP-1	Utilize acquisition, elevation, or retrofitting to protect personal properties from hazards.	All Hazards	High	Emergency Management	State, Local	2025, pending funding	Deferred. Will continue pending funding sources.
<b>Public Education and Awareness</b>							
PEA-1	Educate public for all hazards.	All Hazards	High	Town of New London	Local	2025	Deferred. Will continue with education with assistance from Emergency Management

## Town of Norwood Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
p-1	Town needs second water supply in case the dam on Lake Tillery (Pee Dee River) is discharged- connect to Stanly County line on Maulden Road.	Drought, Wildfire	High	Department of Utility	Local	2025	The action will be revisited during the 2025 hazard mitigation plan update.
<b>Property Protection</b>							
PP-1	Replace sewer lines in Crawley Street section of town.	Hazardous Materials Incident	High	Wastewater Department	State, Federal grants	Contingent on when grants are approved	The action will be revisited during the 2025 hazard mitigation plan update.
PP-2	Utilize acquisition, elevation, or retrofitting to protect personal properties from hazards.	All Hazards	High	Emergency Management	State, Local	2025, pending funding	City identified and raised a number of manholes to prevent inflow and infiltration. Manhole rehab continues to be a priority to prevent flooding and Town will continue to upfit and raise manholes as funding allows.
<b>Natural Resource Protection</b>							
NRP-1	Better manage stormwater runoff.	Flood	Moderate	Parks and Recreation	Local	2025, annually revise	This action will be monitored annually.
<b>Public Education and Awareness</b>							
PEA-1	Educate public for all hazards.	All Hazards	High	Red Cross, Emergency Management	Red Cross	2025	Deferred. Will continue with education with assistance from Emergency Management

## Town of Oakboro Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Prepare and adopt a town-wide Stormwater Management master plan.	Flood	High	Zoning	Budget	When funding becomes available, 2025	As of 2019, this action has not been completed. Pending staff time and funding. This action will be revisited during the 2025 hazard mitigation plan update.
P-2	Get board approval and conduct tabletop exercise for Emergency Operations Plan.	All Hazards	High	Board of Commissioners	Budget	When funding becomes available, 2025	As of 2019, this action has not been completed. Pending staff time and funding. This action will be revisited during the 2025 hazard mitigation plan update.
P-3	Conduct a stormwater drainage study/plan for known problem areas.	Flood	High	Zoning	Budget	When funding becomes available, 2025	As of 2019, this action has not been completed. Pending staff time and funding. This action will be revisited during the 2025 hazard mitigation plan update.
P-4	Urge direct burial of phone and electrical lines where appropriate.	Winter Storm, Tornado, Severe Thunderstorm, Hurricanes and Tropical Storm	High	Telephone/Electric Companies	Telephone/Electric Companies	When funding becomes available, 2025	As of 2019, this action has not been completed. Pending staff time and funding. This action will be revisited during the 2025 hazard mitigation plan update.
<b>Property Protection</b>							
PP-1	Utilize acquisition, elevation, or retrofitting to protect personal properties from hazards.	All Hazards	High	Emergency Management	State, Local	2025, pending funding	Deferred. Will continue pending funding sources.
<b>Public Education and Awareness</b>							
PEA-1	Educate public for all hazards.	All Hazards	High	Red Cross, Emergency Management	Red Cross	2025, annually revise	Deferred. Will continue with education with assistance from Emergency Management

## Town of Red Cross Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Property Protection</b>							
PP-1	Utilize acquisition, elevation, or retrofitting to protect personal properties from hazards.	All Hazards	High	Emergency Management	State, Local	2025, pending funding	Deferred. Will continue pending funding sources.
<b>Public Education and Awareness</b>							
PEA-1	Educate public for all hazards.	All Hazards	High	Town of Red Cross	Local	2025, annually revise	Deferred. Will continue with education with assistance from Emergency Management

## Town of Richfield Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Property Protection</b>							
PP-1	Utilize acquisition, elevation, or retrofitting to protect personal properties from hazards.	All Hazards	High	Emergency Management	State, Local	2025, pending funding	Deferred. Will continue pending funding sources.
<b>Public Education and Awareness</b>							
PEA-1	Educate public for all hazards.	All Hazards	High	Town of Richfield	Local	2025, annually revise	Deferred. Will continue with education with assistance from Emergency Management

## Town of Stanfield Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Property Protection</b>							
PP-1	Utilize acquisition, elevation, or retrofitting to protect personal properties from hazards.	All Hazards	High	Emergency Management	State, Local	2025, pending funding	Deferred. Will continue pending funding sources.
<b>Public Education and Awareness</b>							
PEA-1	Develop water conservation education programs.	Drought	Moderate	Utilities	Grants, Budget	6-12 months	Deferred. This action will be revisited during the 2025 hazard mitigation plan update.
PEA-1	Educate public for all hazards.	All Hazards	High	Town of Stanfield	Local	2025, annually revise	Deferred. Will continue with education with assistance from Emergency Management

## Union County Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-2	Continue to actively participate in the NFIP by monitoring and enforcing current flood ordinances.	Flood	Low	Planning	N/A	Annually	Continuing our current participation in NFIP. No changes to our ordinance are anticipated due to our strong regulations currently in place.
P-3	Prohibit the placement of earthen fill in identified floodplain areas that would raise base flood elevations.	Flood	Low	Planning	N/A	2025	Fill is not allowed in the floodplain unless it can be demonstrated that no increase to flood levels will result from the fill placement.
P-4	Research, develop and adopt a local tree ordinance that will encourage the preservation of healthy trees in large-scale developments and the removal of "hazard" trees along public rights of way as part of the Land Use Ordinance.	Hurricane and Tropical Storm, Winter Storm, Severe Thunderstorm	Low	Planning	N/A	2025	Deferred. As of the 2014 hazard mitigation plan update, this action has not been implemented. Implementation is pending staff time, funding. Action will be revisited during the 2019 hazard mitigation plan update.
P-5	Expand GIS/GPS capability for Union County agencies.	All Hazards	Low	GIS, Health Dept., Environmental Health	Local	2025	Emergency Management and Health are continuing to identify special need citizens. Updated forms and distribution channels to identify potential citizens is evolving. GIS is an intricate part of activations in the Emergency Operations Center.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
P-10	Develop a local dam safety and inspection program.	Dam Failure, Flood	Low	Emergency Management	DHS, National Dam Safety Program, NCDENR, USACE	2025	All Dams within Union County have been identified by the State and forwarded to County. High hazard and moderate hazard DAMS specifically, have been identified for the States' aerial program, which will ensure the State and local government visually observe where each high hazard dam is located and their inundation impact. Less than 1/3 of the high hazard Dams have submitted their Emergency Action Plan. This is an on-going process between the State and County to improve.
<b>Public Education and Awareness</b>							
PEA-1	Develop procedures for public education for pre-storm debris removal.	Winter Storm, Hurricane and Tropical Storm, Severe Thunderstorm	Moderate	Public Works	Local, Solid Waste Fund	2025	This is implemented through the Public Works Department.
PEA-3	Provide hazard susceptibility checklists for homeowners to conduct hazard risk inspections for their own property and link information on Union County website.	All Hazards	Moderate	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update of material	Emergency Management has coordinated with the Union County WebMaster to ensure checklist is available to residents on the Emergency Management web page. As well as all-hazard quizzes for county residents to test their knowledge on weather safety. Ready.gov and NC Ready links are currently on the webpage.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PEA-5	Improve public education on the removal and disposal of storm generated debris from private property.	Hurricane and Tropical Storm, Winter Storm, Severe Thunderstorm	Low	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update of material	American Red Cross links are recommended and implemented with all Union County municipalities and can be located on their web-sites.
PEA-6	Offer disaster preparedness education; "Be Red Cross Ready" for hurricane, flood, winter storms, etc.	All Hazards	High	American Red Cross	American Red Cross	2025, Annual review and update of material	ARC recently re-located and are highly visible throughout the county @ vendor fairs educating public on preparedness. Also ARC has been instrumental in preparing Union County with sheltering procedures. Fire Marshal's Office has undertaken fire extinguisher training for all interested staff.

## Town of Fairview Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Natural Resource Protection</b>							
NRP-1	Develop an Open Space/Greenway Plan that integrates flood mitigation strategies with open space management techniques.	Flood	Low	Planning, Parks and Recreation	Local, NCDENR, NCDOT, The Conservation Fund	2025, Annual update and review	The is implemented through the open space and Greenway program.
<b>Public Education and Awareness</b>							
PEA-1	Send appropriate local officials to FEMA's Emergency Management Institute (EMI) for continuing education and professional development in emergency management.	All Hazards	Moderate	Emergency Management	FEMA, Local Operating Budget	Reviewed annually.	Every year training is done as needed
PEA-3	Provide hazard susceptibility checklists for homeowners to conduct hazard risk inspections for their own property and link information on Union County website.	All Hazards	Moderate	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update of material	This is implemented through EM and ARC.
PEA-4	Offer disaster preparedness education; "Be Red Cross Ready" for hurricane, flood, winter storms, etc.	All Hazards	High	American Red Cross	American Red Cross	2025, Annual review and update of material	This is implemented through EM and ARC.

## Town of Hemby Bridge Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Public Education and Awareness</b>							
PEA-1	Send appropriate local officials to FEMA's Emergency Management Institute (EMI) for continuing education and professional development in emergency management.	All Hazards	Moderate	Emergency Management	FEMA, Local Operating Budget	Reviewed annually.	Union County has designed a series of trainings regarding awareness for municipalities and their citizens. Municipalities attend and are encouraged to participate in free training at the State level. Union County has also offered local HSEEP table-top exercises to municipalities.
PEA-2	Raise public awareness of natural hazards that could affect the area.	All Hazards	Moderate	Emergency Management	Local	2025	Union County has identified local and regional grants and have applied for same. These grants are designed to utilize multiple distribution methods, including local bill-boards, to heighten the awareness of all-hazard preparation. Additionally, lectures and presentations about weather related preparedness to local organizations by Emergency Management is continuous.
PEA-3	Provide hazard susceptibility checklists for homeowners to conduct hazard risk inspections for their own property and link information on Union County website.	All Hazards	Moderate	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update of material	American Red Cross links are recommended and implemented with all Union County municipalities and can be located on their web-sites.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PEA-4	Offer disaster preparedness education; "Be Red Cross Ready" for hurricane, flood, winter storms, etc.	All Hazards	High	American Red Cross	American Red Cross	2025, Annual review and update of material	ARC recently re-located and are highly visible throughout the county @ vendor fairs educating public on preparedness. Also ARC has been instrumental in preparing Union County with sheltering procedures. Fire Marshal's Office has undertaken fire extinguisher training for all interested staff.

## Town of Indian Trail Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Natural Resource Protection</b>							
NRP-1	Expand the Adopted Tree Ordinance and conduct a Canopy Assessment.	Wildfire, Tornado, Severe Storm	Moderate	Town Administration	Local	2025	This ordinance will be a part of the Unified Development Ordinance Update that is drafted and scheduled for implementation Fall of 2019.
NRP-2	Renew Storm Water Maintenance contract.	Flood	High	Engineering	Stormwater Utility	Annually	This action is completed on an annual basis.
NRP-3	Create a Sedimentation and Erosion Control Program	Erosion	Low	Engineering	Local	2025	This is a new action.
<b>Emergency Services</b>							
ES-1	Draft and adopt an Emergency Operations Plan.	All Hazards	Moderate	Town Administration	Local	2025	There has been progress made since the previous update, but this action is still in progress.
ES-2	Investigate the creation of a Continuity of Operations Plan.	All Hazards	Low	Town Administration	Local	2020	This action is in progress. Staff has initiated the process. Implementation status will be updated in 2020
<b>Public Education and Awareness</b>							
PEA-2	Raise public awareness of natural hazards that could affect the area.	All Hazards	Moderate	Emergency Management	Local	Annually	In addition to the County's programs, the Town regularly communicates to citizens via social media and town website, and when needed for weather events.

## Village of Lake Park Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Property Protection</b>							
PP-1	Maintain 13 stormwater ponds to prevent localized flooding.	Flooding	High	Village Council	Grant Program & Stormwater utility	2025	This is a new action.
<b>Natural Resource Protection</b>							
NRP-1	Develop an Open Space/Greenway Plan that integrates flood mitigation strategies with open space management techniques.	Flood	Low	Planning, Parks and Recreation	Local, NCDENR, NCDOT, The Conservation Fund	2025	The Open Space and Greenway program is currently being developed and parts have been implemented but this task is not complete and more planning and implementation is required.
<b>Structural Projects</b>							
SP-1	Address aging stormwater infrastructure.	Flooding	High	Village Council	Stormwater utility	2025	This is a new action.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Public Education and Awareness</b>							
PEA-1	Educate residents about potential natural disasters.	All Hazards	Moderate	Village Council	Local	2025	The Village provides information about natural disaster and County Emergency Management information/happenings on the Village website and in the Village newsletter. The action will be revisited in 2025 to determine further progress made.
PEA-2	Provide hazard susceptibility checklists for homeowners to conduct hazard risk inspections for their own property and link information on Union County website.	All Hazards	Moderate	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update of material	Emergency Management has coordinated with the Union County WebMaster to ensure checklist is available to residents on the Emergency Management web page. Ready.gov and NC Ready links are currently on the webpage.
PEA-3	Offer disaster preparedness education; "Be Red Cross Ready" for hurricane, flood, winter storms, etc.	All Hazards	High	American Red Cross	American Red Cross	2025, Annual review and update of material	"Be Red Cross Ready" is an education tool/brochures which are distributed and discussed with county residents weekly at local fairs and events. Also listed on web page.
PEA-4	Educate the public of drainage problems through the newsletter and social media.	Flooding	Moderate	Village Council	Stormwater utility	2025, Annual review and update of material	This is a new action.

## Town of Marshville Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Public Education and Awareness</b>							
PEA-1	Raise public awareness of natural hazards that could affect the area.	All Hazards	Moderate	Emergency Management	Local	2025	The county has implemented several programs to better educate the public, but additional outreach is necessary. This action will be reevaluated in 2025.
PEA-2	Provide hazard susceptibility checklists for homeowners to conduct hazard risk inspections for their own property and link information on Union County website.	All Hazards	Moderate	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update of material	Emergency Management has coordinated with the Union County WebMaster to ensure checklist is available to residents on the Emergency Management web page. Ready.goc and NC Ready links are currently on the webpage.
PEA-3	Offer disaster preparedness education; "Be Red Cross Ready" for hurricane, flood, winter storms, etc.	All Hazards	High	American Red Cross	American Red Cross	2025, Annual review and update of material	"Be Red Cross Ready" is an education tool/brochures which are distributed and discussed with county residents weekly at local fairs and events. Also listed on web page.

## Village of Marvin Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Natural Resource Protection</b>							
NRP-1	Restrict developments/land development on slopes greater than 15%.	Erosion	High	Planning	Local	2025	This action is deferred. Currently the ordinance restricts development on slopes greater than 4:1 (25%) (Section 150.073). We plan to revise this ordinance in 2025.
NRP-3	Update Tree Preservation Restrictions— not allow internal and external tree preservation on individual lots.	Thunderstorms, Severe Winter Weather	Moderate	Planning	Local	2025	Deferred, moderate priority: This issue will be re-evaluated for potential deletion in 2025.
<b>Structural Projects</b>							
SP-1	Identify and evaluate the need to increase dimensions of drainage culverts in troublesome areas.	Flood	Moderate	Planning	General funds, DHS/FEMA grants	2025	This action is deferred. We are currently researching whether this was done as part of our 2017 Engineering Standards Update. Due to staff turnover, we are uncertain as to the status at this time.

## Town of Mineral Springs Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Natural Resource Protection</b>							
NRP-1	Develop an Open Space/Greenway Plan that integrates flood mitigation strategies with open space management techniques.	Flood	Low	Planning, Parks and Recreation	Local, NCDENR, NCDOT, The Conservation Fund	2025	No changes have been made since the last update.
<b>Emergency Services</b>							
ES-2	Encourage appropriate emergency services training and continuing education to Fire Department members.	All Hazards	High	Fire Department	Local, State	Annually	No changes, the fire department continues to conduct training on an annual basis.
<b>Public Education and Awareness</b>							
PEA-2	Raise public awareness of natural hazards that could affect the area	All Hazards	Moderate	Town Administration	Town Budget	2025, Annual reviews and update of material	The Mineral Springs website contains links for ready.gov and readync.gov.
PEA-3	Provide hazard susceptibility checklists for homeowners to conduct hazard risk inspections for their own property and link information on Union County website.	All Hazards	Moderate	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update of material	The Mineral Springs website has a link to the Union County website.
PEA-4	Offer disaster preparedness education; "Be Red Cross Ready" for hurricane, flood, winter storms, etc.	All Hazards	High	American Red Cross	American Red Cross	2025, Annual review and update of material	Red Cross attends the Mineral Springs annual festival and distributes brochures to participate when they visit their booth.

## City of Monroe Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-4	Develop stormwater illicit discharge detection.	Flood	Moderate	Engineering	Local	2020	This action is currently in process and scheduled to be complete in 2020.
P-7	Designate a local floodplain manager/CRS coordinator that achieves CFM certification and enters the City of Monroe into the NFIP's Community Rating System.	Flood	Moderate	Planning	City General Fund	2019	Partially complete. Engineering has a CFM on staff but not a member of CRS. This action will be completed by 2019
<b>Structural Projects</b>							
SP-2	Increase dimension of drainage culverts in troublesome areas, including NFIP-designated Repetitive Loss Property zones.	Flood	Moderate	Engineering	Local	2025	As of 2019 this action has not been completed due to funding constraints and limited staff time for implementation. This action will be revisited during the 2025 update.
SP-3	Examine the cost and benefit of increasing flood protection at the City's wastewater treatment plant above the 100 year level which is currently in place, with a goal of protecting to the 500 year flood elevation.	Flood	Moderate	Water Resources Department	Capital Budget Project	2030	Deferred. TBD as part of design of the next full plant expansion project In Year 2030.
<b>Public Education and Awareness</b>							
PEA-1	Advertise and promote the availability of flood insurance.	Flood	Low	Planning	Local	2025	As of 2019 this action has not been completed due to funding constraints and limited staff time for implementation. This action will be revisited during the 2025 update.
PEA-2	Raise public awareness of natural hazards that could affect the area.	All Hazards	Moderate	City Administration	City Budget	2020, annually revise	This is actively being implemented.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PEA-3	Provide hazard susceptibility checklists for homeowners to conduct hazard risk inspections for their own property and link information on Union County website.	All Hazards	Moderate	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update of material	Emergency Management has coordinated with the Union County WebMaster to ensure checklist is available to residents on the Emergency Management web page. Ready.goc and NC Ready links are currently on the webpage.
PEA-4	Offer disaster preparedness education; "Be Red Cross Ready" for hurricane, flood, winter storms, etc.	All Hazards	High	American Red Cross	American Red Cross	2025, Annual review and update of material	"Be Red Cross Ready" is an education tool/brochures which are distributed and discussed with county residents weekly at local fairs and events. Also listed on web page.

## Town of Stallings Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Natural Resource Protection</b>							
NRP-1	Stabilize identified erosion hazard areas.	Erosion	Low	Engineering	Stormwater	2025	This is a new action.
<b>Public Education and Awareness</b>							
PEA-1	Launch public education campaign to protect groundwater and related environmental issues.	All Hazards	Moderate	Town and County Administration	Local	2025	Required per condition of Phase II Stormwater permit
PEA-2	Conduct public education concerning natural hazards that could affect the town.	All Hazards	Moderate	Town Administration	Local	2025	The county has implemented several programs to better educate the public, but additional outreach is necessary so this action will be completed by 2025.
PEA-3	Provide hazard susceptibility checklists for homeowners to conduct hazard risk inspections for their own property and link information on Union County website.	All Hazards	Moderate	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update of material	ARC recently re-located and are highly visible throughout the county @ vendor fairs educating public on preparedness. Also ARC has been instrumental in preparing Union County with sheltering procedures. UC Fire Marshal's Office has undertaken fire extinguisher training for all interested staff.
PEA-4	Offer disaster preparedness education; "Be Red Cross Ready" for hurricane, flood, winter storms, etc.	All Hazards	High	American Red Cross	American Red Cross	2025, Annual review and update of material	ARC recently re-located and are highly visible throughout the county @ vendor fairs educating public on preparedness. Also ARC has been instrumental in preparing Union County with sheltering procedures. UC Fire Marshal's Office has undertaken fire extinguisher training for all interested staff.

## Town of Unionville Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Natural Resource Protection</b>							
NRP-1	Develop an Open Space/Greenway Plan that integrates flood mitigation strategies with open space management techniques.	Flood	Low	Planning, Parks and Recreation	Local, NCDENR, NCDOT, The Conservation Fund	2025	This task remains incomplete and more planning and implementation are required.
<b>Public Education and Awareness</b>							
PEA-3	Provide hazard susceptibility checklists for homeowners to conduct hazard risk inspections for their own property and link information on Union County website.	All Hazards	Moderate	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update of material	Ready.gov and NC Ready links have been added to the Town's website.
PEA-4	Offer disaster preparedness education; "Be Red Cross Ready" for hurricane, flood, winter storms, etc.	All Hazards	High	American Red Cross	American Red Cross	2025, Annual review and update of material	"Be Red Cross Ready" is added to the Town's website.

## Town of Waxhaw Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Maintain the debris management plan.	All Hazards	Moderate	Waxhaw Board of Commissioners	General budget	Semi-annually	In progress. Plan will be finished Fall 2014.
P-3	Require sprinkler systems in older structures.	Wildfire	Moderate	Waxhaw Board of Commissioners	Local	2025	Implementation determined by Board of Commissioners.
P-4	Implement flooding mitigation at Town Hall Annex (P&R offices) located at 317 N. Broome Street	Flooding	High	Parks & Recreation	FEMA and local	2025	New action: During long periods of rain or short heavy rains the topography of this property causes runoff to pond at one corner of the building, which has caused interior flooding (mild but still a potential hazard for mold and mildew). Plans to mitigate the runoff and test for/remediate any mold issues are underway for short-term mitigation but a long-term plan may be necessary.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
P-5	Create interconnectivity/additional egress from existing subdivisions (approximately 30). New developments should follow regulations requiring multiple ingress/egress points.	Flooding, Wildfire	High	Engineering	Local	2022	This is a new action.
<b>Property Protection</b>							
PP-1	Develop a Debris Management Plan	All Hazards	Moderate	Safety/Emergency Management	Operating budget	2021	New action: Get a local site approved by the state for temporary debris. Draft RFP for debris management contract. Award a debris management contract to have in place prior to any emergency events. Develop a policy in accordance with BMP on how often re-bid the debris management contract.
<b>Emergency Services</b>							
ES-1	Develop a Continuity of Operations Plan (COOP) for all facilities, departments, and operations of the town	All Hazards	Moderate	Safety/ Emergency Management	Local	2025	This is a new action
ES-2	Elevate Emergency Operations Training Requirements for staff. Department Heads will be required to take at least NIMS/ICS 100, 200, 300, 400, 700, and 800. As local EM program develops, key staff may be required to take additional FEMA courses.	All Hazards	Moderate	Safety/ Emergency Management	Operational	2025	This is a new action
ES-3	Hold regular Table Top Exercises (TTX) regularly 1-2 times per year.	All Hazards	Moderate	Safety/ Emergency Management	Operational	2025	This is a new action.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
ES-4	Develop a local Emergency Operations Plan (EOP)	All Hazards	Moderate	Safety/ Emergency Management	Operational	2025	This is a new action.
<b>Public Education and Awareness</b>							
PEA-1	Raise public awareness of natural hazards that could affect the area	All Hazards	Moderate	Town Administration	Town Budget	2025, Annual review and update	Significant advances have been made through 2019, but additional work is needed.

## Town of Weddington Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-4	Limit floodplain development through strenuous permitting processes.	Flood	High/Moderate	Planning and Zoning	Local/General Funds	2025, Annual review and update	Progress has been made since the previous update.
<b>Natural Resource Protection</b>							
NRP-1	Develop an Open Space/Greenway Plan that integrates flood mitigation strategies with open space management techniques.	Flood	Low	Planning, Parks and Recreation	Local, NCDENR, NCDOT, The Conservation Fund	2025, Annual review and update	Progress has been made since the previous update.
NRP-2	Update subdivision ordinance to include useable open space - high percentage and less clear cutting	Flood	High	Planning	General Funds	2025	This is a new action.
NRP-3	Adopted a new erosion control ordinance. Local program to moderate versus state	Erosion	High	Planning	General Funds	2025	This is a new action.
NRP-4	Develop a New Tree Ordinance to further protect from clear cutting	?	High	Planning	General Funds	2025	This is a new action.
<b>Public Education and Awareness</b>							
PEA-1	Educate the public about potential natural hazards and safety measures that can be taken.	All Hazards	Moderate	Town Administration	General Funds	2025, Annual review and update	The county has implemented several programs to better educate the public, but additional outreach is necessary.
PEA-2	Provide hazard susceptibility checklists for homeowners to conduct hazard risk inspections for their own property and link information on Union County website.	All Hazards	Moderate	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update	Emergency Management has coordinated with the Union County WebMaster to ensure checklist is available to residents on the Emergency Management web page.
PEA-3	Offer disaster preparedness education; "Be Red Cross Ready" for hurricane, flood, winter storms, etc.	All Hazards	High	American Red Cross	American Red Cross	2025, Annual review and update	"Be Red Cross Ready" is an education tool/brochures which are distributed and discussed with county residents weekly at local fairs and events. Also listed on web page.

## Village of Wesley Chapel Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Natural Resource Protection</b>							
NRP-1	Develop an Open Space/Greenway Plan that integrates flood mitigation strategies with open space management techniques.	Flood	Low	Planning, Parks and Recreation	Local, NCDENR, NCDOT, The Conservation Fund	2025	No updates on this have occurred in 2019 within Wesley Chapel. The Village is currently reviewing the development of a Comprehensive Plan where this can be folded into the document.
<b>Emergency Services</b>							
ES-1	Acquire training in wildfire suppression for the Wesley Chapel Volunteer Fire Department and the Bakers Volunteer Fire Department.	Wildfire	High	Fire Department	Fire Department	2025, Annual review and update	Required disaster training is ongoing for fire department.
ES-2	Routine inspection of accessibility, proper function, and a numbering system for record keeping of fire hydrants in the Village of Wesley Chapel and surrounding municipalities and County areas.	Wildfire	Moderate	Fire Department	Fire Department	2025, Annual review and update	Process has been implemented for hydrant numbering and system check.
ES-3	Acquire disaster training for firefighters.	All Hazards	High	Fire Department	Fire Department	2025, Annual review and update	Required disaster training is implemented through the fire department.
<b>Public Education and Awareness</b>							
PEA-1	Ensure public awareness of potential natural hazards and safety actions that can be taken.	All Hazards	Moderate	Village Council	Local	2025, Annual review and update	Requested links are still placed on the Village of Wesley Chapel's website. (Ready.gov; readync.org; nccrimecontrol.org)
PEA-2	Provide hazard susceptibility checklists for homeowners to conduct hazard risk inspections for their own property and link information on Union County website.	All Hazards	Moderate	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update	The county webpage for EM has been revised and provides citizens with multiple resources in emergency preparedness for all-hazards.

**SECTION 9: MITIGATION ACTION PLAN**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PEA-3	Offer disaster preparedness education; "Be Red Cross Ready" for hurricane, flood, winter storms, etc.	All Hazards	High	American Red Cross	American Red Cross	2025, Annual review and update	New 2019 initiatives for American Red Cross can be located @ redcross.org. They include: Citizens CPR; Ready Ratings; Pillowcase and Pedro the Penguin.

## Town of Wingate Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-2	Adopt minimum residential street width by ordinance.	All Hazards	High	Administration	General Funds	2019	This action is currently in progress. Ordinance has been drafted; ordinance adoption planned Spring 2019.
<b>Natural Resource Protection</b>							
NRP-1	Develop an Open Space/Greenway Plan that integrates flood mitigation strategies with open space management techniques.	Flood	Low	Planning, Parks and Recreation	Local, NCDENR, NCDOT, The Conservation Fund	2019	The Greenway Master Plan was adopted and the University Loop bike trail was completed in 2016 around Meadow Branch. This task is not complete and has not been fully implemented. The Spring 2019 scheduled adoption of Wingate's Land Use Ordinance includes the addition of open space and park space requirements.
<b>Public Education and Awareness</b>							
PEA-1	Conduct public education concerning the natural hazards that could affect the town.	All Hazards	Moderate	Administration	Local	2025	An effort will be made to utilize website and social media avenues to present information to the public.
PEA-2	Provide hazard susceptibility checklists for homeowners to conduct hazard risk inspections for their own property and link information on Union County website.	All Hazards	Moderate	Emergency Management, American Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2025, Annual review and update of material	An effort will be made to push Ready.gov and ReadyNC.org information through website and social media.
PEA-3	Offer disaster preparedness education; "Be Red Cross Ready" for hurricane, flood, winter storms, etc.	All Hazards	High	American Red Cross	American Red Cross	2025, Annual review and update of material	An effort will be made to push Red Cross information through website and social media to the public.

**SECTION 9: MITIGATION ACTION PLAN**

---

# SECTION 10

## PLAN MAINTENANCE PROCEDURES

### 44 CFR Requirement

#### **44 CFR Part 201.6(c)(4)(i):**

The plan shall include a plan maintenance process that includes a section describing the method and schedule of monitoring, evaluating and updating the mitigation plan within a five-year cycle.

#### **44 CFR Part 201.6(c)(4)(ii):**

The plan maintenance process shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

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

- ◆ 10.1 Implementation and Integration
- ◆ 10.2 Monitoring, Evaluation and Enhancement
- ◆ 10.3 Continued Public Involvement
- ◆ 10.4 Evaluation of Monitoring, Evaluation and Update Process

---

### 10.1 IMPLEMENTATION AND INTEGRATION

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

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

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

Since the initial plan was adopted in 2015 for all three counties, and with each County-specific plan prior to that, each County and participating jurisdiction has worked to integrate the hazard mitigation plan into other planning mechanisms where applicable/feasible. Examples of how this integration has occurred have been documented in the Implementation Status discussion provided for each of the mitigation actions found in Section 9. Specific examples of how integration has occurred include:

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

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

## **10.2 MONITORING, EVALUATION, AND ENHANCEMENT**

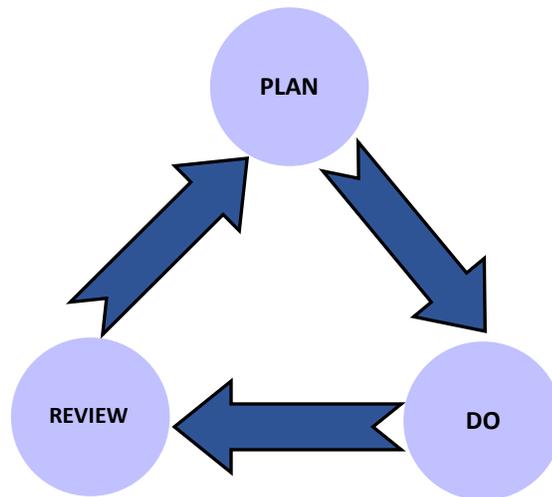
Periodic revisions and updates of the Hazard Mitigation Plan are required to ensure that the goals of the Plan are kept current, taking into account potential changes in hazard vulnerability and mitigation priorities. In addition, revisions may be necessary to ensure that the Plan is in full compliance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

When determined necessary, the Cabarrus Stanly Union Regional Hazard Mitigation Planning Committee shall meet in March of every year to evaluate and monitor the progress attained and to revise, where needed, the activities set forth in the Plan. The findings and recommendations of the Regional Hazard Mitigation Planning Committee shall be documented in the form of a report that can be shared with interested City and County Council members. The Regional Hazard Mitigation Planning Committee will also meet following any disaster events warranting a reexamination of the mitigation actions being implemented or proposed for future implementation. This will ensure that the Plan is continuously

updated to reflect changing conditions and needs within the Cabarrus Stanly Union Region. For future updates of the plan, North Carolina Emergency Management’s Hazard Mitigation Planning section will help coordinate the reconvening the Regional Hazard Mitigation Planning Committee for these reviews through coordination with each County’s Emergency Management Departments.

**FIVE (5) YEAR PLAN REVIEW**

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



The plan review provides participating jurisdiction officials with an opportunity to evaluate those actions that have been successful and to explore the possibility of documenting potential losses avoided due to the implementation of specific mitigation measures. The plan review also provides the opportunity to address mitigation actions that may not have been successfully implemented as assigned. North Carolina Emergency Management’s Hazard Mitigation Planning section will help coordinate the reconvening the Regional Hazard Mitigation Planning Committee and conducting the five-year review through coordination with each County’s Emergency Management Departments.

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

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

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

**DISASTER DECLARATION**

Following a disaster declaration, the Cabarrus Stanly Union Regional Hazard Mitigation Plan will be revised as necessary to reflect lessons learned, or to address specific issues and circumstances arising from the event. It will be the responsibility of the North Carolina Emergency Management’s Hazard Mitigation Planning section to coordinate the reconvening of the Regional Hazard Mitigation Planning Committee and ensure the appropriate stakeholders are invited to participate in the plan revision and update process following declared disaster events.

**REPORTING PROCEDURES**

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

**PLAN AMENDMENT PROCESS**

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

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

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

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

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

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

## **10.3 CONTINUED PUBLIC INVOLVEMENT**

### **44 CFR Requirement**

#### **44 CFR Part 201.6(c)(4)(iii):**

The plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process

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

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

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

## **10.4 EVALUATION OF PREVIOUS MONITORING, EVALUATION AND UPDATE PROCESS**

Over the past five years, the participating jurisdictions have been independently implementing, monitoring and evaluating their own mitigation action plans. Progress made in implementing actions has been documented in Section 9: *Mitigation Action Plan* where each action contains a narrative about the implementation status of the action as of 2015. That said, the jurisdiction did waiver slightly from

## **SECTION 10: PLAN MAINTENANCE**

---

the monitoring and evaluation process defined in the original version of the plan, but still made significant process in implementing their mitigation action plans. During the 2020 update of this plan, the Regional Hazard Mitigation Planning Committee determined that the procedures for the upcoming five-year monitoring and evaluation process will remain as defined above and will be re-evaluated during the next plan update process.

The five-year comprehensive update process began as early as 2018 when North Carolina Emergency Management made the decision to set aside HMGP funding from Hurricane Matthew to fund the Cabarrus Stanly Union Hazard Mitigation Plan. To facilitate this effort, NCEM assigned the plan update to their pre-qualified hazard mitigation planning consultants ESP Associates. Representatives from ESP Associates first reached out to Cabarrus, Stanly, and Union representatives in October of 2018 to initiate the plan update process. More details about the plan update process are provided in Section 2, Planning Process.

For the next update of this plan, NCEM's Hazard Mitigation Planning section will continue take the lead on organizing and initiating the 5-year update of the plan.

# Appendix A

## Plan Adoption

### 44 CFR Requirement

**44 CFR Part 201.6(c)(5):** The plan shall include documentation that the plan has been formally adopted by the local governing body of the jurisdiction requesting approval of the plan.

This section of the Plan includes a copy of the local adoption resolution passed by the participating jurisdictions in the Cabarrus Stanly Union Region.

Cabarrus County	
Concord	Midland
Harrisburg	Mount Pleasant
Kannapolis	Unincorporated Cabarrus County
Stanly County	
Albemarle	Oakboro
Badin	Red Cross
Locust	Richfield
Misenheimer	Stanfield
New London	Unincorporated Stanly County
Norwood	
Union County	
Fairview	Monroe
Hemby Bridge	Stallings
Indian Trail	Unionville
Lake Park	Waxhaw
Marshville	Weddington
Marvin	Wesley Chapel
Mineral Springs	Wingate
Unincorporated Union County	

# Appendix B

## Planning Tools

This section of the Plan includes the following three (3) items:

1. A Blank Public Survey
2. A Blank Capability Assessment
3. Scoring Criteria for the Capability Assessment

## PUBLIC SURVEY FOR HAZARD MITIGATION PLANNING

### **We need your help!**

Cabarrus, Stanly, and Union Counties and the municipalities within the counties are working together to become less vulnerable to natural disasters, and your participation in the process is important to us!

The counties, along with local jurisdictions and other partners, are working to update the multi-jurisdictional *Regional Hazard Mitigation Plan*. This Plan identifies and assesses our community's natural hazard risks and identifies strategies that determine how to best minimize or manage those risks.

This survey is an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that should help lessen the impacts of future hazard events.

**Please help us by completing this survey by February 28, 2019 and returning it to:**

Jamie DeRose, ESP Associates, Inc  
2200 Gateway Centre Blvd., Suite 216  
Morrisville, NC 27560

Surveys can also be emailed to [jderose@esspassociates.com](mailto:jderose@esspassociates.com).

If you have any questions regarding this survey or would like to learn about more ways you can participate in the update of the *Cabarrus Stanly Union Regional Hazard Mitigation Plan*, please contact ESP Associates, Inc, planning consultant for the project. You may reach Jamie DeRose (ESP Associates) at 919-415-2757 or by email at [jderose@esspassociates.com](mailto:jderose@esspassociates.com).

### **1. Where do you live?**

- |   |   |
|---|---|
| <input type="checkbox"/> Unincorporated Cabarrus County | <input type="checkbox"/> Misenhiemer    |
| <input type="checkbox"/> Unincorporated Stanly County   | <input type="checkbox"/> Monroe         |
| <input type="checkbox"/> Unincorporated Union County    | <input type="checkbox"/> Mount Pleasant |
| <input type="checkbox"/> Albemarle                      | <input type="checkbox"/> New London     |
| <input type="checkbox"/> Badin                          | <input type="checkbox"/> Norwood        |
| <input type="checkbox"/> Concord                        | <input type="checkbox"/> Oakboro        |
| <input type="checkbox"/> Fairview                       | <input type="checkbox"/> Red Cross      |
| <input type="checkbox"/> Harrisburg                     | <input type="checkbox"/> Richfield      |
| <input type="checkbox"/> Hemby Bridge                   | <input type="checkbox"/> Stallings      |
| <input type="checkbox"/> Indian Trail                   | <input type="checkbox"/> Stanfield      |
| <input type="checkbox"/> Kannapolis                     | <input type="checkbox"/> Unionville     |
| <input type="checkbox"/> Lake Park                      | <input type="checkbox"/> Waxhaw         |
| <input type="checkbox"/> Locust                         | <input type="checkbox"/> Weddington     |
| <input type="checkbox"/> Marshville                     | <input type="checkbox"/> Wesley Chapel  |
| <input type="checkbox"/> Marvin                         | <input type="checkbox"/> Wingate        |
| <input type="checkbox"/> Midland                        | <input type="checkbox"/> Other: _____   |
| <input type="checkbox"/> Mineral Springs                |   |

**2. Have you ever experienced or been impacted by a disaster?**

- Yes
- No

**a. If “Yes,” please explain:**

**3. How concerned are you about the possibility of your community being impacted by a disaster?**

- Extremely concerned
- Somewhat concerned
- Not concerned

**4. Please select the one hazard you think is the *highest threat* to your neighborhood:**

- |   |  |
|---|--|
| <input type="checkbox"/> Dam / Levee Failure          | <input type="checkbox"/> Hurricane / Tropical Storm    |
| <input type="checkbox"/> Drought                      | <input type="checkbox"/> Landslide                     |
| <input type="checkbox"/> Earthquake                   | <input type="checkbox"/> Lightning                     |
| <input type="checkbox"/> Erosion                      | <input type="checkbox"/> Nuclear Accident              |
| <input type="checkbox"/> Extreme Heat                 | <input type="checkbox"/> Thunderstorm Wind / High Wind |
| <input type="checkbox"/> Flood                        | <input type="checkbox"/> Tornado                       |
| <input type="checkbox"/> Hailstorm                    | <input type="checkbox"/> Wildfire                      |
| <input type="checkbox"/> Hazardous Materials Incident | <input type="checkbox"/> Winter Storm / Freeze         |

**5. Please select the one hazard you think is the *second-highest threat* to your neighborhood:**

- |   |   |
|---|---|
| <input type="checkbox"/> Dam / Levee Failure          | <input type="checkbox"/> Hurricane / Tropical Storm |
| <input type="checkbox"/> Drought                      | <input type="checkbox"/> Landslide                  |
| <input type="checkbox"/> Earthquake                   | <input type="checkbox"/> Lightning                  |
| <input type="checkbox"/> Erosion                      | <input type="checkbox"/> Nuclear Accident           |
| <input type="checkbox"/> Extreme Heat                 | <input type="checkbox"/> Thunderstorm / High Wind   |
| <input type="checkbox"/> Flood                        | <input type="checkbox"/> Tornado                    |
| <input type="checkbox"/> Hailstorm                    | <input type="checkbox"/> Wildfire                   |
| <input type="checkbox"/> Hazardous Materials Incident | <input type="checkbox"/> Winter Storm / Freeze      |

**6. Is there another hazard not listed above that you think is a wide-scale threat to your neighborhood?**

- Yes (please explain): \_\_\_\_\_
- No

**7. Is your home located in a FEMA floodplain?**

- Yes
- No
- I don't know

**8. Do you have flood insurance for your home/personal property?**

- Yes
- No
- I don't know

**a. If "No," why not?**

- My home is not located in a floodplain
- I rent
- It's too expensive
- I don't need it because it never floods
- I don't need it because my home is elevated or otherwise protected
- I never really considered it
- Other (please explain): \_\_\_\_\_

**9. Have you taken any actions to make your home, neighborhood, or family safer from hazards?**

- Yes
- No

**b. If "Yes," please explain:**

**10. Are you interested in making your home, neighborhood, or family more resistant to hazards?**

- Yes
- No

**11. Do you know what office to contact regarding risks from hazards in your area?**

- Yes
- No

**12. What is the most effective way for you to receive information about how to make your home, neighborhood, or family more resistant to hazards?**

- Newspaper
- Television advertising
- Television programs
- Radio advertising
- Radio programs
- Internet
- Email
- Mail
- Public workshops/meetings
- School meetings
- Other (please explain): \_\_\_\_\_

**13. In your opinion, what are some steps your local government could take to reduce the risk of future hazard damages in your neighborhood?**

**14. Are there any other issues regarding the risks and losses from hazards or disasters that you would like to mention?**

**15. A number of community-wide activities can reduce vulnerability to hazards. In general, these activities fall into one of the following six broad categories. Please tell us how important you think each category is for your community to consider.**

Category	Very Important	Somewhat Important	Not Important
<p><b><u>1. Prevention</u></b>            Administrative or regulatory actions that influence the way land is developed and buildings are built. Examples include planning and zoning, building codes, open space preservation, and floodplain regulations.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b><u>2. Property Protection</u></b>            Actions that involve modification of existing buildings to protect them from a hazard or removal from the hazard area. Examples include acquisition, relocation, elevation, structural retrofits, and storm shutters.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b><u>3. Natural Resource Protection</u></b>            Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. Examples include: floodplain protection, habitat preservation, slope stabilization, riparian buffers, and forest management.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b><u>4. Structural Projects</u></b>            Actions intended to lessen the impact of a hazard by modifying the natural progression of the hazard. Examples include dams, levees, detention/retention basins, channel modification, retaining walls, and storm sewers.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b><u>5. Emergency Services</u></b>            Actions that protect people and property during and immediately after a hazard event. Examples include warning systems, evacuation planning, emergency response training, and protection of critical emergency facilities or systems.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b><u>6. Public Education and Awareness</u></b>            Actions to inform citizens about hazards and the techniques they can use to protect themselves and their property. Examples include outreach projects, school education programs, library materials, and demonstration events.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**THANK YOU FOR YOUR PARTICIPATION!**

*This survey may be submitted anonymously; however, if you provide us with your name and contact information below we will have the ability to follow up with you to learn more about your ideas or concerns (optional):*

**Name:** \_\_\_\_\_

**Address:** \_\_\_\_\_

**Phone:** \_\_\_\_\_ **E-Mail:** \_\_\_\_\_

## Local Capability Assessment Survey

Jurisdiction/Agency: \_\_\_\_\_

Phone: \_\_\_\_\_

Point of Contact: \_\_\_\_\_

E-mail: \_\_\_\_\_

**1. PLANNING AND REGULATORY CAPABILITY** - Please indicate whether the following planning or regulatory tools (plans, ordinances, codes or programs) are currently in place or under development for your jurisdiction by placing an "X" in the appropriate box. Then, for each particular item in place, identify the department or agency responsible for its implementation and indicate its estimated or anticipated effect on hazard loss reduction (Strongly Supports, Helps Facilitate or Hinders) with another "X". Finally, please provide additional comments or explanations in the space provided or with attachments.

Planning / Regulatory Tool	In Place	Under Development	Department / Agency Responsible	Effect on Loss Reduction			Comments
				Strongly Supports	Helps Facilitate	Hinders	
Hazard Mitigation Plan							
Comprehensive Land Use Plan (or General, Master or Growth Mgt. Plan)							
Floodplain Management Plan							
Open Space Management Plan (or Parks & Rec./ Greenways Plan)							
Stormwater Management Plan / Ordinance							
Natural Resource Protection Plan							
Flood Response Plan							
Emergency Operations Plan							
Continuity of Operations Plan							
Evacuation Plan							
Other Plans (please explain under Comments)							

### Local Capability Assessment Survey

Planning / Regulatory Tool	In Place	Under Development	Department / Agency Responsible	Effect on Loss Reduction			Comments
				Strongly Supports	Facilitates	Hinders	
Disaster Recovery Plan							
Capital Improvements Plan							
Economic Development Plan							
Historic Preservation Plan							
Floodplain Ordinance (or Flood Damage Prevention Ordinance)							
Zoning Ordinance							
Subdivision Ordinance							
Unified Development Ordinance							
Post-disaster Redevelopment / Reconstruction Ordinance							
Building Code							
Fire Code							
National Flood Insurance Program (NFIP)							
NFIP Community Rating System (CRS Program)							

## Local Capability Assessment Survey

**2. ADMINISTRATIVE AND TECHNICAL CAPABILITY** - Please indicate whether your jurisdiction maintains the following staff members within its current personnel resources by placing an "X" in the appropriate box . Then, if YES, please identify the department or agency they work under and provide any other comments you may have in the space provided or with attachments.

Staff / Personnel Resources	Yes	No	Department / Agency	Comments
Planners with knowledge of land development and land management practices				
Engineers or professionals trained in construction practices related to buildings and/or infrastructure				
Planners or engineers with an understanding of natural and/or human-caused hazards				
Emergency manager				
Floodplain manager				
Land surveyors				
Scientist familiar with the hazards of the community				
Staff with education or expertise to assess the community's vulnerability to hazards				
Personnel skilled in Geographic Information Systems (GIS) and/or FEMA's HAZUS program				
Resource development staff or grant writers				

### Local Capability Assessment Survey

**3. FISCAL CAPABILITY** - Please indicate whether your jurisdiction has access to or is eligible to use the following local financial resources *for hazard mitigation purposes* (including as match funds for State of Federal mitigation grant funds). Then, identify the primary department or agency responsible for its administration or allocation and provide any other comments you may have in the space provided or with attachments.

Financial Resources	Yes	No	Department / Agency	Comments
Capital Improvement Programming				
Community Development Block Grants (CDBG)				
Special Purpose Taxes (or taxing districts)				
Gas / Electric Utility Fees				
Water / Sewer Fees				
Stormwater Utility Fees				
Development Impact Fees				
General Obligation, Revenue and/or Special Tax Bonds				
Partnering arrangements or intergovernmental agreements				
Other: _____				

## Local Capability Assessment Survey

**4. POLITICAL CAPABILITY** - Political capability can be generally measured by the degree to which local political leadership is willing to enact policies and programs that reduce hazard vulnerabilities in your community, even if met with some opposition. Examples may include guiding development away from identified hazard areas, restricting public investments or capital improvements within hazard areas, or enforcing local development standards that go beyond minimum State or Federal requirements (e.g., building codes, floodplain management, etc.). Please identify some general examples of these efforts if available and/or reference where more documentation can be found.

### Local Capability Assessment Survey

**5. SELF-ASSESSMENT OF CAPABILITY** - Please provide an approximate measure of your jurisdiction's capability to effectively implement hazard mitigation strategies to reduce hazard vulnerabilities. Using the following table, please place an "X" in the box marking the most appropriate degree of capability (Limited, Moderate or High) based upon best available information and the responses provided in Sections 1-4 of this survey.

	DEGREE OF CAPABILITY		
	LIMITED	MODERATE	HIGH
Planning and Regulatory Capability			
Administrative and Technical Capability			
Fiscal Capability			
Political Capability			
<b>OVERALL CAPABILITY</b>			

## Points System for Capability Ranking

**0-19 points = Limited overall capability**  
**20-39 points = Moderate overall capability**  
**40-68 points = High overall capability**

### I. Planning and Regulatory Capability (Up to 43 points)

*Yes = 3 points*

*Under Development = 1 point*

*Included under County plan/code/ordinance/program = 1 point*

*No = 0 points*

- Hazard Mitigation Plan
- Comprehensive Land Use Plan
- Floodplain Management Plan
- National Flood Insurance Program
- NFIP Community Rating System

*Yes = 2 points*

*Under Development = 1 point*

*Included under County plan/code/ordinance/program = 1 point*

*No = 0 points*

- Open Space Management Plan / Parks & Recreation Plan
- Stormwater Management Plan
- Natural Resource Protection Plan
- Flood Response Plan
- Emergency Operations Plan
- Continuity of Operations Plan
- Evacuation Plan
- Disaster Recovery Plan
- Flood Damage Prevention Ordinance
- Post-disaster Redevelopment / Reconstruction Ordinance

*Yes = 1 point*

*No = 0 points*

- Capital Improvements Plan
- Economic Development Plan
- Historic Preservation Plan
- Zoning Ordinance
- Subdivision Ordinance
- Unified Development Ordinance
- Building Code
- Fire Code

## **II. Administrative and Technical Capability (Up to 15 points)**

*Yes = 2 points*

*Service provided by County = 1 point*

*No = 0 points*

- Planners with knowledge of land development and land management practices
- Engineers or professionals trained in construction practices related to buildings and/or infrastructure
- Planners or engineers with an understanding of natural and/or human-caused hazards
- Emergency manager
- Floodplain manager

*Yes = 1 point*

*No = 0 points*

- Land surveyors
- Scientist familiar with the hazards of the community
- Staff with education or expertise to assess the community's vulnerability to hazards
- Personnel skilled in Geographical Information Systems (GIS) and/or Hazus
- Resource development staff or grant writers

## **III. Fiscal Capability (Up to 10 points)**

*Yes = 1 point*

*No = 0 points*

- Capital Improvement Programming
- Community Development Block Grants (CDBG)
- Special Purpose Taxes (or tax districts)
- Gas / Electric Utility Fees
- Water / Sewer Fees
- Stormwater Utility Fees
- Development Impact Fees
- General Obligation / Revenue / Special Tax Bonds
- Partnering arrangements or intergovernmental agreements
- Other

# **Appendix C**

## **Local Mitigation Plan Review Tool**

This section of the Plan includes a completed Local Mitigation Plan Review Tool.

# Appendix D

## Planning Process Documentation

This section of the Plan includes the following five (5) categories of items:

1. *CSU Regional Hazard Mitigation Planning Committee Meeting Agendas*
2. *CSU Regional Hazard Mitigation Planning Committee Meeting Sign-in Sheets*
3. *CSU Regional Hazard Mitigation Planning Committee Meeting Minutes*
4. *Neighboring Jurisdiction Outreach Documentation*
5. *Public Survey Summary Results*

# **AGENDA**

Cabarrus Stanly Union Regional Hazard Mitigation Plan Update

Kickoff Meeting

November 29, 2018

10:00 AM – Noon

## **1) Introductions**

## **2) Mitigation Refresher/Icebreaker Exercise**

## **3) Project Overview**

- a) Key Objectives
- b) Project Tasks
- c) Project Schedule
- d) Project Staffing

## **4) Roles & Responsibilities**

- a) ESP
- b) County Leads
- c) Participating Jurisdictions/Stakeholders

## **5) Next Steps**

- a) Data collection efforts
- b) Begin public outreach
- c) Discuss next Hazard Mitigation Planning Team meeting

## **6) Questions, Issues or Concerns**

# **AGENDA**

Cabarrus Stanly Union Regional Hazard Mitigation Plan

Mitigation Strategy Workshop

January 24, 2019

10:00AM - Noon

- 1) Introductions**
- 2) Mitigation Recap**
- 3) Project Schedule**
- 4) Risk Assessment Findings**
  - a) Hazard Identification**
  - b) Hazard Profiles**
  - c) Hazard Vulnerability Assessment**
- 5) Capability Assessment Findings**
- 6) Mitigation Strategy**
- 7) Mapping Exercise**
- 8) Summary of Public Involvement**
- 9) Plan Maintenance**
- 10) Next Steps**

**Cabarrus Stanly Union Regional Hazard Mitigation Plan  
Kickoff Meeting**

**November 29, 2018**

**3:00PM - 5:00PM**

Name	Agency	City	Phone Number	E-mail Address
JASON BURNETT	CABARRUS EM	CONCORD	704-920-2417	JABURNETT@ CABARRUSCOUNTY.US
BOBBY SMITH	CABARRUS EM	CONCORD	704-920-2562	RSSMITH@ CABARRUSCOUNTY.US
Karen Hamby	NCem	State	828-726-4000	Karen.Hamby@ ncdps.gov
Dawn Gustafson	Cabarrus EM	CONCORD	704-920-2143	ddgustafson@ cabarruscounty.us
Paul Reynolds	Stanly Co GIS	Albemarle	704-986-3635	preynolds@stanly countync.gov
Bryan Kindley	Monroe Fire	Monroe	704-361-0063	bkindley@ monroenc.org
MICHAEL RANK	ALBEMARLE FIRE	ALBEMARLE	704-984-9480	<del>mrank@</del> albemornc.gov
STEVEN SKINNER	CORNING FIRE	CONCORD	704-589-7114	SKINNERSL@ CORNING.COM

Name	Agency	City	Phone Number	E-mail Address
Terry Foxx	NCEM Risk Mgt	Conover	828-228-8526	terry.foxx@ ncdps.gov
Brian Simpson	Stanly EM	Albemarle	704-986-3650	bsimpson@ stanlycountync.gov
Michael Smith	Stanly EM	Albemarle	704-986-3650	Michael.Smith@ StanlyCountyNC.gov
Jennifer Layton	Stanly Co. Health Dept	-	704-986-3018	jlayton@ stanlycountync.gov
Daniel Barham	Stanly EM	Albemarle	704-986-3650	dbarham @stanlycountync.gov
Robert Bushey	Cabarrus County Transportation	Kannapolis	704-920-2932	rbushey@CabarrusCounty.us
Ray Gilleland	CABARRUS Sheriff's Office	CONCORD	704-920-3111	JRGilleland
Jessica Hillie	Cabarrus County Transportation	Kannapolis	(704) 920-2236	Jessicahillie@ CabarrusCounty.us
Kelly Sifford	Cabo Co. Planning Development	Concord	704-920-2142	KFSifford@ CabarrusCounty.us
Richard Lewis	ARC	Concord	704-796-5474	dick.lewis@vidcross. org



Name	Agency	City	Phone Number	E-mail Address
Dan Mays	Union City	Monroe	704-283-3575	Dan.Mays@unioncounty.nc.gov
Cheri Clark	Village of Lake Park Union County	Village Lake Park	704-882-8657	Cheri.Clark@lakepark.nc.gov
Jonathan Marshall	Cabarrus Co.		704 920-2145	jmarshall@cabarruscounty.us
Erinn Nichols	Town of Stallings Union Co.	Stallings	704.821.0313	enichols@stallingsnc.org
L.J. Westcott	Rider Transit	Concord / Kannapolis	704.920.5878	westcottlj@concordnc.gov

Name	Agency	City	Phone Number	E-mail Address
Berke Jones	Cabarrus Chamber	Concord	704-782-4000	bjones@cabarruswa
Susie Morris	Cab. Co.	Concord	704-920-2858	Samorris@cabarruscounty.us
Ernie Hiers	KFD	Kannapolis	704-920-4260	ehiers@kannapolisnc.gov
Doug Britt	City of Monroe	Monroe	704-282-4568	dbritt@monroenc.org
Chris Ferguson	NCER		(919) 825-2565	christopher.ferguson@ncers.gov
Irene Sacks	Kannapolis		7049204326	isacks@kannapolisnc.gov
Heather Lemire	Red Cross	Stanley Cabarrus Mn	980 348 7127	heather.lemire2@redcross.org
Ryan McInerney	Cabarrus Health Alliance	*	704 920-1010	Ryan.McInerney@cabarrushealth.org
Kristin Burton	CABCO	Concord	2266	Klburton@cabarruswa

Name	Agency	City	Phone Number	E-mail Address
Dane Hinson	Stanly GIS	Albemarle	704-986-3638	dhinson@stanlycountync.gov
DON ELKINS	MONROE P.D.	MONROE	704-282-4700	delkins@monroenc.org
Terry Clinton	Kannapolis PD	Kannapolis	704-920-4007	tclinton@kannapolisnc.gov
Terry Spry	Kannapolis P.D.	Kannapolis	704-920-4071	tspry@kannapolisnc.gov
Dave Jenkins	Stanly	Albemarle	704-986-3000	djenkins@stanlycountync.gov
IAN CRANE	CONCORD E.M.	CONCORD	704-920-5211	CraneI@concord nc.gov
Heather Harper	AtsumHealth	Concord	704-4726231	heather.harper@ atsumhealth.org
Jim Sell	Concord Emergency Mgmt.	Concord	910-246-3341	sellj@concordnc.gov
Susan Fearrington	Cabarrus County	Concord	<del>910</del> 704-920-2894	Sbfearrington @cabarruscounty.us
Alma Whitley	Town of Red Cross	OATHOUSE, NC	704-485-2002	alma@townofred cross.com

# CSU Mitigation Strategy Meeting - January 24, 2019

Name	Agency	City	Phone Number	E-mail Address
Michael Smith	Stanly Co. EM	Albemarle	704-986-3650	MICHAEL.SMITH@STANLYCOUNTY.NC.GOV
Brian Simpson	Stanly Co EM	Albemarle	704-986-3650	bsimpson@stanlycountync.gov
Dawn Gustafson	Cabarrus EM	Concord	704-920-2143	ddgustafson@cabarruscounty.us
JASON BURNETT	CABARRUS Co. EM	CONCORD	704-920-2417	JABURNETT@CABARRUSCOUNTY.US
IAN CRANE	CITY OF CONCORD E.M.	CONCORD	704-920-5211	CraneI@concordnc.gov
Karen Hamby	NC Em	State	828-726-4000	Karen.Hamby@ncdps.gov
STEVEN SKINNER	Corwintown Inc	Midland	704-569-7114	SKINNERSE@CORWINTOWN.COM
DON ELKINS	MONROE P.D.	MONROE	704-201-2109	delkins@monroenc.org
Ray Allen	Concord FD	Concord	704-920-5536	allenr@concordnc.gov

Name	Agency	City	Phone Number	E-mail Address
Da				
Danny Barhan	Stanly City Emerg Serv		980 439 4191	dbarhan@stanlycountync.gov
Lloyd Payne	City of Concord		704-920-5215	paynel@concordnc.gov
Jim Sells	Concord EM		704-920-5528	sellsj@concordnc.gov
Keith Cook	CHS NorthEast		704 403 4094	William.Cook@Atriumhealth.org
John Mello	NCEM Mitigation Plans		919-825-2334 <del>919-825-2334</del>	johnmello@ncdps.gov
CHUCK FERGUSON	NCEM	STATE	919 825-2569	christopher.ferguson@ncdps.gov
Kristin Buntan	Cabco		704-920-2666	KLBuntan@Cabarruscounty.org
Susie Morris	Cabco		704-920-2858	samorris@cabarruscounty.org
Jacazza Jones	NCEM Hazard Mitigation		919 825 2592	jacazza.jones@ncdps.gov

Name	Agency	City	Phone Number	E-mail Address
EDWARDINE MARRONE	FEMA	RALEIGH	404 433 3968	EDWARDINE. MARRONE@ FEMA.DHS.GOV
Kelly S. Rford	Cab Co Planning- Dev	Concord	704-920-2142	ktsifford@ cabarruscounty.w
Cheeri Clark	Village of Lake Park	Lake Park	704-882-8657	Cheeri.Clark@ lakeparknc.gov
Jonathan Marshall	Cabarrus Co.		704 920-2145	jmarshall@ cabarruscounty.nc
Ellie Shuid	Albemarle		704-984-9426	eshuid@albemarle.nc.gov
Jay Voyles	Albemarle		704-984-9438	ivoyles@albemarle.nc.gov
MICHAEL SANDI	STANLY CO		704-986-3645	M SANDI @ STANLY COUNTY NC.GOV
Jennifer Layton	Stanly Co Health	Stanly Co		

Name	Agency	City	Phone Number	E-mail Address
Jake Williams	Concord Fire	Concord	704 920 5524	Williamsj@Concordnc.gov
Todd Culp	CABARRUS	CONCORD	704 920-2235	TACULP@CABARRUSCOUNTY.NC
Duo M		MIDLAND	888-2232	dpc@midlandnc.gov
Michael Roark	ALBEMARLE FIRE	ALBEMARLE	704-984-9480	mroark@albemarle-nc.gov
L.J. Westowski	Concord Kampis Area Transit	Concord Kampis	704. 920. 5878	westowski@concordnc.gov

## **MEETING MINUTES**

### **CSU RHMP Update Kickoff Meeting**

**November 29, 2018**

#### **Cabarrus County Governmental Center**

Bobby Smith, Cabarrus County Director of Emergency Management, opened the meeting by welcoming everyone to the Governmental Center and introducing Nathan Slaughter and Jamie DeRose.

Nathan Slaughter, Department Manager from ESP Associates, Inc. and Project Manager for the update of the CSU Regional Hazard Mitigation Plan, began the meeting by welcoming the attendees and giving a brief overview of the project and the purpose of the meeting.

Mr. Slaughter led the meeting of the Regional Hazard Mitigation Planning Team and began by having attendees introduce themselves. The 44 attendees included representatives from various departments and local jurisdictions within each of the three counties participating in the plan update. All three counties were represented. Mr. Slaughter then provided an overview of the items to be discussed at the meeting and briefly reviewed the agenda and presentation slide handouts. He then defined mitigation and gave a review of the Disaster Mitigation Act of 2000 and NC Senate Bill 300.

To continue, Mr. Slaughter provided detailed information about the project. He mentioned that the project is funded by a FEMA PDM grant, and that representatives from each County met together to hire ESP Associates, Inc. to manage the update, thus ensuring that Mr. Slaughter would remain the Project Manager. For this update, there was no local match requirement.

Mr. Slaughter then explained some of the basic concepts of mitigation. He explained how we should think about mitigation: we want to mitigate hazard impacts of existing development in the community (houses, businesses, critical facilities, etc.), and ensure that future development is conducted in a way that doesn't increase vulnerability. This can be achieved by having good plans, policies, and procedures in place.

Following the overview, Mr. Slaughter led the group in an "icebreaker" exercise to refamiliarize meeting participants to various mitigation techniques. He briefly recapped the six different categories of mitigation techniques: emergency services, prevention, natural resource protection, structural projects, public education and awareness, and property protection. Each attendee was then given \$20 in mock currency and asked to "spend" their mitigation money as they personally deemed appropriate among the six mitigation categories. Money was "spent" by placing it in cups labeled with each of the mitigation techniques. Upon completion of the exercise, Jamie DeRose, Lead Planner from ESP, tabulated and shared the results with the group. The most mock money was spent on emergency services, followed by prevention techniques. These results were compared against those from the previous plan development's ice breaker exercise. This helped demonstrate how priorities in mitigation actions have changed since the previous update.

After the icebreaker exercise, Mr. Slaughter reviewed the key objectives of the project, which are to:

- Coordinate between the three participating counties to update the regional plan
- Update the plan to demonstrate progress and reflect current conditions
- Complete the update before the existing plan expires on June 18, 2020
- Increase public awareness and education

- Maintain grant eligibility for participating jurisdictions
- Update the plan in accordance with Community Rating System (CRS) requirements, and
- Maintain compliance with State and Federal requirements

Next, he explained new elements to this update, which include the NCEM's RMT, Activity 510 compliance for CRS communities, Risk MAP, Community Wildfire Protection Plans, the NC Resilience Assessment, and EMAP compliance.

Mr. Slaughter reviewed the list of participating jurisdictions with the group, which all agreed to participate again. He also explained the planning process and specific tasks to be accomplished for the project, which include the planning process, risk assessment, capability assessment, mitigation strategy, mitigation action plan, and plain maintenance procedures. For the risk assessment portion of the process, Mr. Slaughter asked each county to designate a point of contact to coordinate the gathering of GIS data required for the analysis. He also reviewed the list of identified hazards and the committee agreed to maintain the previous list of hazards for the three counties.

The project schedule was presented and Mr. Slaughter noted that the twelve-month schedule provided ample time to produce a quality plan and meet state and federal deadlines.

Mr. Slaughter discussed what data would need to be collected to complete the project. This includes GIS Data, Capability Assessment Revisions, a Public Participation Survey, and updates to existing Mitigation Actions.

Mr. Slaughter then reviewed the roles and responsibilities of ESP Associates, Inc, the County leads, and the participating jurisdictions. The presentation concluded with a discussion of the next steps to be taken in the project development. He encouraged meeting participants to distribute the Public Participation Survey. The next HMPT meeting was scheduled for some time in February 2019 to discuss the findings of the risk and capability assessments and to begin updating existing mitigation actions and identify new goals.

## **MEETING MINUTES**

### **Mitigation Strategy Meeting**

**January 24, 2019**

#### **Cabarrus County Governmental Center**

Nathan Slaughter, Project Manager from ESP Associates, began the meeting by welcoming the attendees and reviewing the meeting handouts, which included an agenda, existing plan goals for the regional plan, and a hard copy of the meeting presentation. Mr. Slaughter asked meeting attendees to introduce themselves and gave a refresher on mitigation, why we plan, and the key objectives of the project. He reviewed the participating jurisdictions, project tasks and project schedule. He stated that a draft of the updated Regional Hazard Mitigation Plan would be presented in May.

Jamie DeRose, Lead Planner from ESP Associates, then presented the findings of the risk assessment. She shared the list of all hazards that are addressed in the regional plan, and reviewed the list of hazards addressed in the North Carolina State Hazard Mitigation Plan. She discussed a couple of caveats for the risk assessment and indicated that best available data was used. While that information is helpful, events are often under-reported, so it is important to keep the end goal in sight. The purpose of the risk assessment was shared: to compare hazards and determine which should be the focus of the mitigation actions. Finally, she mentioned to the stakeholders that it ultimately is their risk assessment, so their recommendations for adjustment are welcomed and encouraged.

Ms. DeRose stated that since the last plan was updated, there have been two Presidential disaster declarations that have impacted the region, which helped emphasize the need to continue updating the mitigation plan.

The following Hazard Profiles and summaries of each hazard were then shared:

- **DROUGHT:** There were 19 regional drought events between 2010 and 2018, and future occurrences are likely.
- **HAILSTORM:** There have been 283 recorded events since 1959. Future occurrences are likely.
- **HURRICANE AND COASTAL STORM:** 59 storm tracks have come within 75 miles of the region since 1854. 4 of those were classified as a hurricane or tropical storm. Future occurrences are likely.
- **LIGHTNING:** Since 1996, there have been 31 reported occurrences, which resulted in 8 injuries and \$2.2 million dollars in property damage. Future occurrences are highly likely.
- **TORNADOES:** There have been 43 recorded events since 1989, causing one death, 30 injuries, and \$144,556,583 in property damage. Future occurrences are likely.
- **SEVERE THUNDERSTORMS AND HIGH WIND:** 585 severe thunderstorm events have been recorded since 1957. These events resulted in 7 injuries and \$2.19 million in property damages. Future occurrences are highly likely.
- **WINTER STORM AND FREEZE:** 135 winter weather events that resulted in over \$19 million in property damage have been recorded since 1993. Future occurrences are highly likely.
- **DAM AND LEVEE FAILURE:** Of the 242 dams in the region, 58 are considered high hazard dams. No serious breaches have been reported, and future occurrences are unlikely.
- **EROSION:** Although little information could be obtained on erosion occurrences in the region, erosion was addressed in the previous Stanly County plan. Future occurrences are possible.

- FLOOD: 197 flood events have occurred since 1883, resulting in over \$19.2 million in property damage, 6 deaths, and 4 injuries. There have also been 266 reported NFIP losses since 1978 and approximately \$4.8 million in claims. There are 24 repetitive loss properties, and future occurrences are highly likely.
- EARTHQUAKE: No significant earthquake events have taken place in the region, but future occurrences are possible.
- LANDSLIDE: No records of severe landslides were reported, and future occurrences are possible.
- HAZARDOUS MATERIALS INCIDENTS: 8 serious HAZMAT events have been reported through the PHMSA. There are 11 TRI Facilities in the region. Future occurrences are possible.
- TERROR THREAT: There have not been any terror threats in the region, but terrorism is still important to cover as a hazard. Future occurrences are unlikely.
- WILDFIRE: FEMA reports that 188 acres in the region are burned every year on average. Future occurrences are likely.

In concluding the review of Hazard Profiles, Ms. DeRose stated if anyone had additional information for the hazard profiles, or disagreed with any of the data presented, they should call or email her with their concerns.

The results of the hazard identification process were used to generate a Priority Risk Index (PRI), which categorizes and prioritizes potential hazards as high, moderate or low risk based on probability, impact, spatial extent, warning time, and duration. The highest PRI was assigned to Winter Storms and Freeze, followed by Severe Thunderstorm and Flood. The committee reviewed most recent hazard profile data and discussed moving wildfire down and HAZMAT up in rankings.

Ms. DeRose then displayed maps that presented each county's social vulnerability, as documented by the Center for Disease Control. The maps present how socially vulnerable areas in each county are as compared to the rest of North Carolina. Many indicators were used to determine the social vulnerability, and the factors were grouped into four themes that were based on census-tract levels.

After a brief break, Mr. Slaughter then presented the Capability Assessment Findings. ESP Associates used a scoring system that was used to rank the participating jurisdictions in terms of capability in four major areas (Planning and Regulatory; Administrative and Technical; Fiscal; Political). Important capability indicators include National Flood Insurance Program (NFIP) participation, Building Code Effective Grading Schedule (BCEGS) score, Community Rating System (CRS) participation, and the Local Capability Assessment Survey conducted by ESP Associates.

Mr. Slaughter reviewed the Relevant Plans and Ordinances, Relevant Staff/Personnel Resources, and Relevant Fiscal Resources. All of these categories were used to rate the overall capability of the participating counties and jurisdictions. Most jurisdictions are in the moderate to high range for Planning and Regulatory Capability and in the low to moderate range for Fiscal Capability. There is variation between the jurisdictions for Administrative and Technical Capability, mainly with respect to availability of planners and grant writers. Based upon the scoring methodology, it was determined that all of the participating jurisdictions have moderate or high capabilities to implement hazard mitigation programs and activities.

Mr. Slaughter then transitioned to the Mitigation Strategy portion of the presentation. He began by reviewing some of the major concepts of mitigation and then gave the results of the icebreaker exercise from the first Regional Hazard Mitigation Planning Committee meeting, where attendees were given “money” to spend on various hazard mitigation techniques. The results were as follows:

- Emergency Services \$107
- Prevention \$93
- Public Education and Awareness \$59
- Structural Projects \$42
- Natural Resource Protection \$28
- Property Protection \$12

Mr. Slaughter gave an overview of the process for updating the Mitigation Strategy and presented the existing mitigation goals for the regional plan. He asked the Regional Hazard Mitigation Planning Committee to review the goals to determine whether or not they still reflect current vulnerabilities and current mitigation priorities. The committee members agreed that the existing goals should remain unchanged.

Mr. Slaughter then indicated that each participating jurisdiction would need to provide a status update for their existing mitigation actions (completed, deleted, or deferred) by February 28, 2019. Mr. Slaughter also discussed the Mitigation Action Worksheets to be completed for any new mitigation actions and requested that all worksheets be returned by February 28, 2019. Mr. Slaughter then presented sample mitigation actions for the committee members to consider to include in their plan update.

During a working lunch, the attendees split into three groups by county. They were instructed to look at large maps of their counties that included major roads and floodplains and identify vulnerable areas that could be considered for potential new mitigation actions.

Mr. Slaughter and Ms. DeRose then discussed the results of the public participation survey that was posted on several of the participating counties’ and jurisdictions’ websites. As of the meeting date, 160 responses had been received. Based on the preliminary results, respondents felt that winter storms, severe thunderstorms, and floods posed the greatest threats to their neighborhood. Most did not live in a floodplain or have flood insurance, but 70% of all respondents did not know who to contact regarding reducing their risks to hazards.

Finally, Mr. Slaughter discussed the next steps in the planning process. These included returning mitigation action updates and delivery of a draft plan in May 2019. He sincerely thanked the group for taking the time to attend and the meeting was adjourned.

eNotifications went out to – anyone that has signed up for email notifications...

Example:

https://mail.google.com/mail/u/0/?tab=wm#inbox/FMfcgxvzMBjNBhwzbtbVHTdqsTDnQhpn

Android SMS Messa... Kronos Workforce C...

Search mail

1 of 90,22

75,279

Albemarle, NC: Survey for Regional Hazard Mitigation Plan – Please Participate!

City of Albemarle, NC <webmaster@ci.albemarle.nc.us> to me 11:01 AM (2 m)

Survey for Regional Hazard Mitigation Plan – Please Participate!

Cabarrus, Stanly, and Union Counties and the municipalities within the counties are working together to become less vulnerable to natural disasters, and public participation is an important part of the process!

Post Date: 12/07/2018 9:54 AM

12

9,502

14,750

+

**Survey for Regional Hazard Mitigation Plan – Please Participate!**

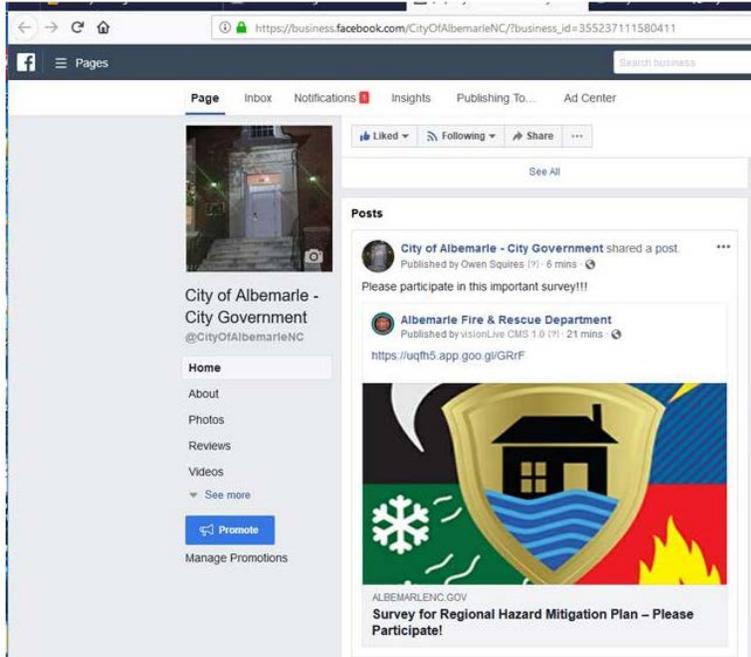
Cabarrus, Stanly, and Union Counties and the municipalities within the counties are working together to become less vulnerable to natural disasters, and public participation is an important part of the process! The three jurisdictions are working together to update the Regional Hazard Mitigation Plan, which identifies and assesses the community's natural hazard risks and identifies strategies to best minimize or manage those risks. It is for those not actively involved in the plan's development to voice their opinions and contribute to the plan. The information shared is important for us to understand local concerns to lead to the best activities to lessen disasters.

PLEASE! Click on this link to participate in the survey:  
[Cabarrus, Stanly and Union Counties - Survey about our Regional Hazard Mitigation Plan](#)



```
graph TD; 1[1 Organize the Planning Process and Resources] --> 2[2 Assess Risks]; 2 --> 3[3 Develop a Mitigation Strategy]; 3 --> 4[4 Adopt and Implement the Plan]; 4 --> 1;
```

City's Facebook page:  
<https://facebook.com/CityofAlbemarleNC>



The screenshot shows the Facebook page for the City of Albemarle. The page header includes navigation options like 'Page', 'Inbox', 'Notifications', 'Insights', 'Publishing To...', and 'Ad Center'. The main content area features a post from the 'City of Albemarle - City Government' (@CityOfAlbemarleNC) shared by Owen Squires. The post text reads: 'Please participate in this important survey!!!'. Below the text is a link: 'https://uqfh5.app.goo.gl/GRrF'. The image for the post is a shield-shaped graphic divided into four quadrants: top-left (black with a white house silhouette), top-right (blue with a white sun), bottom-left (green with a white snowflake), and bottom-right (red with a yellow flame). Below the image, the text reads: 'ALBEMARLENC.GOV Survey for Regional Hazard Mitigation Plan – Please Participate!'.

Albemarle Fire Department:  
<https://www.facebook.com/Albemarle-Fire-Rescue-Department-260699398032>

**Posts**



This block provides a detailed view of the Facebook post. At the top, it shows the profile picture and name of the 'Albemarle Fire & Rescue Department' with a timestamp of '12 mins'. Below this is the URL 'https://uqfh5.app.goo.gl/GRrF'. The central image is the same shield-shaped hazard mitigation graphic seen in the previous screenshot. Below the image, the text reads: 'ALBEMARLENC.GOV Survey for Regional Hazard Mitigation Plan – Please Participate!'. At the bottom, the post is attributed to 'Owen G Squires' and includes interaction buttons for 'Like', 'Comment', 'Share', and a menu icon.

Direct link to the news article:  
<http://www.albemarlenc.gov/Home/Components/News/News/3426/>

The screenshot shows the City of Albemarle website. The header includes the city logo and navigation menu. The main content area features a news article titled "Survey for Regional Hazard Mitigation Plan - Please Participate!". Below the article text is a circular diagram with four numbered steps: 1. Organize the Planning Process and Resources (blue), 2. Assess Risks (red), 3. Develop and Implement the Plan (green), and 4. Adopt and Improve the Plan (green). The diagram shows a clockwise cycle between these steps.

Twitter:  
<https://twitter.com/cityalbemarlenc>

The screenshot shows a Twitter post from the City of Albemarle (@CityAlbemarleNC). The tweet includes a profile picture of a baseball cap and a large graphic. The graphic is a shield-shaped emblem with a house in the center, surrounded by icons for snow, water, and fire. The text of the tweet reads: "Survey for Regional Hazard Mitigation Plan - Please Participate! Cabarrus, Stanly, and Union Counties and the municipalities within the counties are working together to become less vulnerable to natural disas... albemarlenc.gov".

This email message will be sent to about 148 recipients.

To... **Susie Morris**

Cc...

Bcc... [jim.burquin.c567@statefarm.com](mailto:jim.burquin.c567@statefarm.com); [jim.hodgens.bwh@statefarm.com](mailto:jim.hodgens.bwh@statefarm.com); [keith.whaley.nvza@statefarm.com](mailto:keith.whaley.nvza@statefarm.com); [mary.ballantine.pici@statefarm.com](mailto:mary.ballantine.pici@statefarm.com); [ralph@ralphbrittain.com](mailto:ralph@ralphbrittain.com); [martin.cain@wslife.com](mailto:martin.cain@wslife.com); [accutech@accutechsurveinq.com](mailto:accutech@accutechsurveinq.com); [csherman@spasociates.com](mailto:csherman@spasociates.com); [imcraaddock@cesids.com](mailto:imcraaddock@cesids.com); [scottnorstar@ctc.net](mailto:scottnorstar@ctc.net); [bernevmp2@aol.com](mailto:bernevmp2@aol.com); [twest@harrisburgsurveying.com](mailto:twest@harrisburgsurveying.com); [zmsurvey@vnet.net](mailto:zmsurvey@vnet.net); [bdaniels@gmail.com](mailto:bdaniels@gmail.com); [blongr@carolina.rr.com](mailto:blongr@carolina.rr.com); [turnerth@ctc.net](mailto:turnerth@ctc.net); [mgtassopa@vnet.net](mailto:mgtassopa@vnet.net); [gsflowe@gmail.com](mailto:gsflowe@gmail.com); [cabyrd@accutechsurveinq.com](mailto:cabyrd@accutechsurveinq.com); [glk-survey@yahoo.com](mailto:glk-survey@yahoo.com); [jmdavis@cesids.com](mailto:jmdavis@cesids.com); [sdver@isaacsgrp.com](mailto:sdver@isaacsgrp.com); [rwhitehurst@eagleonline.net](mailto:rwhitehurst@eagleonline.net); [ymore@cmoorearch.com](mailto:ymore@cmoorearch.com); [jim@hensonfoley.com](mailto:jim@hensonfoley.com); [robert.tripp@merrick.com](mailto:robert.tripp@merrick.com); [Rob.Nanfelt@rebic.com](mailto:Rob.Nanfelt@rebic.com); [Janie.Macrae@cccar Carolinas.com](mailto:Janie.Macrae@cccar Carolinas.com); [rufus@pyramidlandsurveying.com](mailto:rufus@pyramidlandsurveying.com); [medinsurvey@yahoo.com](mailto:medinsurvey@yahoo.com)

Subject Cabarrus/Stany/Union County (CSU) Regional Hazard Mitigation Plan Survey

Hi,  
The Cabarrus Stanly Union (CSU) Regional Hazard Mitigation Plan is currently being updated. As part of that process, a survey is being used to collect important input from citizens and other stakeholders. The survey is available online at: [https://s.surveypplanet.com/YbXxO\\_oVV](https://s.surveypplanet.com/YbXxO_oVV) Please take a few minutes to participate in the planning process and provide feedback. The survey should take no longer than 10 minutes to complete and is open until February 28<sup>th</sup>, 2019.

**Susie Morris, AICP, CFM, CZO**  
Planning and Zoning Manager

Planning and Development Department  
Cabarrus County

O: 704-920-2858  
F: 704-920-2227  
[www.cabarruscounty.us](http://www.cabarruscounty.us)



Tweets **190** Following **53** Followers **623** Likes **32** Lists **0** Moments **0**

Edit profile

### Cabarrus County Emergency Management

@CabCoEM

Official Twitter account of Cabarrus County Emergency Management. Feed is monitored 24/7. Emergencies call 911.

Concord, NC

[cabarruscounty.us/departments/em...](http://cabarruscounty.us/departments/em...)

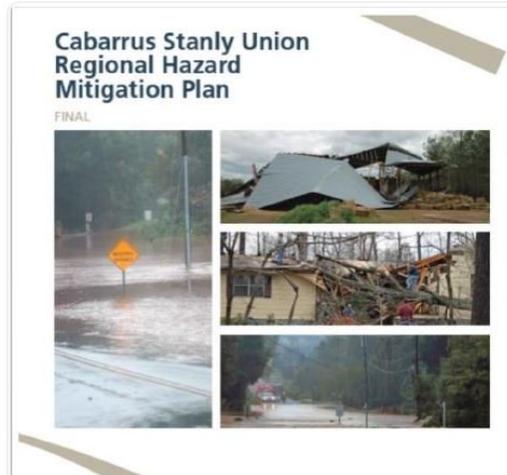
Joined March 2018

95 Photos and videos



#### Tweets Tweets & replies Media

**Cabarrus County Emergency Management** @CabCoEM · 14m  
We want your input! It is time to update the Regional Hazard Mitigation plan. The plan identifies our community's natural hazard risks & strategies to manage those risks. To share your opinion & participate in the planning process complete this survey: [s.surveypplanet.com/YbXxO\\_oVV](https://s.surveypplanet.com/YbXxO_oVV)



#### Who to follow · Refresh · View all

**Lincoln County EM** @LinCoEM

Follow



**Pasq Camden EM** @PasqCoEM

Follow



**Independent Tribune** @independenttribune

Follow

Find people you know

#### Trends for you · Change

**#ThursdayMotivation**

18.9K Tweets

**Browns**

38.2K Tweets

**#ThursdayThoughts**

56.9K Tweets

**Panthers**

15.8K Tweets

**Joe Kelly**

7,846 Tweets

**Morning Joe**

12.5K Tweets



# VILLAGE OF LAKE PARK

## A Community For All Seasons

- Government ▾
- Boards & Commissions ▾
- Community ▾
- Five Year Development Plan



- Home
- Ordinances
- Policies and Resolutions
- Forms ▶
- News ▶
- Business Directory
- Helpful Links

### Welcome to Our Website



Lake Park, NC, a village in northwest Union County, is 15 miles from downtown Charlotte, North Carolina. Villagers have built a variety of homes here: traditional single-family homes, care-free patio homes, condominiums, and townhomes.

Lake Park's landmark, a chiming clocktower, overlooks this beautiful

village with churches, schools, shops, offices, and a

### Cabarrus Stanly Union Regional Hazard Mitigation Plan

Click [here](#) to participate in the Cabarrus Stanly Union Regional Hazard Mitigation Plan survey. Hazard Mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.

officials to know ahead of time what assistance you may need ...

[Read More](#)



## Nathan Slaughter

---

**From:** Nathan Slaughter  
**Sent:** Monday, November 18, 2019 1:51 PM  
**To:** Chris.Soliz@rowancountync.gov; jsmyre@co.iredell.nc.us; kwolfe@co.iredell.nc.us; cbonham@ci.charlotte.nc.us; amjackson@charlottenc.gov; alton.hanes@davidsoncountync.gov; rdiggs@co.anson.nc.us; donna.wright@richmondnc.com; robbie.smith@montgomerycountync.com; dplayer@lancastercountysc.net; hhainey@chesterfieldcountysc.com; s.akers@marlborocounty.sc.gov  
**Subject:** NOTIFICATION: Cabarrus Stanly Union Regional Hazard Mitigation Plan

Good afternoon

You are receiving this email because a neighboring County (Cabarrus, Stanly and/or Union County NC), along with the municipalities within those counties and other participating partners, are now working to update the region's multi-jurisdictional *Cabarrus Stanly Union Regional Hazard Mitigation Plan* as required by the Federal Emergency Management Agency (FEMA). The purpose of this plan is to identify and assess the region's natural hazard risks and determine strategies for how to best minimize or manage those risks. Upon completion, the plan will represent a comprehensive multi-jurisdictional *Hazard Mitigation Plan* for the three-county region.

You are being notified of this planning process for two purposes:

1. FEMA requires that neighboring jurisdictions be provided an opportunity to be involved in the planning process.
2. You may want to contribute information to these jurisdictions to consider as they update their hazard mitigation plan.

I serve as the Project Manager for the update of the plan. Please let me know if you would like to contribute information, be invited to any upcoming meetings in the development of the plan or if you would like to receive a copy of the draft plan.

Should you have any questions about the *Cabarrus Stanly Union Regional Hazard Mitigation Plan*, please do not hesitate to contact me. Thank you for your time!

**Nathan Slaughter, AICP, CFM**

Department Manager – Hazard Mitigation

**ESP Associates, Inc.**

2200 Gateway Centre Boulevard – Suite 216

Morrisville, NC 27560

[www.espassociates.com](http://www.espassociates.com)

[nslaughter@espassociates.com](mailto:nslaughter@espassociates.com)

919.415.2726 | Direct

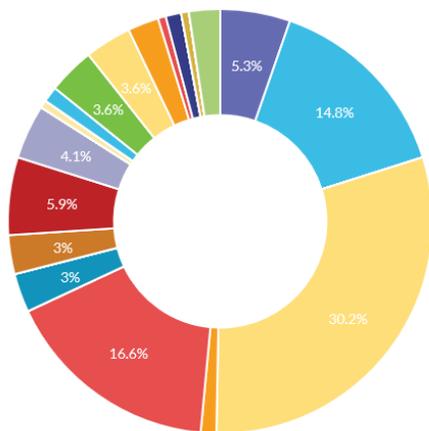
919.678.1070 | Office

919.244.9536 | Cell

Neighboring Jurisdictions for the Cabarrus Stanly Union Region

Jurisdiction	Name	Title	Email
Rowan County NC	Chris Soliz	Rowan County Emergency Services Director	<a href="mailto:Chris.Soliz@rowancountync.gov">Chris.Soliz@rowancountync.gov</a>
Iredell County NC	Jody Smyre	Iredell County EM Director	<a href="mailto:jsmyre@co.iredell.nc.us">jsmyre@co.iredell.nc.us</a>
Iredell County NC	Kathy Wolfe	Iredell County Floodplain Manager	<a href="mailto:kwolfe@co.iredell.nc.us">kwolfe@co.iredell.nc.us</a>
Charlotte-Mecklenburg County NC	Cindy Bonham	Charlotte-Mecklenburg EM Director	<a href="mailto:cbonham@ci.charlotte.nc.us">cbonham@ci.charlotte.nc.us</a>
Charlotte-Mecklenburg County NC	General Inquiries	Charlotte-Mecklenburg Planning	<a href="mailto:amjackson@charlottenc.gov">amjackson@charlottenc.gov</a>
Davidson County, NC	Alton Hanes	Davidson County Emergency Management Director	<a href="mailto:alton.hanes@davidsoncountync.gov">alton.hanes@davidsoncountync.gov</a>
Anson County, NC	Rodney Diggs	Anson County emergency Management Director	<a href="mailto:rdiggs@co.anson.nc.us">rdiggs@co.anson.nc.us</a>
Richmond, NC	Donna Wright	Richmond County Emergency Mngement Director	<a href="mailto:donna.wright@richmondnc.com">donna.wright@richmondnc.com</a>
Montgomery, NC	Robbie Smith	Montgomery County Emergency Management Director	<a href="mailto:robbie.smith@montgomerycountync.com">robbie.smith@montgomerycountync.com</a>
Lancaster, SC	D. Player	Lancaster County Emergency Management Director	<a href="mailto:dplayer@lancastercountysc.net">dplayer@lancastercountysc.net</a>
Chesterfield, SC	Harold Hainey	Chesterfield County Emergency management Director	<a href="mailto:hhainey@chesterfieldcountysc.com">hhainey@chesterfieldcountysc.com</a>
Marlboro, SC	Steve Akers	Marlboro County Emergency Management Director	<a href="mailto:s.akers@marlborocounty.sc.gov">s.akers@marlborocounty.sc.gov</a>

**Q1** 1. Where do you live?  
Multiple Choice



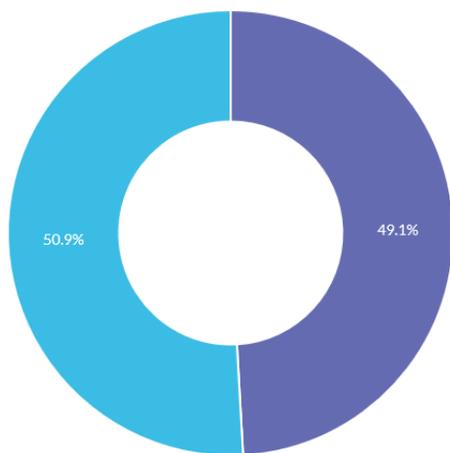
Choice	Total
Unincorporated Cabarrus County	9
Unincorporated Stanly County	25
Unincorporated Union County	0
Albemarle	51
Badin	2
Concord	28
Fairview	0
Harrisburg	5
Hemby Bridge	0
Indian Trail	0
Kannapolis	5

Unanswered  
**0**

Answered  
**169**

[See all answers >](#)

**Q2** 2. Have you ever experienced or been impacted by a disaster?  
Multiple Choice



Choice	Total
Yes	83
No	86

Unanswered  
**0**

Answered  
**169**

[See all answers >](#)

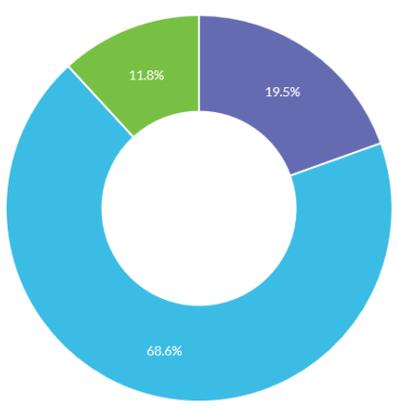
Q3 3. If "Yes," please explain.  
Essay

Date	Answers
Jan 30	Hurricane Hugo, Florence, micro-burst & tornados
Jan 22	Hurricane Hugo
Jan 17	hurricanes
Jan 15	back in 2013 A huge tree landed on my house, the business owner of the property of the tree had been told three years I advance that it was dying and to cut it down, we got no federal declaration and I was out \$40,000. Then With Florence, my basement and yard flooded, again, our emergency manager, according to both state and FEMA representatives, never applied for assistance for individuals. And despite what the county web site states, individuals DO NOT qualify for SBA loans, because we did not get a federal IA declaration. so you are lying to us.
Jan 9	Trees down during storm, flooding during the recent rains, power outages, etc. Minimal impact.
Jan 7	Flood of basement
Jan 7	Hurricane Hugo, majority of roads getting from Stanly into Montgomery County. Power lines down. 2003 ice storm knocking out power for 4 days.
Dec 20, 2018	Hurricanes, flooding
Dec 19, 2018	Damage to property due to flooding caused by hurricanes, high winds and winter storms.
Dec 18, 2018	Worked disaster shelter operations, during hurricane and ice storms

Load More

Unanswered 97      Answered 72      [See all answers >](#)

Q4 4. How concerned are you about the possibility of our community being impacted by a disaster?  
Multiple Choice



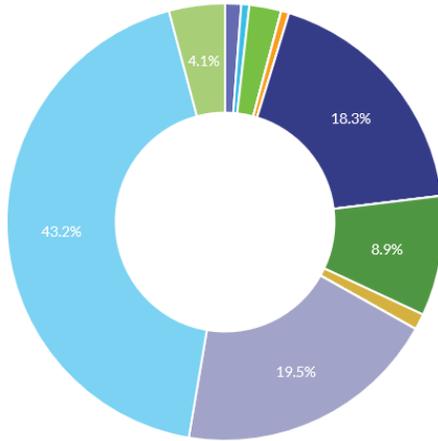
Choice	Total
Extremely concerned	33
Somewhat concerned	116
Not concerned	20

Unanswered 0      Answered 169      [See all answers >](#)

Q5

5. Please select the one hazard you think is the highest threat to your neighborhood:

Multiple Choice



Choice	Total
Acts of Terror	2
Dam/Levee Failure	1
Drought	4
Earthquake	0
Expansive Soils	1
Extreme Heat	0
Flood	31
Hailstorm	0
Hurricane Remnants	15
Land Subsidence	2
Landslide	0

Unanswered  
0

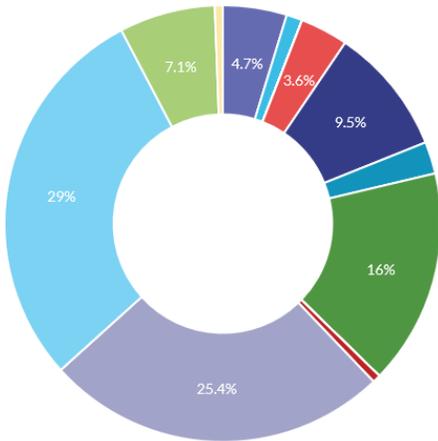
Answered  
169

[See all answers >](#)

Q6

6. Please select the one hazard you think is the second highest threat to your neighborhood:

Multiple Choice



Choice	Total
Acts of Terror	8
Dam/Levee Failure	2
Drought	0
Earthquake	0
Expansive Soils	0
Extreme Heat	6
Flood	16
Hailstorm	4
Hurricane Remnants	27
Land Subsidence	0
Landslide	0

Unanswered  
0

Answered  
169

[See all answers >](#)

Q7 7. Are there any other hazards that you feel pose a wide-scale threat to your community?  
Essay

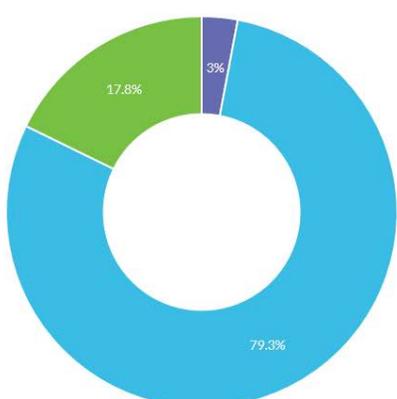


Date	Answers
Jan 30	Power outages, tornadoes
Jan 25	3. Terrorism
Jan 16	No, in some 20 years of living in Stanly, high wind is the biggest threat I face out by the airport. Ice / snow might be second only because the county as a whole is not prepared to handle significant accumulation of either.
Jan 15	flooding is constant, trees falling down, and after hours the power outage number rolls over to 911. so if we have a big disaster after 5pm or on a weekend or holiday, 911 will be overloaded. also, there are downtown businesses buildings that are termite ridden and in such decay because the city and county will not adopt resolutions given to them by the ADDC, that if a wall between two building fail, it could act like dominoes.
Jan 9	flash flooding
Jan 7	The city should remove trees that are a risk to the powerlines, be it ice, snow, and high winds.
Dec 27, 2018	Drought
Dec 20, 2018	hurricanes, tornados
Dec 18, 2018	Ice//winter storms, severe weather such as tornados and hurricanes
Dec 17, 2018	Active Violence (such as active shooter) Tornado Hazardous Materials Incident Winter Storms Pandemic Terrorism

Load More

Unanswered 109      Answered 60      [See all answers >](#)

Q8 8. Is your home located in a floodplain?  
Multiple Choice

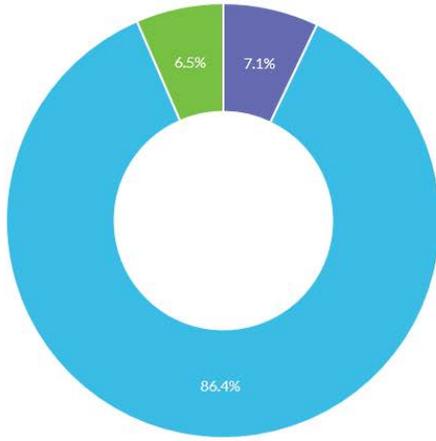


Choice	Total
Yes	5
No	134
I don't know	30

Unanswered 0      Answered 169      [See all answers >](#)

Q9

9. Do you have flood insurance?  
Multiple Choice



Choice	Total
Yes	12
No	146
I don't know	11

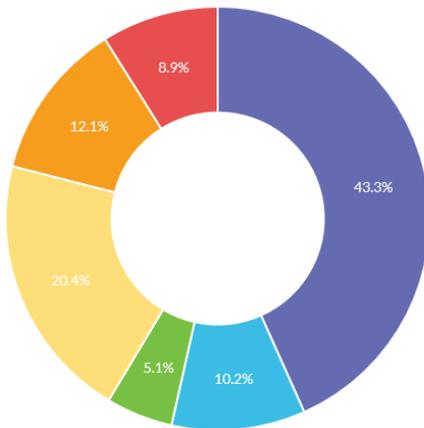
Unanswered  
0

Answered  
169

[See all answers >](#)

Q10

10. If you do not have flood insurance, why not?  
Multiple Choice



Choice	Total
Not located in floodplain	68
Too expensive	16
Not necessary because it never floods	8
Not necessary because I'm elevated or otherwise protected	32
Never really considered it	19
Other	14

Unanswered  
12

Answered  
157

[See all answers >](#)

Q11 11. If "Other," please explain.  
Essay



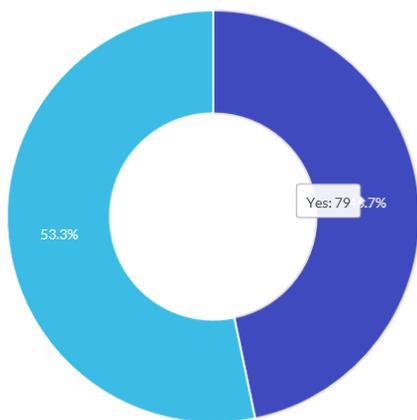
Date	Answers
Jan 25	Home is a second floor condo.
Jan 15	too expensive and my home didn't flood by rising waters, but from soaked groundwater seeping under my foundation,
Jan 9	I have never considered flood insurance because we have never flooded and our home is not in a flood prone area. However, since the huge amount of rain that we have received over the last few months, I am experiencing some concern. I have standing water in a large part of my yard now (although it has not affected the house).
Dec 20, 2018	I was told that if your home is not located in a flood plane you can't get flood insurance.
Dec 18, 2018	Usually by the time it is considered, it is within the range of time where it is not available.
Dec 15, 2018	We have not been flooded as of today - but should a large scale flood occur it may impact us. In fact we are slightly elevated and it would take a big flood to affect us.
Dec 13, 2018	I have flood insurance
Dec 13, 2018	We travel in low lying areas
Dec 11, 2018	I understand the need for it if you are on flood zone. Since I'm not located in one, I don't really feel the need to have it. Pricing is a factor too
Dec 11, 2018	I dont think I need it

Load More

Unanswered 151  
Answered 18

See all answers >

Q12 12. Have you taken any steps to make your home or neighborhood more resistant to hazards?  
Multiple Choice



Choice	Total
Yes	79
No	90

Unanswered 0  
Answered 169

See all answers >

Q13 13. If "Yes," please explain.  
Essay



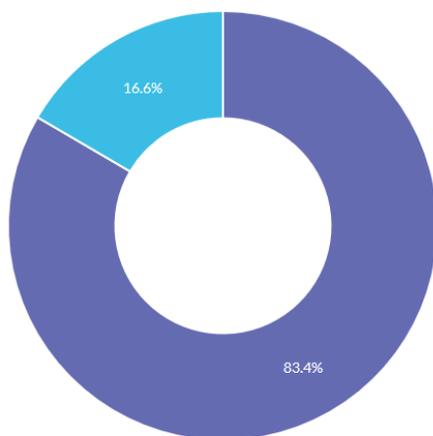
Date	Answers
Jan 31	Took down trees that could damage house in a storm.
Jan 17	tree removal
Jan 16	Cut weak trees down.
Jan 15	sought to have a new emergency manager, I have downspouts directing water away from my home and foundation, waterproofed basement walls, elevated storage barn
Jan 14	Keep debris picked up from around the house
Jan 8	trimmed trees from house and power lines
Jan 7	Built retaining walls
Dec 27, 2018	Generator and high location of structures
Dec 20, 2018	water proofing
Dec 20, 2018	Go bags, tree trimming, emergency supplies always on hand

Load More

Unanswered 99      Answered 70

[See all answers >](#)

Q14 14. Are you interested in making your home or neighborhood more resistant to hazards?  
Multiple Choice



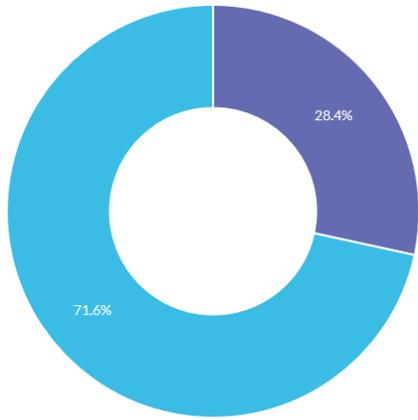
Choice	Total
Yes	141
No	28

Unanswered 0      Answered 169

[See all answers >](#)

Q15

15. Do you know what office to contact to find out more information about how to reduce your risks to hazards in your area?  
Multiple Choice



Choice	Total
Yes	48
No	121

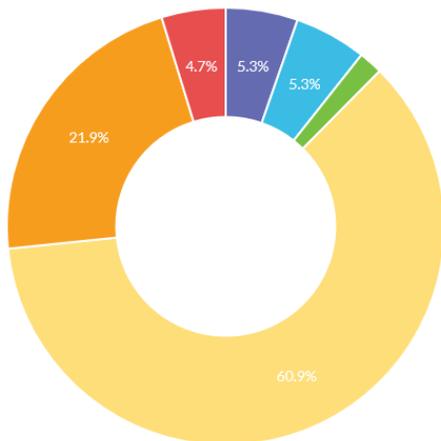
Unanswered  
0

Answered  
169

[See all answers >](#)

Q16

16. What is the most effective way for you to receive information about how to make your home and neighborhood more resistant to hazards?  
Multiple Choice



Choice	Total
Newspaper	9
Television	9
Radio	3
Internet (Including Social Media)	103
Mail	37
Public Workshops/Meetings	8
School Meetings	0

Unanswered  
0

Answered  
169

[See all answers >](#)

Q17

17. Are there any other ways you prefer to receive information? If so, please explain.

Essay



Date	Answers
Jan 22	email
Jan 15	email
Jan 9	Text messages
Jan 4	Text, Apps
Dec 20, 2018	No
Dec 19, 2018	Either email or direct mailings.
Dec 18, 2018	Mail, newspaper articles, public meetings, word of mouth
Dec 17, 2018	email
Dec 15, 2018	I just finished a letter to Albemarle city council raising many of these issues and how I think they could make residents aware of happenings, which I hope to present to city this week
Dec 14, 2018	TEXT MESSAGES

[Load More](#)

 Unanswered  
120

 Answered  
49

[See all answers >](#)

Q18

18. In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future hazard damages in your neighborhood?

Essay



Date	Answers
Feb 18	Plan ahead.
Jan 31	While not officially in a floodplain, our back yard is often partially underwater for days after a heavy rain. I would like the area to be looked at more closely, especially considering that a new development is planned for the wooded area behind us, which is wet much of the time.
Jan 30	Things homeowners can do to mitigate hazard issues
Jan 26	Keep all debris from accumulating under bridges to help with flooding. Government is horrible at that.
Jan 19	Trim trees in our neighborhood
Jan 15	actually apply for disaster aid. get hazard mitigation from FEMA to reduce flooding and take down diseased trees for free, especially on main streets. I have an old oak that needs to come down, but I don't have \$5,000 to do it. But I will let the city take it down, because if it falls, it will block E main st, and take down at least two power poles.
Jan 7	Pass laws to make sure development does no harm to further possible natural hazards.
Jan 4	Pre-hazard planning and sharing safety information. Communication is key.
Dec 27, 2018	Communication with Electric providers to proactively clear their right of ways substantially enough to prevent falling trees and limbs from interrupting service. Make it a state legislative matter the same as NCDEQ regulates sanitary sewer overflows.
Dec 20, 2018	assessments

[Load More](#)

 Unanswered  
84

 Answered  
85

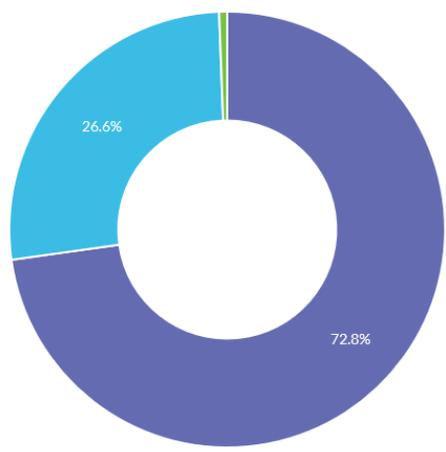
[See all answers >](#)

**Q19** 19. Are there any other issues regarding the reduction of risk and loss associated with hazards or disasters in the community that you think are important? ^  
 Essay

Date	Answers
Jan 31	No
Jan 15	pass the zoning regulations for business to keep the buildings up and enforce residential laws. sell abandoned homes for \$1.00 with the restriction that the home must be renovated within a year. Gary, Indiana is doing it and it is working and an inhabited, and renovated home will pay more property taxes and eliminate blight. also allow chuck honycutt to make low income housing. Renovate old mills and other buildings and turn them into low rent apartments for seniors and disabled people, but they cannot move in their kids or grandkids and friends..Charlotte is dying for low rent senior housing and many people would move here if there was some.
Dec 27, 2018	Proper and timely cancellation of work if roads are unsafe to travel.
Dec 20, 2018	no
Dec 18, 2018	funding is a huge issue. Not having the funds to take down a hazardous tree is one reason folks don't address issues prior to events.
Dec 14, 2018	There seem to be so many more risks we deal with today and there is only so much money to go around to address them. We need to be wise with our resources and make sure we have what's needed for deal with those hazards we have the most potential of experiencing.
Dec 13, 2018	Yes better grading on road shoulders to reduce standing water and better ditch management. Local DOT response and maintenance of roads right of ways has deteriorated over the past 10 years.
Dec 13, 2018	MAKING SURE WATER WAYS ARE CLEAN
Dec 13, 2018	I believe that the city or county should not approve housing construction in flood plains unless there is mitigation to keep the home from flooding. Historically 80% of homes that use flood insurance are repeat claimants. This would eliminate that problem or at least reduce it. Also get a volunteer group that residents can participate in to clean up our neighbors during disasters
Dec 13, 2018	Quick response and recovery efforts

[Load More](#)

**Q20** A number of community-wide activities can reduce our risk from hazards. In general, these activities fall into one of the following six broad categories. In the next six questions, please tell us how... ^  
 Multiple Choice

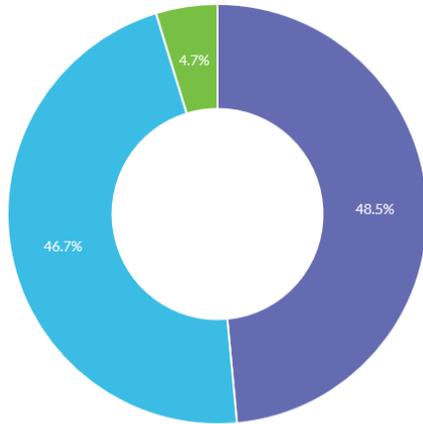


Choice	Total
Very important	123
Somewhat important	45
Not important	1

Q21

21. Property Protection - Actions that involve the modification of existing buildings to protect them from a hazard or removal from the hazard area. Examples include acquisition, relocation, elevation...

Multiple Choice



Choice	Total
Very important	82
Somewhat important	79
Not important	8

Unanswered  
0

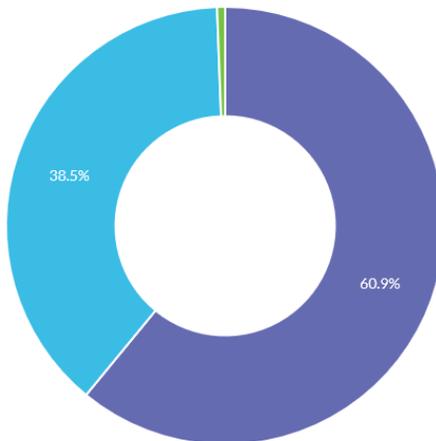
Answered  
169

[See all answers >](#)

Q22

22. Natural Resource Protection - Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. Examples include: floodplain protection, habitat...

Multiple Choice



Choice	Total
Very important	103
Somewhat important	65
Not important	1

Unanswered  
0

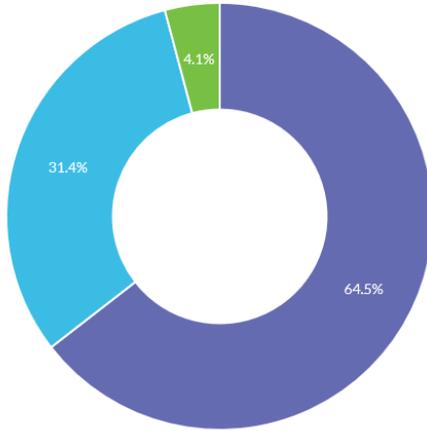
Answered  
169

[See all answers >](#)

Q23

23. Structural Projects - Actions intended to lessen the impact of a hazard by modifying the natural progression of the hazard. Examples include dams, levees, detention/retention basins, channel...

Multiple Choice



Choice	Total
Very important	109
Somewhat important	53
Not important	7

Unanswered  
0

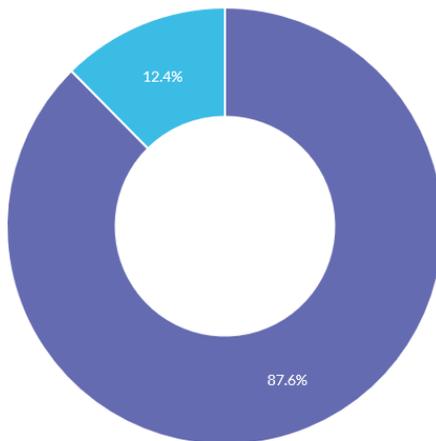
Answered  
169

[See all answers >](#)

Q24

24. Emergency Services - Actions that protect people and property during and immediately after a hazard event. Examples include warning systems, evacuation planning, emergency response training, and...

Multiple Choice



Choice	Total
Very important	148
Somewhat important	21
Not important	0

Unanswered  
0

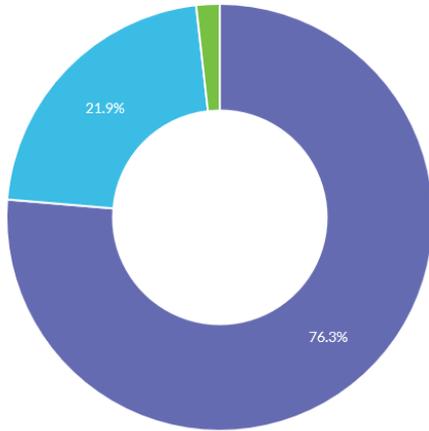
Answered  
169

[See all answers >](#)

Q25

25. Public Education and Awareness - Actions to inform citizens about hazards and the techniques they can use to protect themselves and their property. Examples include outreach projects, school...

Multiple Choice



Choice	Total
Very important	129
Somewhat important	37
Not important	3

Unanswered  
0

Answered  
169

[See all answers >](#)

Q26

This survey may be submitted anonymously; however, if you provide us with your name and contact information below, we will have the ability to follow up with you to learn more about your ideas or...

Essay

Date	Answers
Jan 31	Phil Clutts 7664 Cotton Street, Harrisburg 28075 704-455-8503 <a href="mailto:pclutts@earthlink.net">pclutts@earthlink.net</a>
Jan 26	Chris appmfinc@gmail.com
Jan 15	Elizabeth Roberts <a href="tel:704-986-6724">704-986-6724</a>
Jan 7	Bryan Dunn, Fire Chief Harrisburg Fire Department <a href="tel:704-455-0741">704-455-0741</a>
Dec 18, 2018	dhclayton@stanlycountync.gov
Dec 17, 2018	Lisa Kiser - lkiser@albemarle.gov
Dec 15, 2018	Bud Risner 454 Anderson Road Albemarle, NC 28001 704-225-3498
Dec 14, 2018	Mark Fowler <a href="tel:704787-6765">(704)787-6765</a>
Dec 14, 2018	Brett Matthes 153 Beverly Dr NE Concord <a href="tel:980-621-6946">980-621-6946</a>
Dec 13, 2018	Ed Phillips <a href="tel:704-786-6591">704-786-6591</a>

Load More

Unanswered  
147

Answered  
22

[See all answers >](#)

# Appendix E

## Completed Mitigation Actions

This section of the Plan includes the mitigation actions that have been completed by the participating jurisdictions.

# Cabarrus County Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Adopt and enforce latest model building codes and national wind engineering standards.	Severe Thunderstorm, Hurricane and Tropical Storm, Winter Storm, Tornado	Moderate	Construction Standards	Local	2019 The County will update versions of building codes and wind engineering standards as new ones become available.	Completed. This is part of the state building code and is handled through Construction Standards. The County implements these codes as part of Construction standards review and subsequent inspections for code compliance. This action will be completed by 2019.
P-2	Require residential construction to meet latest wind-resistance standards; encourage replacement of doublewide garage doors to improve wind resistance.	Severe Thunderstorm, Hurricane and Tropical Storm, Winter Storm, Tornado	Moderate	Construction Standards	Local	2019 The County will update versions of wind engineering standards as new ones become available.	Completed. This is part of the state building code and is handled through Construction Standards. The County implements these standards as part of Construction Standards review and subsequent inspections for code compliance. This action will be completed by 2019.
P-3	Review county building codes to determine if current standards will reduce hazards from winter storms.	Winter Storm	Moderate	Construction Standards	Local	2019 The County will continue to monitor versions of building codes as new ones become available.	Completed. This part of the state building code and is handled through Construction Standards. Implement as part of Construction Standards review and subsequent inspections for code compliance. This action will be completed by 2019.

**APPENDIX E: COMPLETED MITIGATION ACTIONS**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
P-6	Review/update flood damage prevention ordinance to ensure maximum protection from flood hazards.	Flood	High	Planning and Development, Board of Commissioners, Construction Standards	Local	Completed. The ordinance will remain as it is until changes occur at state or federal level and/or county is advised to change.	Completed. Model ordinance adopted as recommended by the State. Freeboard of 2' adopted as part of the ordinance which exceeds the typical 1' requirement. Current Flood Damage Ordinance is in compliance and will remain until changes occur at state or federal level and/or county is advised to change.
P-9	Revise/update regulatory floodplain maps.	Flood	Moderate	FEMA, NCDENR, NCEM, Planning and Development	Local, State, Federal	Deleted.	This action was moved to the Deleted Actions tab during the 2019 update.
P-12	Review countywide zoning plan or, at a minimum, adopt zoning in floodplain areas to better control future development in these areas.	Flood	High	Board of Commissioners, Municipalities	Local	Action completed. This action will be removed from future plan updates.	Completed. Cabarrus County has zoning through the county, In 2005, the Cabarrus County zoning ordinance regulations were updated to include a requirement that for any new subdivisions, the floodplain must be included as part of the open space. The Cabarrus County flood damage prevention ordinance also applies to unincorporated county.
P-13	Delineate preferred growth areas and develop are plans for target locations.	Flood	High	Board of Commissioners, Municipalities	Local	Action completed. This action will be removed from future plan updates.	Completed. Cabarrus County has co-adopted plans with the City of Concord and with the Town of Harrisburg to encourage development where infrastructure investments have already been made. New subdivision development regulations require that.

**APPENDIX E: COMPLETED MITIGATION ACTIONS**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
P-16	Review Capital Improvement Plan to ensure no public facilities proposed for flood hazard areas; amend as necessary. Protect new critical facilities (e.g. schools, hospitals, fire, shelters) to 2 feet above the 100 year flood elevation (5 feet above BFE).	Flood	Moderate	Board of Commissioners, Municipalities, Board of Education	Local	This action will be revisited by 2019.	Delete. County does not construct any new critical structures in regulated floodplain.
P-17	Prepare countywide storm water management plan covering river basins.	Flood	Low	DENR, NRCS	State	2015	Delete. County is not a utility provider. Storm water management through cities and towns only. County is subject to Phase II post construction permitting with the state but that is for individual sites. County considering local Erosion Control program for 2020.
P-20	Develop plan for relocating public infrastructure out of flood hazard areas.	Flood	Low	Emergency Management, General Services, Municipalities	Local	This action is being deleted because the County is not a utility provider and does not maintain infrastructure.	This action was moved to the Deleted Actions tab during the 2019 update.
P-23	Track benefits of flood loss reduction.	Flood	Moderate	Planning and Development, Emergency	Local	This action is being deleted.	This action was moved to the Deleted Actions tab during the 2019 update.
P-24	Produce annual progress reports on how plan is being implemented, send with annual CRS recertification.	All Hazards	Low	Planning and Development	Local	This action is being deleted because it is not a CRS requirement.	This action was moved to the Deleted Actions tab during the 2019 update.

**APPENDIX E: COMPLETED MITIGATION ACTIONS**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Property Protection</b>							
PP-1	Ensure that manufactured homes are installed and properly secured.	Severe Thunderstorm, Hurricane and Tropical Storm, Winter Storm, Tornado	High	Construction Standards, Planning and Development	Local	This action has been completed and is ongoing through enforcement of Constructions Standards review. It will be removed from future plan updates.	Completed. This is part of the state building code and is handled through Construction Standards. Implement as part of Construction Standards review and subsequent inspections for code compliance.
PP-2	Ensure doorframes are securely anchored, especially double doors that can be very dangerous in high winds if not securely fastened.	Severe Thunderstorm, Hurricane and Tropical Storm, Winter Storm, Tornado	Moderate	Construction Standards, Planning and Development	Local	This action has been completed and is ongoing through enforcement of Constructions Standards review. It will be removed from future plan updates.	Completed. This is part of the state building code and is handled through Construction Standards. Implement as part of Construction Standards review and subsequent inspections for code compliance.
PP-3	All new, remodeled or repairs to substantially damaged buildings should be elevated to the base flood elevation to a minimum of 2 feet above BFE.	Flood	Moderate	Board of Commissioners, Municipalities, Construction Standards	Local	This action has been completed and is ongoing through enforcement of the Flood Damage Prevention Ordinance. It will be removed from future plan updates.	Completed. This is required as part of the FDPO.
PP-5	Review any rebuilding strategies in wake of local emergencies and consider policies/procedures for minimizing repetitive losses.	Flood	Low	Board of Commissioners, Municipalities, Planning and Development, Construction Standards	Local	This action is implemented as needed through the enforcement of regulations and construction standards. It will be removed from future plan	Structures could not be built back unless they met current codes for building, which now includes flood regulations. Implement as part of Construction standards review and subsequent inspections for code compliance.

**APPENDIX E: COMPLETED MITIGATION ACTIONS**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
PP-6	Prohibit enclosures to the lower areas of elevated buildings, including breakaway walls.	Flood	High	Planning and Development, Construction Standards, Municipalities	Local	This action is implemented as needed through construction standards. It will be removed from future plan updates.	Completed. This part of the state building code and is handled through Construction Standards. Implement as part of Construction Standards review and subsequent inspections for code compliance.
PP-7	Continue to require and maintain FEMA elevation certificates for new buildings or improvements to buildings on lots including any portion of 100 year floodplain.	Flood	High	Planning and Development, Construction Standards	Local	This action is implemented as needed through the enforcement of the Flood Damage Prevention Ordinance. It will be removed from future plan updates.	Elevation certificates are required for development on parcels which have 100 year floodplain present. (Pre-construction and post-construction required).
PP-8	Advise/assist property owners in retrofitting their businesses and homes. Retrofitting means modifying an existing building or yard to protect the property from flood damage.	Flood	Moderate	Planning and Development, Construction Standards	Local	This is an ongoing activity that represents the County's mitigation capability. It will be removed from future plan updates.	Ongoing. Construction Standards staff provides technical assistance for construction as needed.
PP-9	Develop an open space plan.	Flood	Moderate	Planning and Development, Soil and Water	State	This action will be deleted and will not be included in future updates of the hazard mitigation plan.	Deleted. Due to no funding and county policies.

**APPENDIX E: COMPLETED MITIGATION ACTIONS**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
SP-1	Establish coordinating committee to ensure that responsible parties communicate to ensure maximum cooperation in developing and maintaining the county's drainage systems.	Flood	Low	Engineering, Drainage Districts, NCRS Environmental Health	Local	This action will be deleted and will not be included in future plan updates.	Deleted. Cabarrus is not a utility provider.
SP-2	Establish/maintain coordinated Construction Standards program.	Flood	Moderate	Municipal Public Works	Local	This action is complete and will be removed from future plan updates.	Complete and ongoing. The state building code is used and administer through Construction Standards.
<b>Public Education and Awareness</b>							
PEA-1	Maintain current Early Warning System/Dissemination of information alerting town residents when to seek shelter when high winds or other hazards are expected.	All Hazards	Moderate	Emergency Management, Sheriff	Local	This action is complete and will be removed from future plan updates.	Complete and ongoing. Early Warning System/Dissemination of information is used to alert residents when to seek shelter when high winds expected.
PEA-6	Maintain library on retrofitting techniques and publicize through bulletins/newsletters.	Flood	Low	Planning and Development, Construction Standards	FEMA, USACE	This action is complete and ongoing. It will be removed from future plan updates.	This is typically handled by engineered drawings and in conjunction with Construction Standards and the building code. Construction Standards staff provides technical assistance for construction as needed.
PEA-7	Maintain hazard awareness program (elevation certificates, FIRM data, bulletin on property protection measures and flood insurance, etc.).	Flood	Moderate	Planning and Development, Communications and Outreach, Banks, Real Estate Agents, Insurance Agents, Chamber of Commerce	Local	This is an ongoing activity required for CRS credit. This action will be removed from future hazard mitigation plan updates.	Complete and ongoing. Required as part of CRS program. Maintain current information in office and on website.

**APPENDIX E: COMPLETED MITIGATION ACTIONS**

<b>Action #</b>	<b>Description</b>	<b>Hazard(s) Addressed</b>	<b>Relative Priority</b>	<b>Lead Agency/ Department</b>	<b>Potential Funding Sources</b>	<b>Implementation Schedule</b>	<b>Implementation Status (2020)</b>
PEA-9	Establish a Flood Awareness Week to publicize hazard and protection measures.	Flood	Low	Communication and Outreach, Planning and Development, Board of Commissioners, Municipalities, Local Media	Local	This action is complete and ongoing. It will be removed from future plan updates.	Completed. FEMA does an outreach campaign each March in which Cabarrus County participates. Information provided directly from FEMA is disseminated through social media and the Cabarrus County website.
PEA-10	Request that the real estate Multiple Listing Service (MLS) be amended to include notice of flood hazard and the requirement to purchase flood insurance.	Flood	High	Board of Commissioners, Municipalities, Planning and Development, Real Estate Agents	Local	This action will be deleted and will not be included in future plan updates.	Deleted. These databases are handled through local realty groups (i.e., Charlotte Regional, Cabarrus Regional etc.). They have other ways to verify flood data. Liability if placed on site.

# City of Concord Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-9	Continue to provide and maintain NIMS training for all departments and key government officials.	All Hazards	Moderate	All Departments, Emergency Management	DHS, EMI, Community Colleges	This is an ongoing action that will be removed from future plan updates.	This is an ongoing action that will be removed from future plan updates and will be discussed in the Capability Assessment section as an ongoing policy that improves the City's mitigation capability. The initial implementation of training was successful and on-line. FEMA courses have been a good resource. Uncertainty remains if departments are still addressing new hires.
P-10	Promote better communication and coordination between floodplain management division and Business and Neighborhoods and Emergency Management.	Flood	Moderate	Business and Neighborhoods, Emergency Management	N/A	This is an ongoing action that will be removed from future plan updates.	This is an ongoing action that will be removed from future plan updates and will be discussed in the Capability Assessment section as an ongoing policy that improves the City's mitigation capability. Success of this measure resulted in improvement to the community CRS rating. The divisions are in contact and work together to address flood issues.
<b>Property Protection</b>							
PP-3	Burial of new power lines in sub-divisions and evaluation of burial of existing power lines.	Winter Storm, Tornado, Hurricanes and Tropical Storm, Severe Thunderstorm	Moderate	Electric	HMGP, 406 Mitigation, Economic Development	This is an ongoing action that will be removed from future plan updates.	This is an ongoing action that will be removed from future plan updates and will be discussed in the Capability Assessment section as an ongoing policy that improves the City's mitigation capability.

**APPENDIX E: COMPLETED MITIGATION ACTIONS**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Emergency Services</b>							
ES-1	Clearly mark detours during events and recovery operations that cause obstructed roadways.	All Hazards	Moderate	Transportation, Streets	Transportation	This is an ongoing action that will be removed from future plan updates.	This is an ongoing action that will be removed from future plan updates and will be discussed in the Capability Assessment section as an ongoing policy that improves the City's mitigation capability. The Streets Department developed a response trailer equipped to implement emergency detours which has been successfully deployed multiple times.
ES-2	Maintain resources to adequately control traffic such as barricades, barriers, cones, and signs.	All Hazards	Moderate	Transportation, Streets	Transportation, Police, Fire and Life Safety	This is an ongoing action that will be removed from future plan updates.	This is an ongoing action that will be removed from future plan updates and will be discussed in the Capability Assessment section as an ongoing policy that improves the City's mitigation capability. Several departments maintain these including Streets, Fire, and Police. Streets has developed a "detour" trailer equipped with resources to respond to developing situations. An I-85 detour plan is in place and road closure information is posted on the City's web page.

**APPENDIX E: COMPLETED MITIGATION ACTIONS**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
ES-3	Develop Emergency Operations Plans for dams.	Dam Failure	Moderate	Water Resources, Emergency Management	Water resources, WSAAC	Action completed. Will be removed from future hazard mitigation plan updates.	Completed. These plans are developed. The first tabletop exercise was completed in 2014. Results of the exercise will provide knowledge of the plan contents by responsible parties.
ES-4	Develop evacuation and detour routes.	Flood	High	Streets, Police, Fire	Local, Stormwater, Business and Neighborhoods, FMA, HMGP	Action completed. This action will be removed from future plan updates.	Complete. These have been developed for rail incidents though identified flood prone area and detour routes have not been posted to the internet. Annual review and incident review of flood events are conducted.
<b>Public Education and Awareness</b>							
PEA-5	Develop public information and alerting system for dam failure based on plans.	Dam Failure	High	Water Resources, Public Affairs and Project Manager, Emergency Management	Water Resources, WSAAC	Action completed. This action will be removed from future updates.	Completed. The Blackboard system and notification through the Emergency Alert system remain effective means of notification.
PEA-6	Continue emergency notification system (Connect CTY) to notify citizens of hazards and emergencies.	All Hazards	Moderate	Public Affairs	City Administration	Action completed. This action will be removed from future updates.	Completed. Blackboard has replaced Connect CTY.
PEA-8	Conduct NFIP Educational Programs.	Flood	High	Business and Neighborhoods	Local, FEMA	This action has been completed and will be removed from future plan updates.	Completed. These programs are provided upon request and should be considered part of the city's capabilities.
PEA-9	Encourage residents to keep storm drains clear of debris during storm events.	Flood	High	Stormwater	Local, FEMA	This is an ongoing action that will be removed from future plan updates	This is an ongoing action that will be removed from future plan updates and will be discussed in the Capability Assessment section as an ongoing policy that improves the City's mitigation capability. Brochures and information on web page.

# Town of Midland Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	In conjunction with Cabarrus County Government, adopt and enforce latest model building codes and national wind engineering standards.	Severe Thunderstorm, Hurricane and Tropical Storm, Winter Storm, Tornado	Moderate	Town Council, Cabarrus County Construction Standards	Local	This action is being deleted and will not appear in future updates of the hazards mitigation plan.	Enforcement of the building codes is a County function. This action is being deleted.
P-2	Review plan for debris removal and disposal.	Winter Storm	High	Town Council	Local, EMPG	This action is being deleted and will not appear in future updates of the hazards mitigation plan.	Implementation and maintenance of the debris removal and disposal plan is a County function. This action is being deleted.
P-3	In conjunction with Cabarrus County Planning and Development Department, review/update flood damage prevention ordinance to ensure maximum protection from flood hazard events.	Flood	High	Town Council	Local	The ordinance will remain as it is until changes occur at state or federal level and/or county is advised to change.	Completed. Model ordinance adopted as recommended by the State in November 2018. Freeboard of 2' adopted as part of the ordinance which exceeds the typical 1' requirement. Current Flood Damage Ordinance is in compliance and will remain until changes occur at state or federal level and/or county is advised to change.
P-4	Revise/update regulatory floodplain maps with Cabarrus County Planning and Development Department.	Flood	Moderate	FEMA, NCDER, NCEM	Local, State, Federal	This action will be deleted from future plan updates.	Deleted. Not a Town function. Updated maps were provided by FEMA in November of 2008. Revised panels were also provided in February 2014.

**APPENDIX E: COMPLETED MITIGATION ACTIONS**

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
P-8	Adopt policies that discourage growth in flood hazard areas, including policy on not extending public services or utilities into flood hazard zones.	Flood	Moderate	Town Council, Planning and Zoning Commission	Local	This action is being deleted and will not appear in future updates of the hazard mitigation plan.	The County enforces the flood damage prevention ordinance which regulates development in the floodplain.
<b>Property Protection</b>							
PP-1	Ensure that manufactured homes are installed and properly secured.	Severe Thunderstorm, Hurricane and Tropical Storm, Winter Storm, Tornado	High	Town Council, Cabarrus County Construction Standards	Local	This action is being deleted and will not appear in future hazard mitigation plan updates.	Enforcement of building codes is a County function. This action is being deleted.
PP-2	All new, remodeled or repairs to substantially damaged buildings should be elevated to the base flood elevation to a minimum of 2 feet above BFE. Consider prohibiting construction or	Flood	Moderate	Town Council	Local	This action is being deleted and will not appear in future hazard mitigation plan updates.	Enforcement of building codes and the flood damage prevention ordinance are County functions. This action is being deleted.
PP-3	Review any rebuilding strategies in wake of local emergencies and consider policies/procedures for minimizing repetitive losses.	Flood	Low	Town Council	Local	This action is being deleted and will not appear in future hazard mitigation plan updates.	Enforcement of building codes is a County function. This action is being deleted.
PP-4	Advise/assist property owners in retrofitting their businesses and homes. Retrofitting means modifying an existing building or yard to protect the property from flood damage.	Flood	Moderate	Planning and Zoning Commission, Town Council	Local	Ongoing – action will be removed from future plan updates	This is an ongoing action that will be removed from future plan updates and will be discussed in the Capability Assessment section as an ongoing policy that improves the County’s mitigation capability.

**APPENDIX E: COMPLETED MITIGATION ACTIONS**

Public Education and Awareness							
PEA-3	Develop and implement hazard awareness program (elevation certificates, FIRM data, bulletin on property protection measures and flood insurance, etc.).	Flood	Moderate	Town Council, Midland Volunteer Fire Department	Local	This is an ongoing activity required for the County's CRS credit. This action will be removed from future hazard mitigation plan updates.	Complete and ongoing. Required as part of the County's CRS program. Maintain current information in office and on website.
PEA-4	Establish a Flood Awareness Week to publicize hazard and protection measures.	Flood	Low	Town Council	Local	This action is complete and ongoing. It will be removed from future plan updates.	Completed. FEMA does an outreach campaign each March in which Cabarrus County participates. Information provided directly from FEMA is disseminated through social media and the Cabarrus County website.
PEA-5	Request that the real estate Multiple Listing Service (MLS) be amended to include notice of flood hazard and the requirement to purchase flood insurance.	Flood	High	Town Council	Local	This action will be deleted and will not be included in future plan updates.	Deleted. These databases are handled through local realty groups (i.e., Charlotte Regional, Cabarrus Regional etc.). They have other ways to verify flood data. Liability if placed on site.

## Town of Mount Pleasant Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Emergency Services</b>							
PEA-5	Request that the real estate Multiple Listing Service (MLS) be amended to include notice of flood hazard and the requirement to purchase flood insurance.	Flood	Low	Town Council (policy support)	Local	Ongoing	This does not appear to be a responsibility of local government but more of a policy stance regarding the MLS.

# Stanly County Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	No building in floodplain.	Flood	High	Planning	N/A	Ongoing – action will be removed from future plan updates	This is an ongoing action that will be removed from future plan updates and will be discussed in the Capability Assessment section as an ongoing policy that improves the County’s mitigation capability.
P-3	Investigate CRS program	Flood	Moderate	Planning	Local	2019	Delete. The value of potential property loss did not justify implementation. It was not cost effective to implement the program based on the properties involved.

## City of Albemarle Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-2	Map the geographic boundaries of flood areas using Geographic Information Systems (GIS Technology).	Flood	Moderate	Engineering	Local	2024	Completed. Stanly County currently maintains a floodzone GIS layer that delineated the geographic boundaries of flood areas.

## City of Locust Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Develop a stormwater management plan.	Flood	Moderate	Transportation	General Fund	This action has been completed and will be deleted from future plan updates.	Complete. Action will be deleted from future plan updates.
P-2	Saferoom requirements/ordinance in new construction.	Tornado, Severe Thunderstorm, Hurricane and Tropical Storm, Winter Storm	Moderate	Planning	General Fund	This action has been completed and will be deleted from future plan updates.	Complete. Action will be deleted from future plan updates.
<b>Emergency Services</b>							
ES-1	Conduct a comprehensive study on emergency communications issues in our area.	All Hazards	Moderate	Fire Department	General Fund	This action has been completed and will be deleted from future plan updates.	Complete. Action will be deleted from future plan updates.

# Union County Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-4	Research, develop and adopt a local tree ordinance that will encourage the preservation of healthy trees in large-scale developments and the removal of "hazard" trees along public rights of way as part of the Land Use Ordinance.	Hurricane and Coastal Hazards, Severe Winter Weather, Thunderstorm	Low	Planning	N/A	2019	This action is complete. New UDO encourages preservation of existing trees in non-buildable areas over 12" in diameter by requiring mitigation at 125% for trees that are removed. Hazardous trees that would be otherwise maintained are allowed to be removed after approval by the County's Urban Forester.
<b>Natural Resource Protection</b>							
NRP-1	Develop an Open Space/Greenway Plan that integrates flood mitigation strategies with open space management techniques.	Flood	Low	Planning, Parks and Recreation	Local, NCDENR, NCDOT, The Conservation Fund	2019	Adopted a Parks and Greenway Plan that encourages greenway development and floodplain preservation.
<b>Emergency Services</b>							
ES-1	Provide for alternate power or pumping capabilities at major lift stations.	Flood	Low	Public Works	Water and Sewer Fund	2019	New replace pumps have been installed @ lift-station where required to meet the 2.5 times peak average flow guidelines. Additionally, back-up pump station sources have been secured for redundancy.

**APPENDIX E: COMPLETED MITIGATION ACTIONS**

Public Education and Awareness							
PEA-4	Increase awareness of fire safety techniques via the Adult Fire Prevention Program.	Wildfire	Low	Fire Services, Red Cross	DHS, Citizen Corps, FEMA/Red Cross publications	2015, Annual review and update of material	Union County through a grant has purchased an all-hazard education trailer which will target hazards, such as fire, flooding - weather and emergency communications.

## Town of Fairview Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Public Education and Awareness</b>							
PEA-2	Raise public awareness of natural hazards that could affect the area	All Hazards	Moderate	Emergency Management	Local	2019	This action is complete.

## Town of Hemby Bridge Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Natural Resource Protection</b>							
NRP-1	Develop an Open Space/Greenway Plan that integrates flood mitigation strategies with open space management techniques.	Flood	Low	Planning, Parks and Recreation	Local, NCDENR, NCDOT, The Conservation Fund	2019	Adopted a Parks and Greenway Plan that encourages greenway development and floodplain preservation. Also, adopted the Hemby Bridge Small Area Plan in 2018 that encourages floodplain and open space preservation along with greenways.

## Town of Indian Trail Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Maintain Minimum Housing Ordinance.	Flood	Moderate	Town Planning and Zoning	Local	Action will be removed from future hazard mitigation plan updates.	This is an ongoing action that will be removed from future plan updates and will be discussed in the Capability Assessment section as an ongoing policy that improves the Town's mitigation capability.
P-4	Draft and adopt a Stormwater Master Plan	Flood	Moderate	Engineering	Stormwater Utility	2019	This action is complete. We are a Phase II stormwater permitting program.
P-5	Achieve CFM Certification	Flood	Moderate	Engineering	Stormwater Utility	2019	This action is complete. We are a Phase II stormwater permitting program.

## Town of Marshville Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Revise Land Use Plan to include mitigation elements.	All Hazards	Moderate	Planning Board, Land Use Administrator, Town Administrator	Local, General Fund	2019	The Town Plan 2015 Land Use & Comprehensive Master Plan was adopted in 2016. Its goals include preservation of open space and its actions address the protection and enhancement of tree cover.
<b>Natural Resource Protection</b>							
NRP-1	Develop an Open Space/Greenway Plan that integrates flood mitigation strategies with open space management techniques.	Flood	Low	Planning, Parks and Recreation	Local, NCDENR, NCDOT, The Conservation Fund	2019	The Town Plan 2015 Land Use & Comprehensive Master Plan includes this action in its vision and is therefore complete.

## Village of Marvin Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Regularly calculate/document the amount of flood prone property	Flooding	Moderate	Planning, GIS	Local, General Funds	Annually	This action is complete and takes place every year.
<b>Natural Resource Protection</b>							
NRP-2	Create blasting ordinance.	Seismic Disturbance	High	Planning	Local	Summer 2014	This action was completed in 2014.
<b>Public Education and Awareness</b>							
PEA-1	Educate residents about emergency alert procedures	All Hazards	Moderate	Village Administration	Local	2019	This action was completed.
PEA-2	Raise public awareness of natural hazards that could affect the area.	All Hazards	Moderate	Village Administration	Village Budget	2019	This action was completed.

## Town of Mineral Springs Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Structural Projects</b>							
SP-2	Add safeguards for CSX Railroad to prevent derailment near Mineral Springs Mill and Fertilizer.	Hazardous Substances	Moderate	Fire Department, Town Administration	Local	2019	Per Mineral Springs Fire & Rescue Department Chief Donald Gaddy, CSX has remediated any issues found with their tracks in downtown Mineral Springs.

## City of Monroe Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-1	Develop drainage system maintenance procedures for cleaning and clearing debris from system and making repairs as required.	Flood	High	Engineering Department, Street Division	Local	2019	This action is complete.
P-2	Facilitate advanced training of building inspectors.	All Hazards	High	Planning and Development (Building Standards)	Local	2019	This action is complete.
P-5	On-site sediment retention > 12,000 square feet developed.	Flood	Moderate	Engineering	State grants	2019	This action is complete.
<b>Natural Resource Protection</b>							
NRP-2	Develop an Open Space/Greenway Plan that integrates flood mitigation strategies with open space management techniques.	Flood	Low	Planning and Development , Parks and Recreation	Local, NCDENR, NCDOT, The Conservation Fund	2019	This action is complete.

## Town of Stallings Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Natural Resource Protection</b>							
NRP-1	Develop an Open Space/Greenway Plan that integrates flood mitigation strategies with open space management techniques.	Flood	Low	Planning, Parks and Recreation	Local, NCDENR, NCDOT, The Conservation Fund	2019	Complete. Connect Stallings Greenway & Recreation Master Plan adopted by Council. Contract for engineering associated with Phase I design executed.

## Town of Unionville Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Public Education and Awareness</b>							
PEA-2	Raise public awareness of natural hazards that could affect the area.	All Hazards	Moderate	Town Administration	Town Budget	2019	This action has been completed. Preparedness links on Town website.

## Town of Wingate Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-3	Require sprinkler systems in older structures.	Wildfire	Moderate	Waxhaw Board of Commissioners	Local	2015	This action has been deleted.
P-4	Carry out Phase II stream cleanup.	Flood	Low	Waxhaw Board of Commissioners	FEMA	2015	This action has been deleted.
<b>Property Protection</b>							
PP-1	Acquire safe sites for public facilities.	All Hazards	Moderate -High	Waxhaw Board of Commissioners	Local	2019	This action has been completed.
<b>Emergency Services</b>							
ES-3	Renovate fire hydrant system in downtown.	Wildfire	Moderate	Waxhaw Board of Commissioners	General Budget	2015	This action has been completed.

## Town of Weddington Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Emergency Services</b>							
ES-2	Assisted in upgrading Providence VFD to code for overnight facilities to help with fire coverage/response times.	All Hazards	High/ Moderate	Town Administration	Local Fund Balance	Apr-14	This action has been deleted.

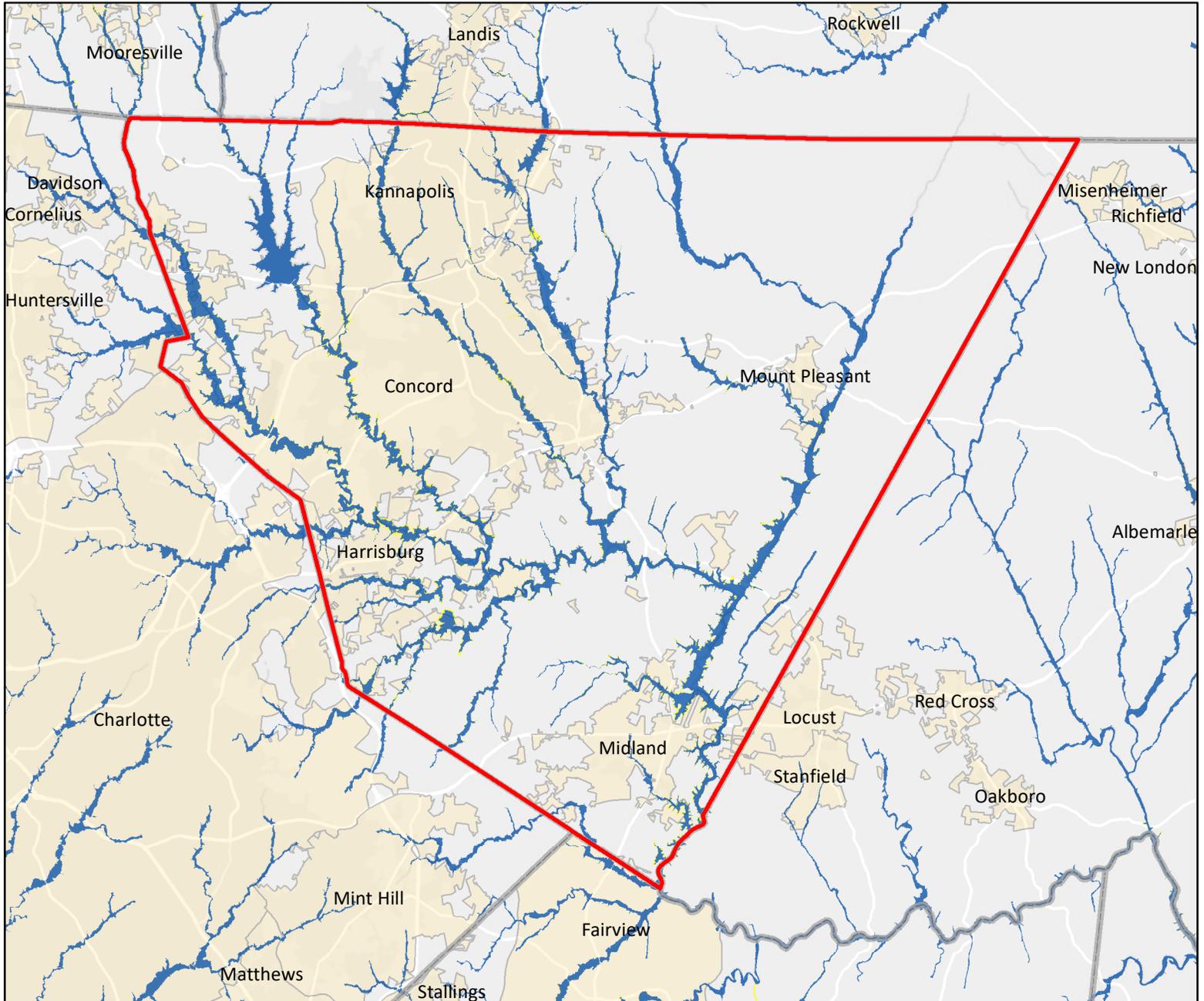
## Town of Wingate Completed Mitigation Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Lead Agency/ Department	Potential Funding Sources	Implementation Schedule	Implementation Status (2020)
<b>Prevention</b>							
P-7	Designate a local floodplain manager that achieves CFM certification	Flood	Moderate	Planning	General Funds	2019	This action is complete
<b>Structural Projects</b>							
SP-2	TV sewer mains and either make local point repairs, or line pipe using CIPP.	Flood	High	Public Works	Water/Sewer	2019	This action is complete.

# **Appendix F**

## **Flood Hazard Maps**

# Cabarrus County - Flood Hazard Areas



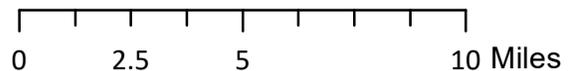
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

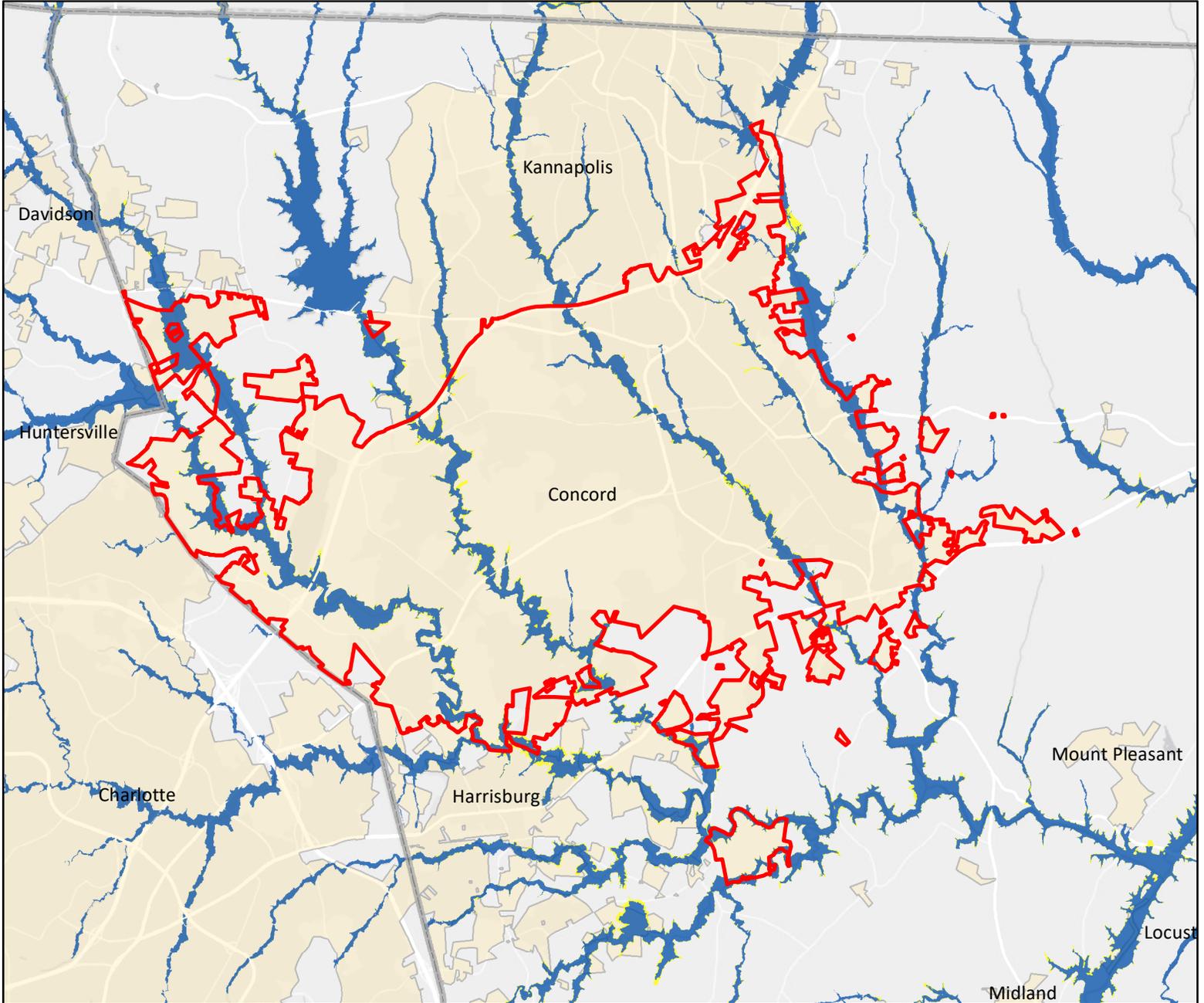
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Concord - Flood Hazard Areas



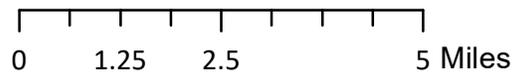
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

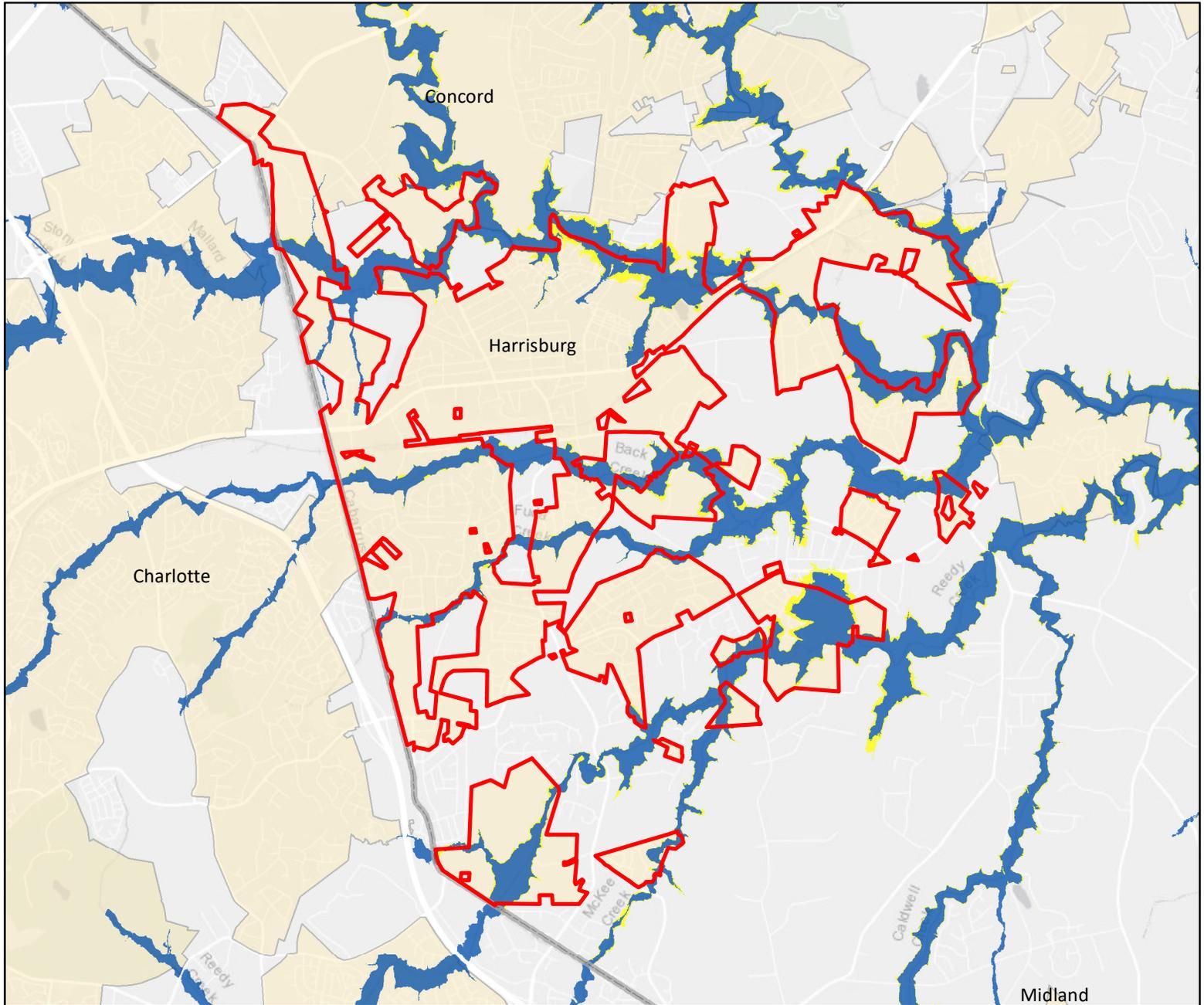
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Harrisburg - Flood Hazard Areas



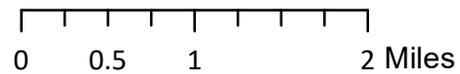
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

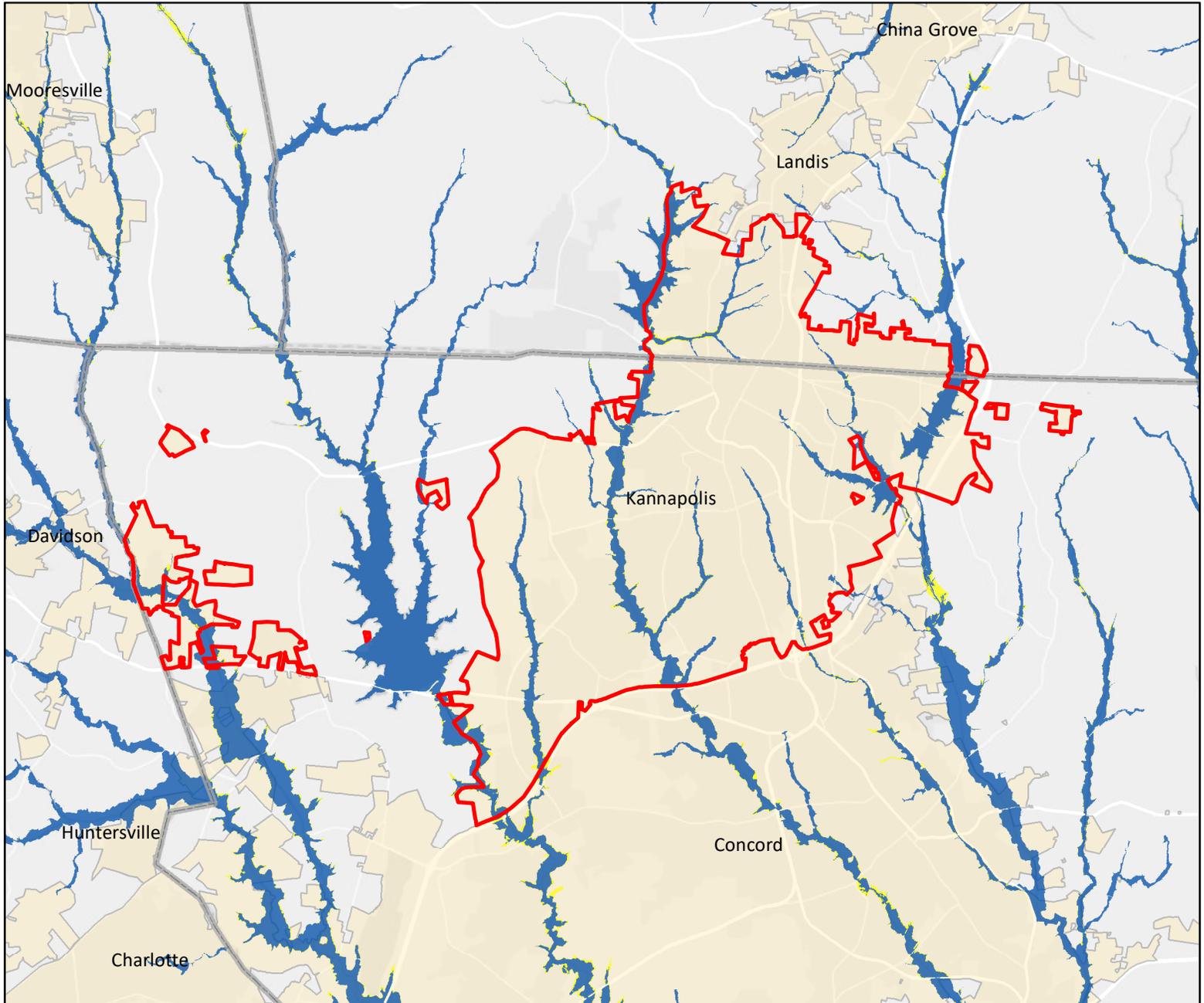
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Kannapolis - Flood Hazard Areas



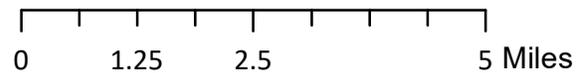
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

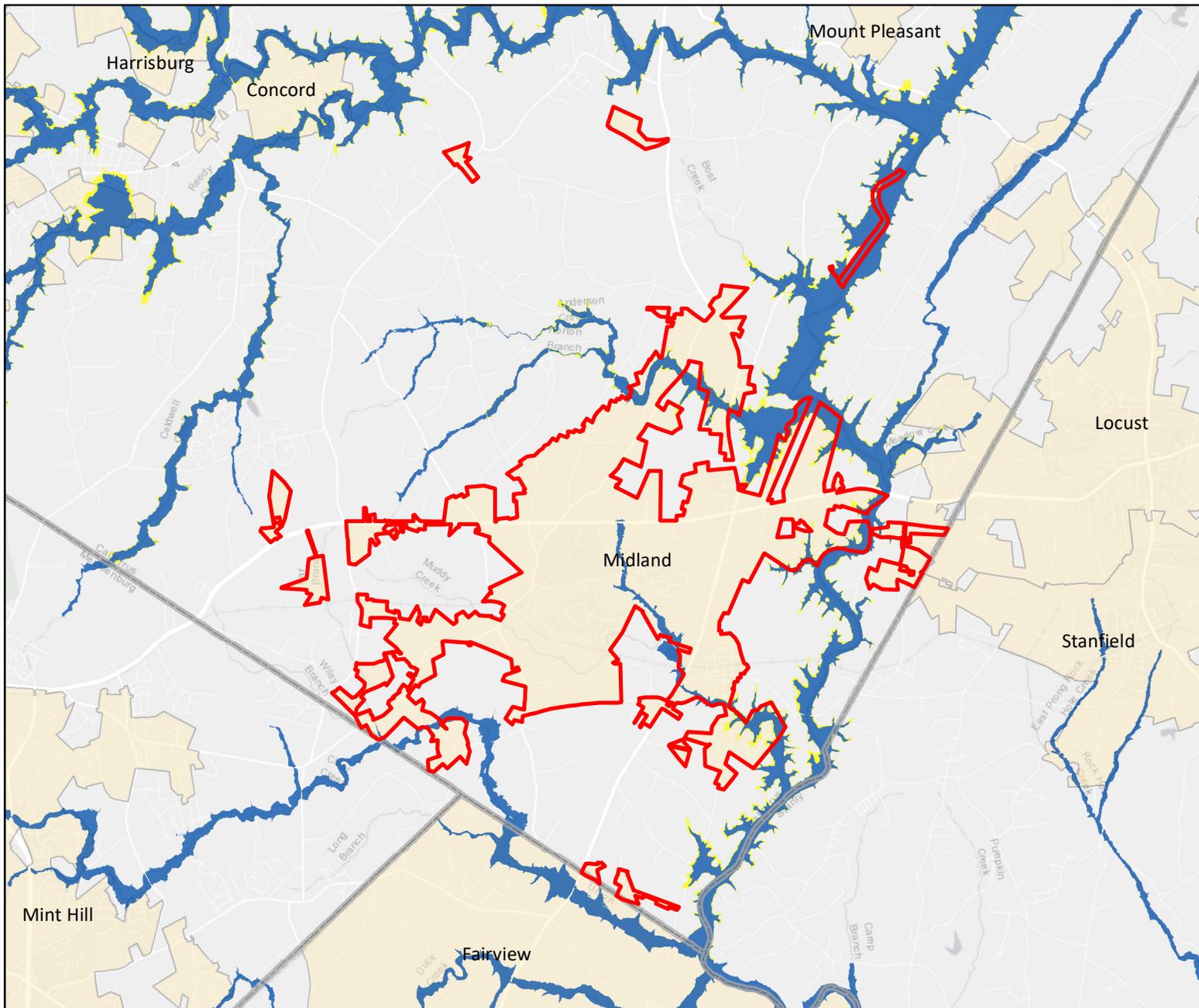
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Midland - Flood Hazard Areas



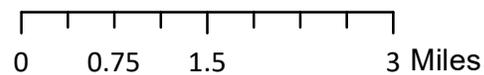
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

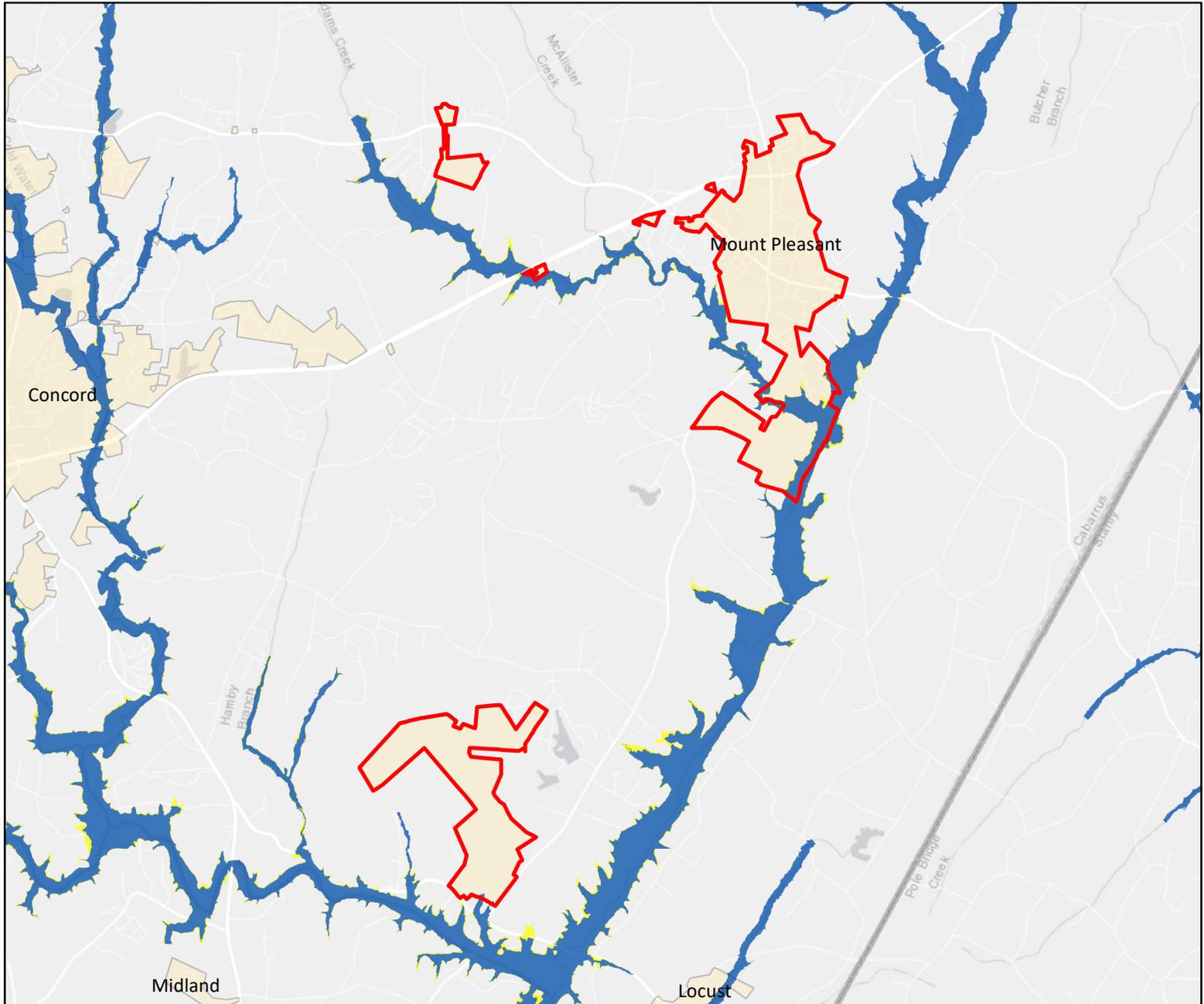
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Mount Pleasant - Flood Hazard Areas



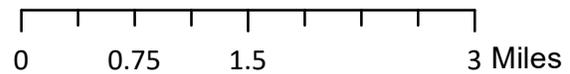
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

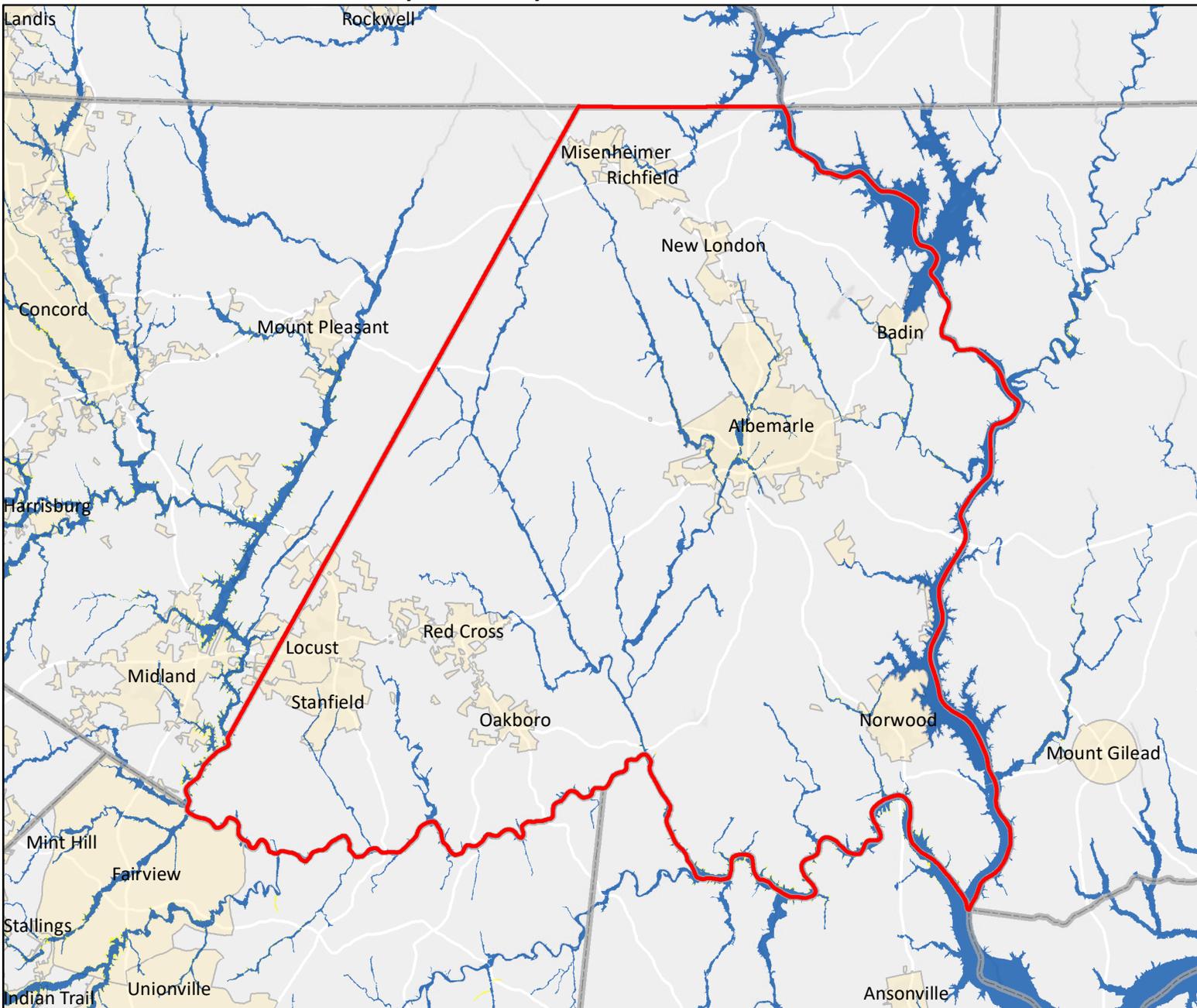
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Stanly County - Flood Hazard Areas



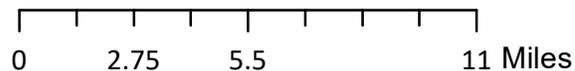
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

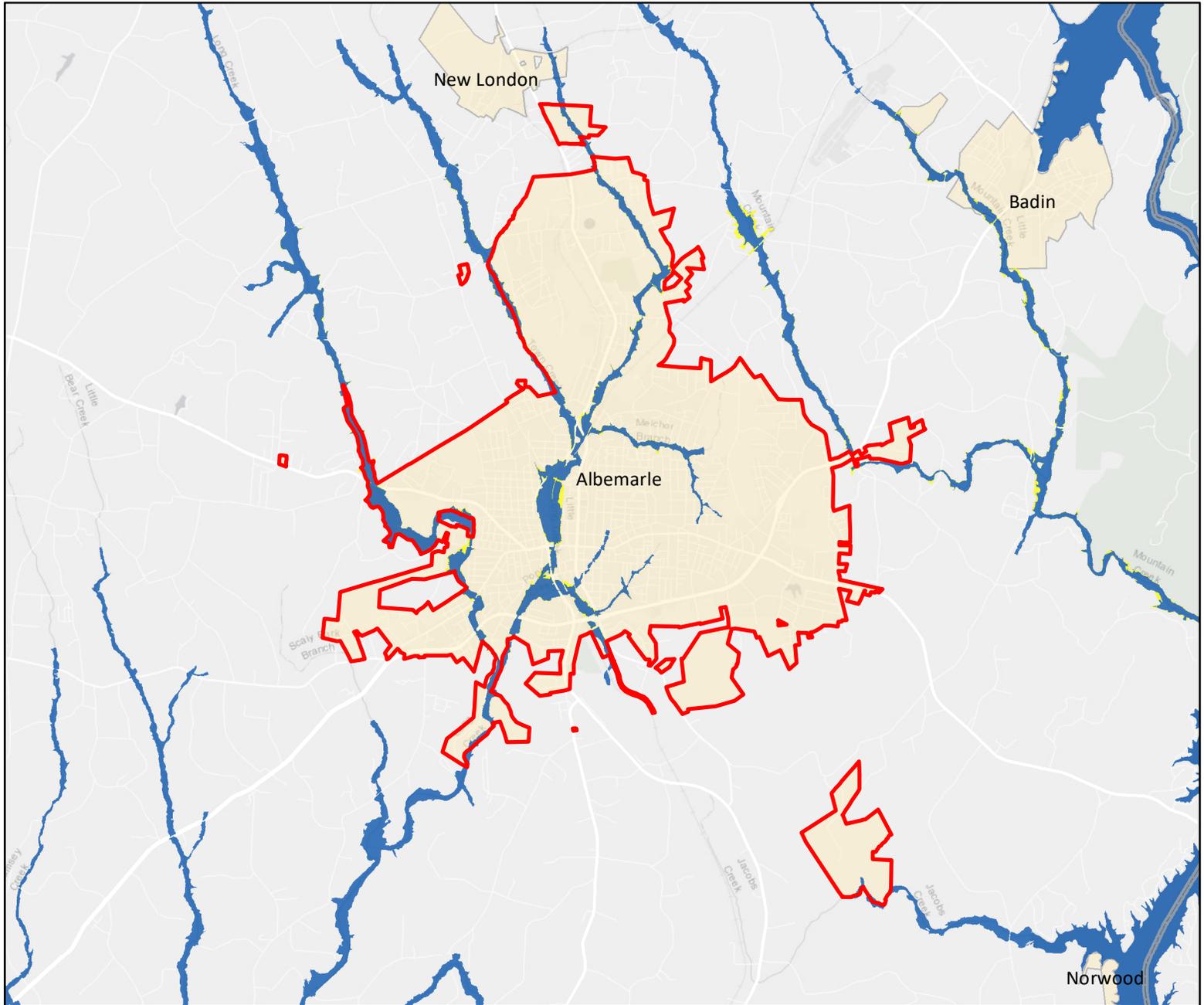
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Albemarle - Flood Hazard Areas



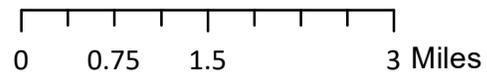
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

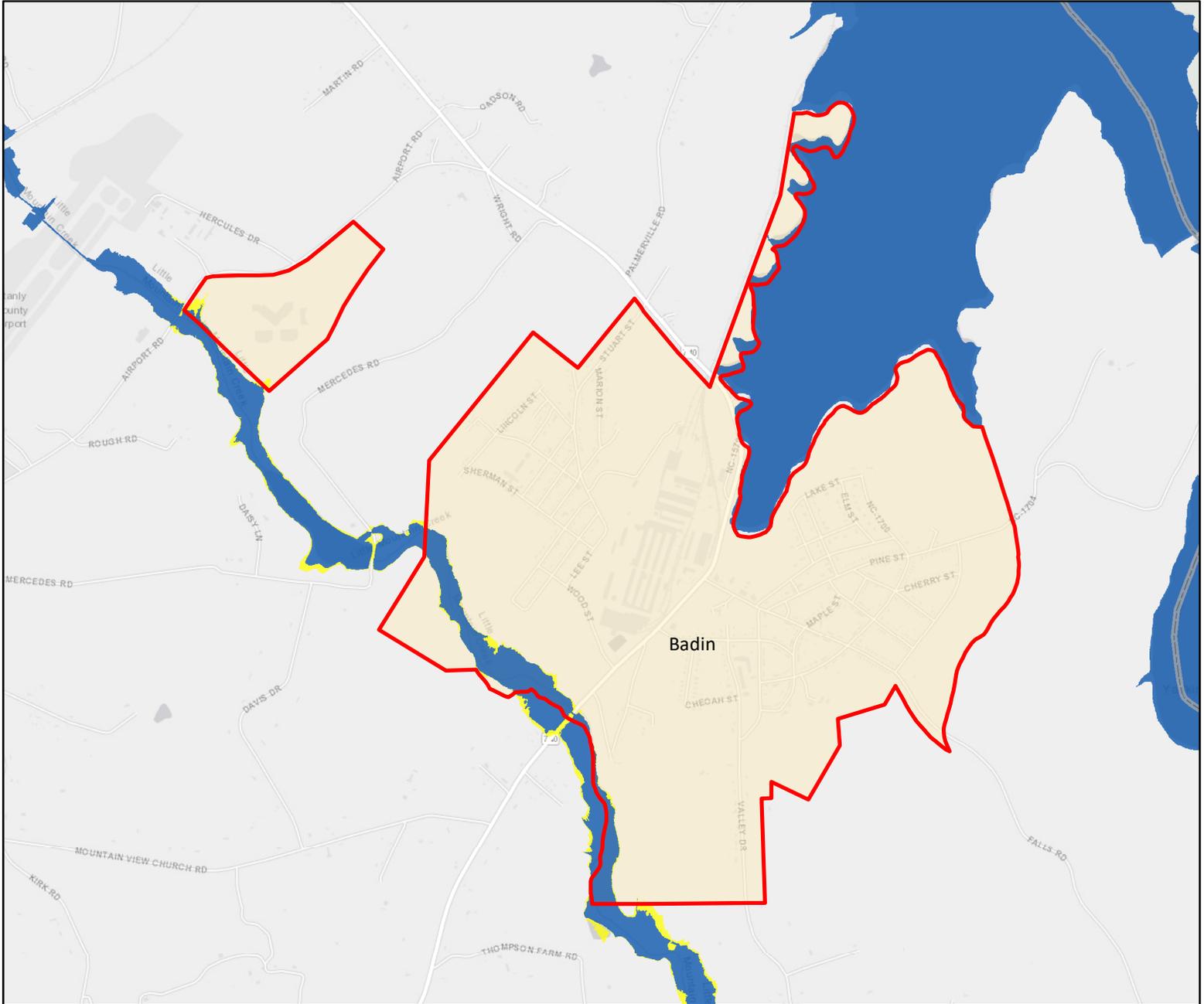
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Badin - Flood Hazard Areas



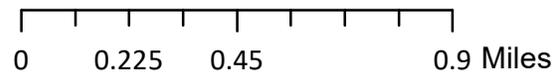
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

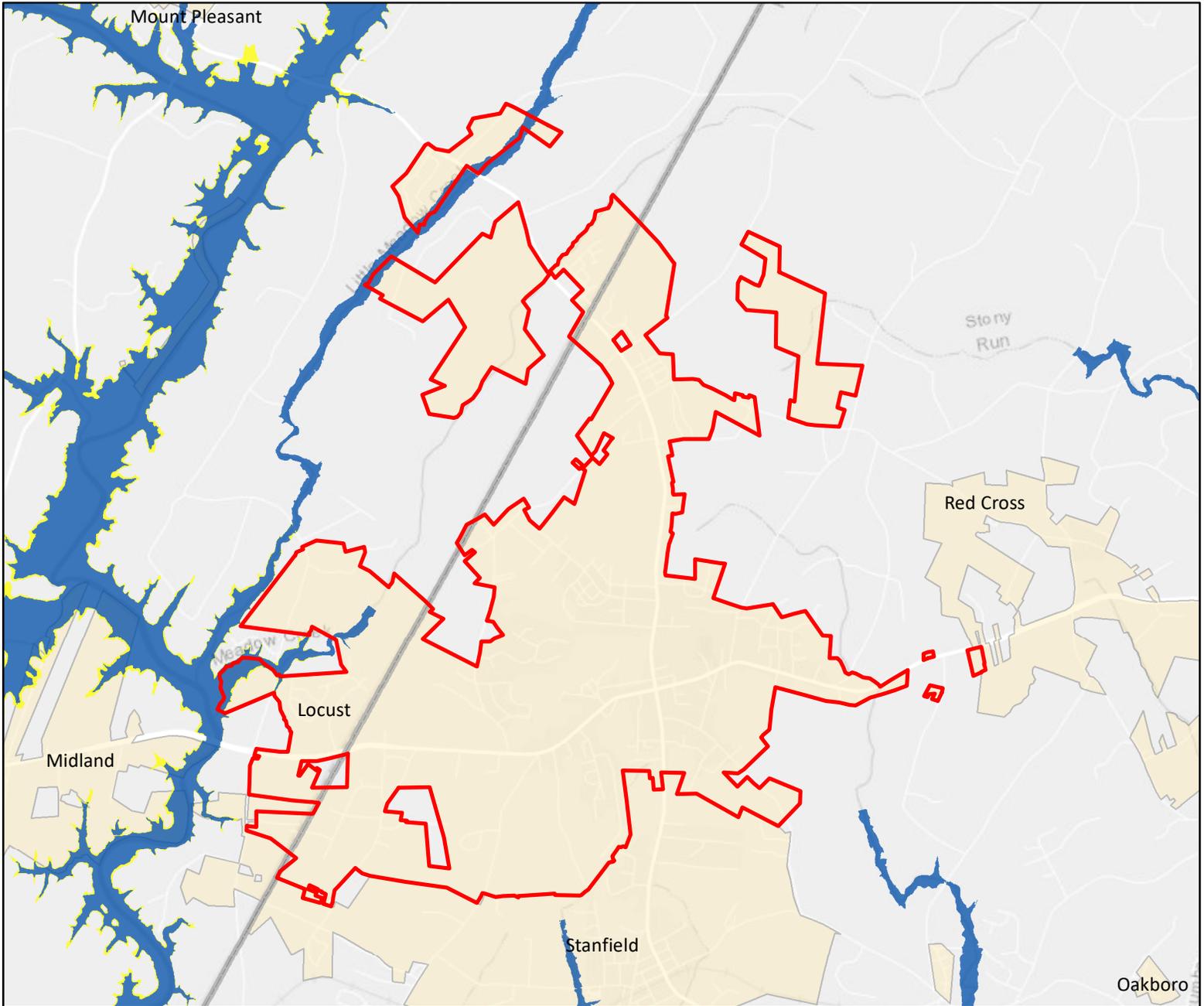
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Locust - Flood Hazard Areas



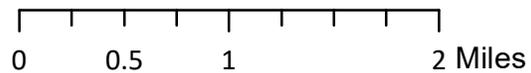
## Legend

- County Boundary
- Municipal Boundary
- Major Roads

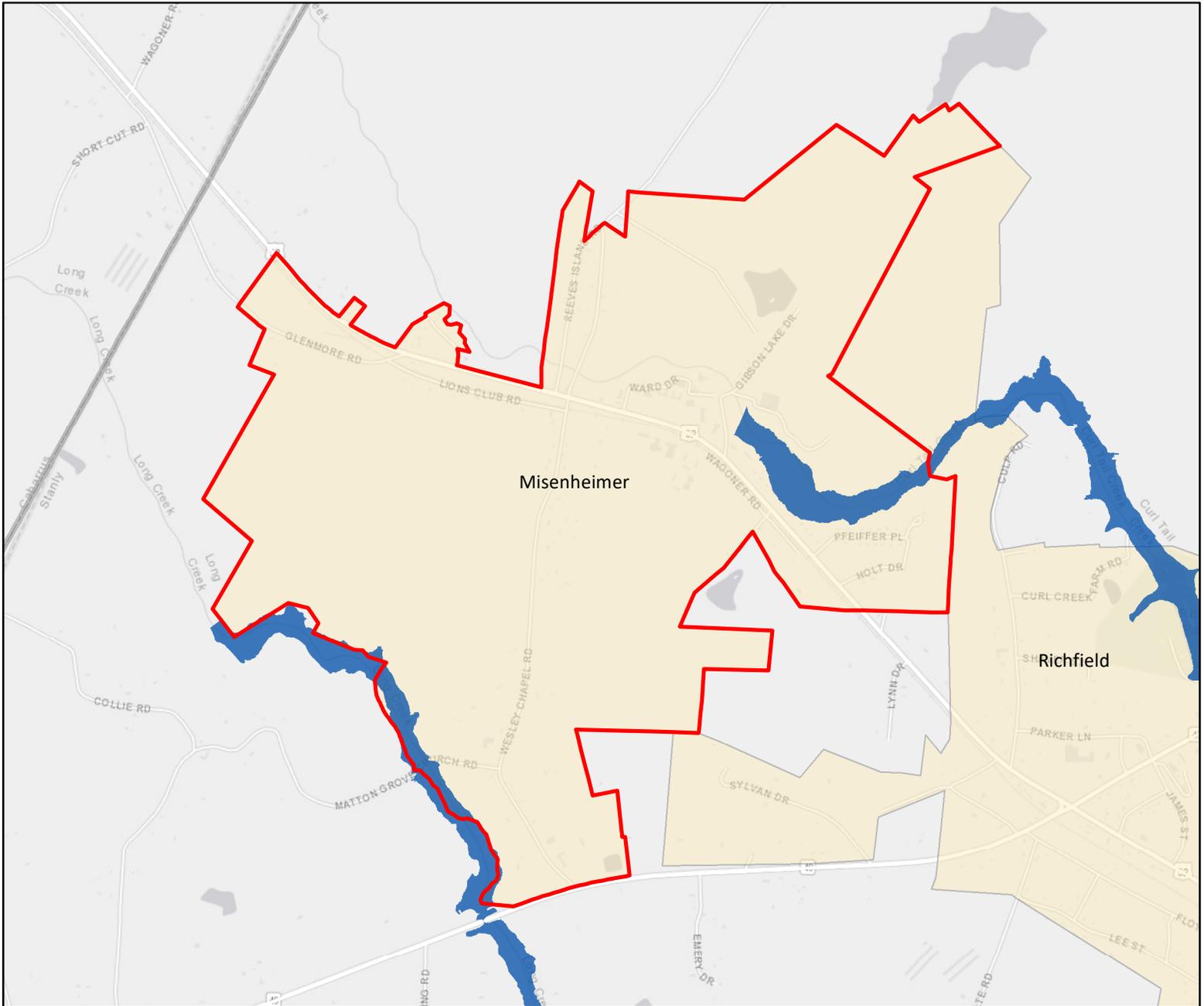
## Flood Zone

- 100 Year Flood Zone
- 500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Misenheimer - Flood Hazard Areas



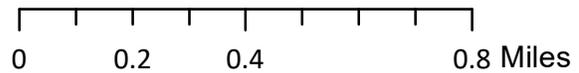
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

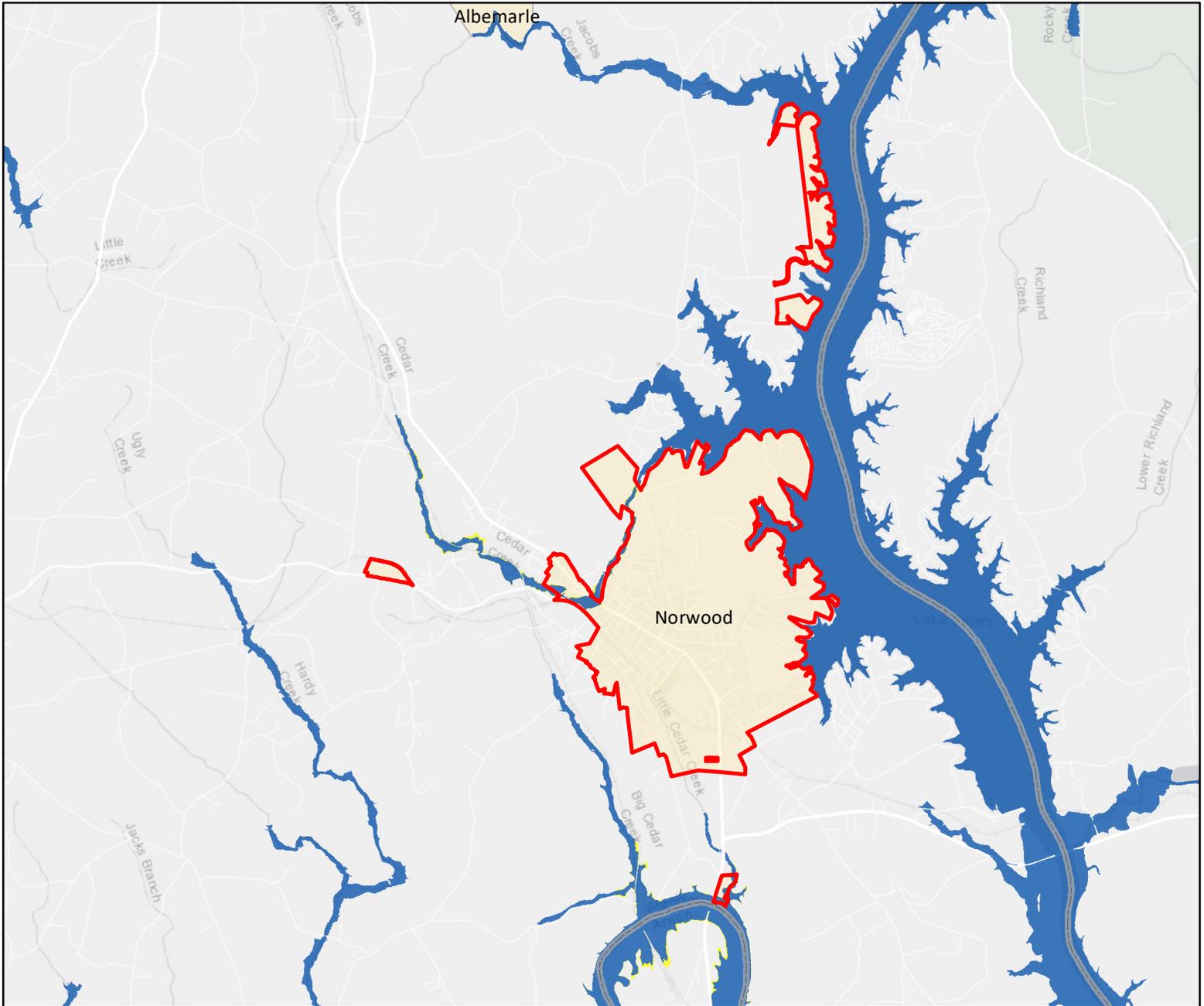
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Norwood - Flood Hazard Areas



## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

## Flood Zone

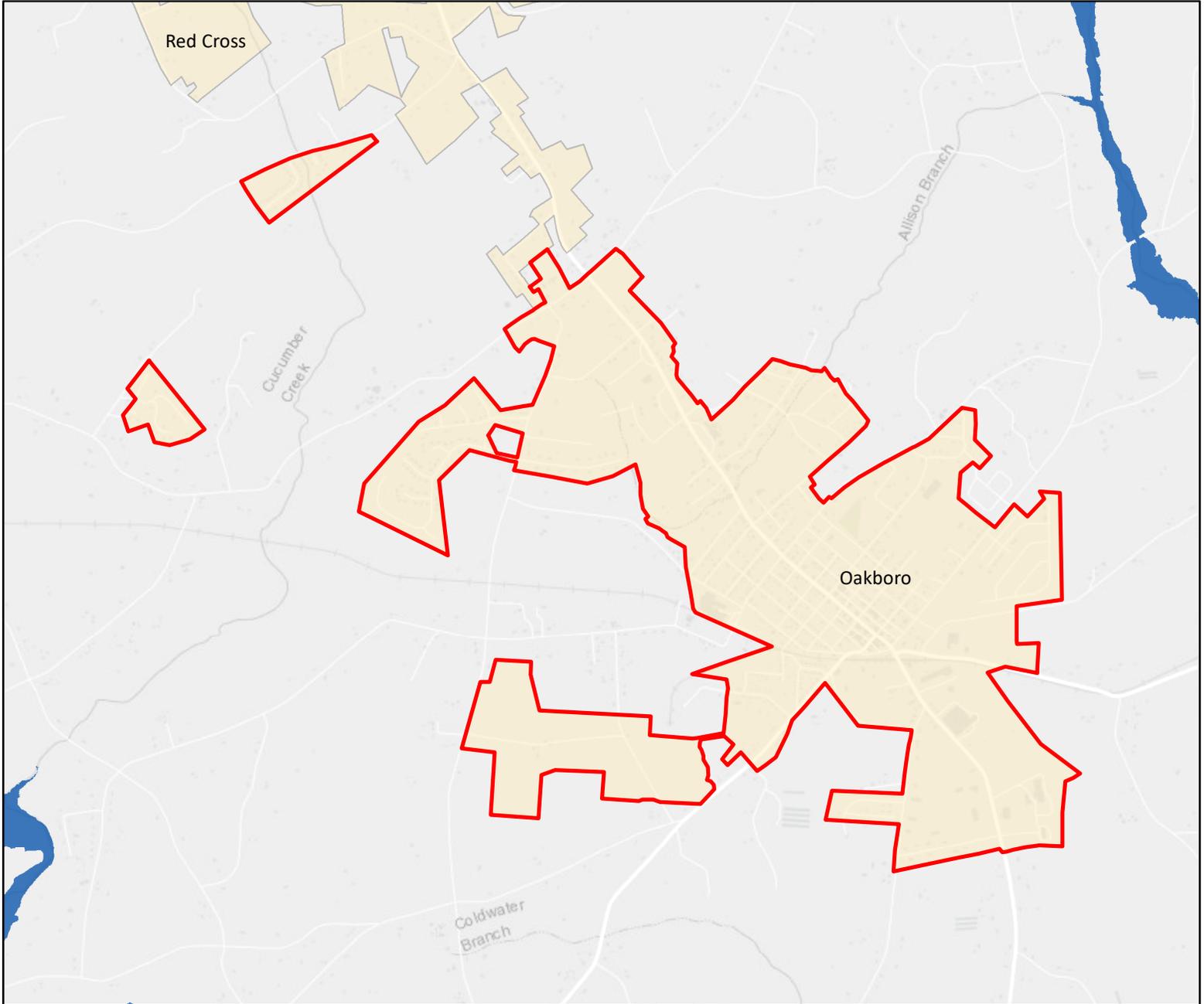
-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program

0 0.75 1.5 3 Miles



# Oakboro - Flood Hazard Areas



## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

## Flood Zone

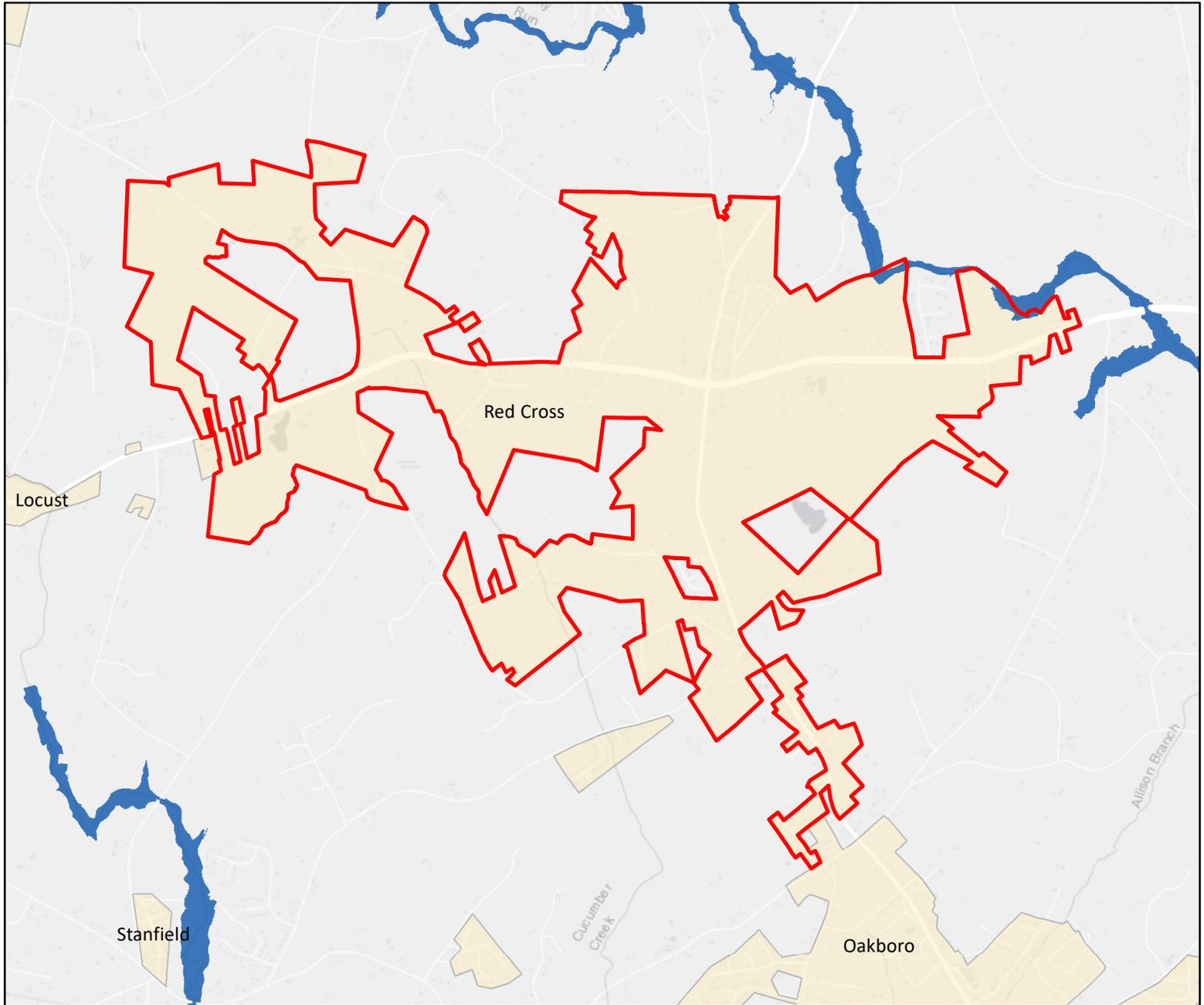
-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program

0 0.3 0.6 1.2 Miles



# Red Cross - Flood Hazard Areas



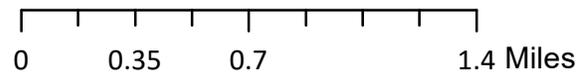
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

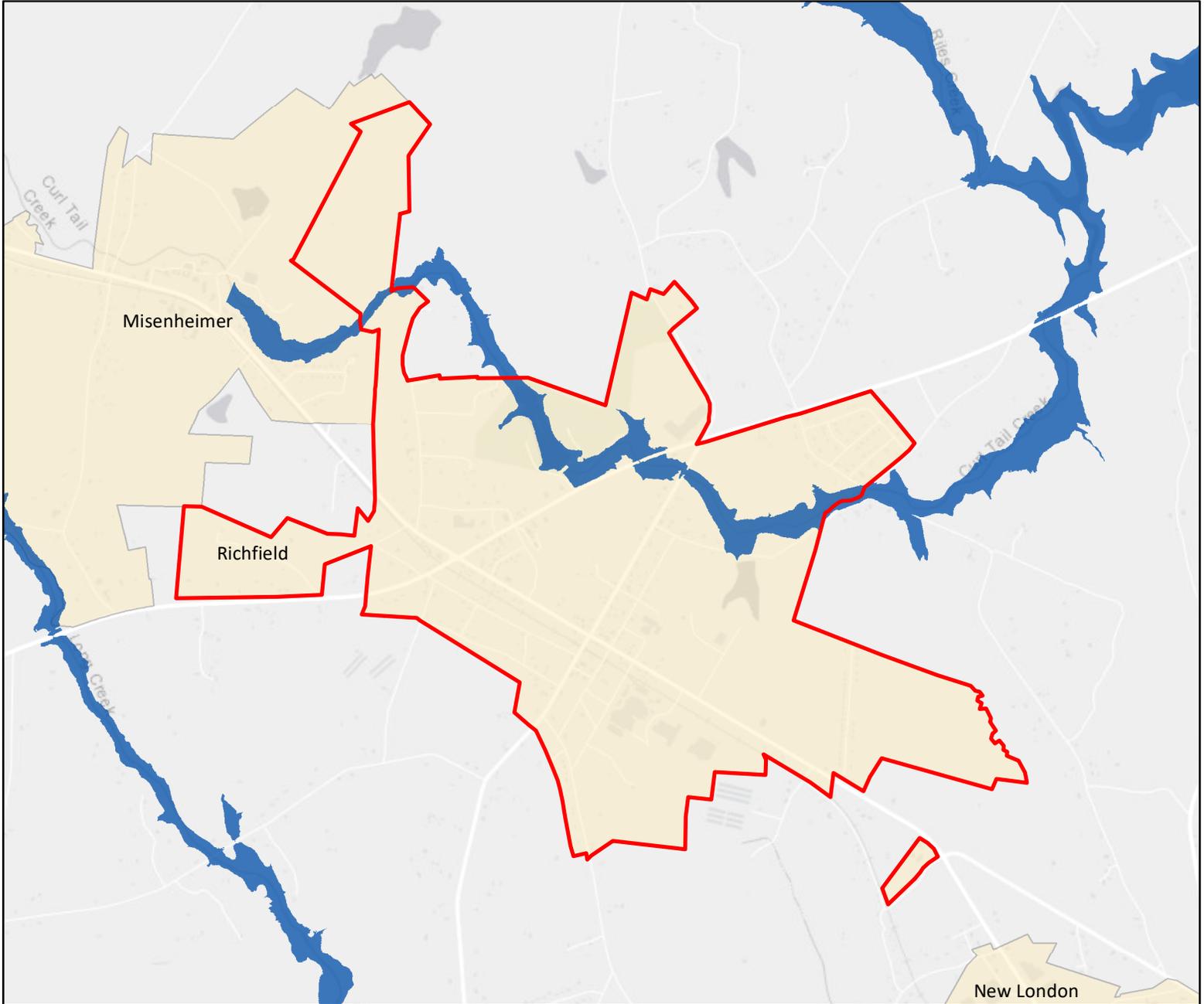
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Richfield - Flood Hazard Areas



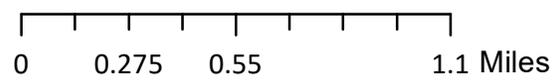
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

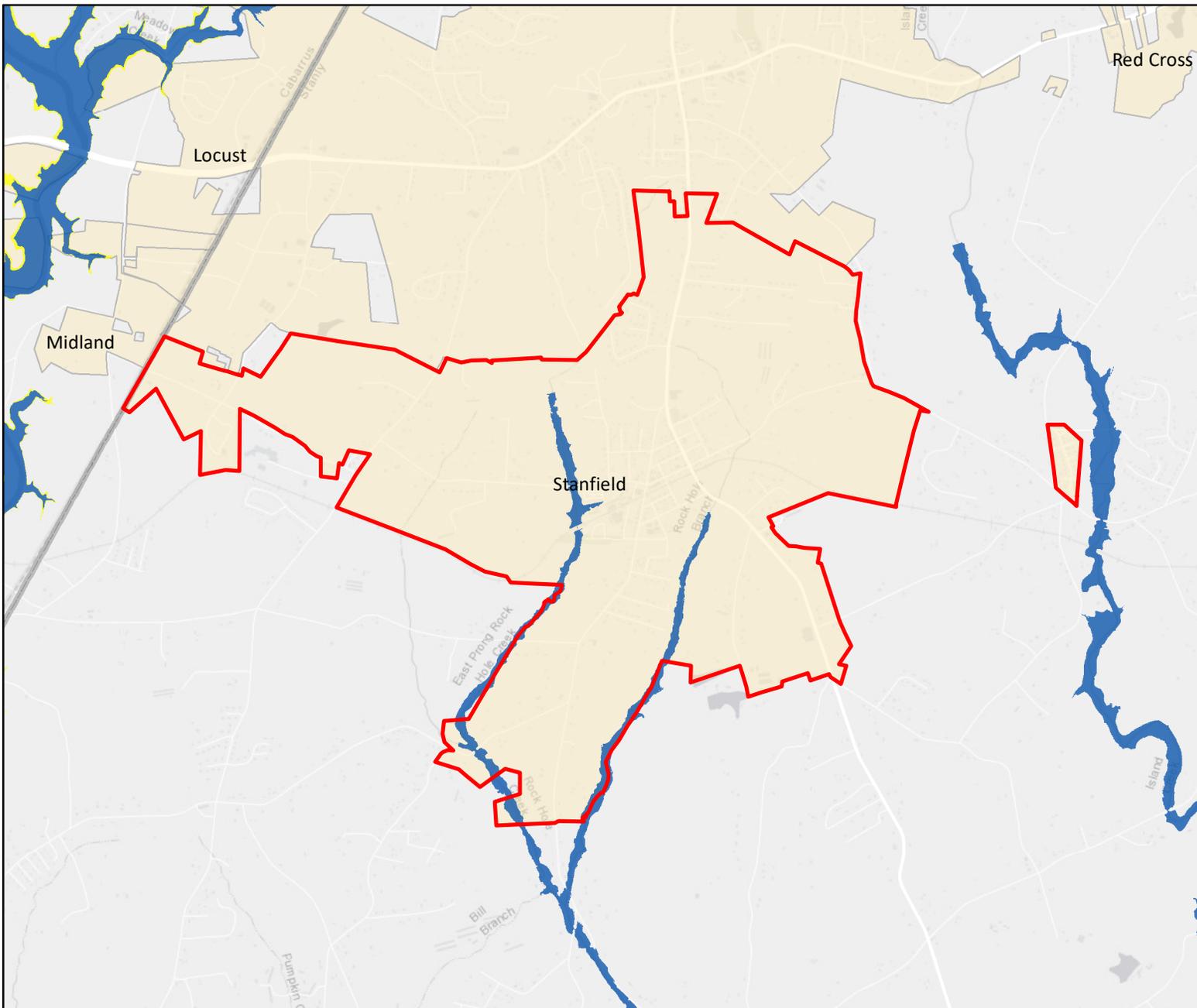
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Stanfield - Flood Hazard Areas



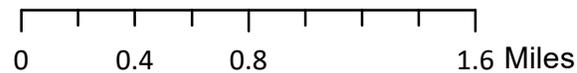
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

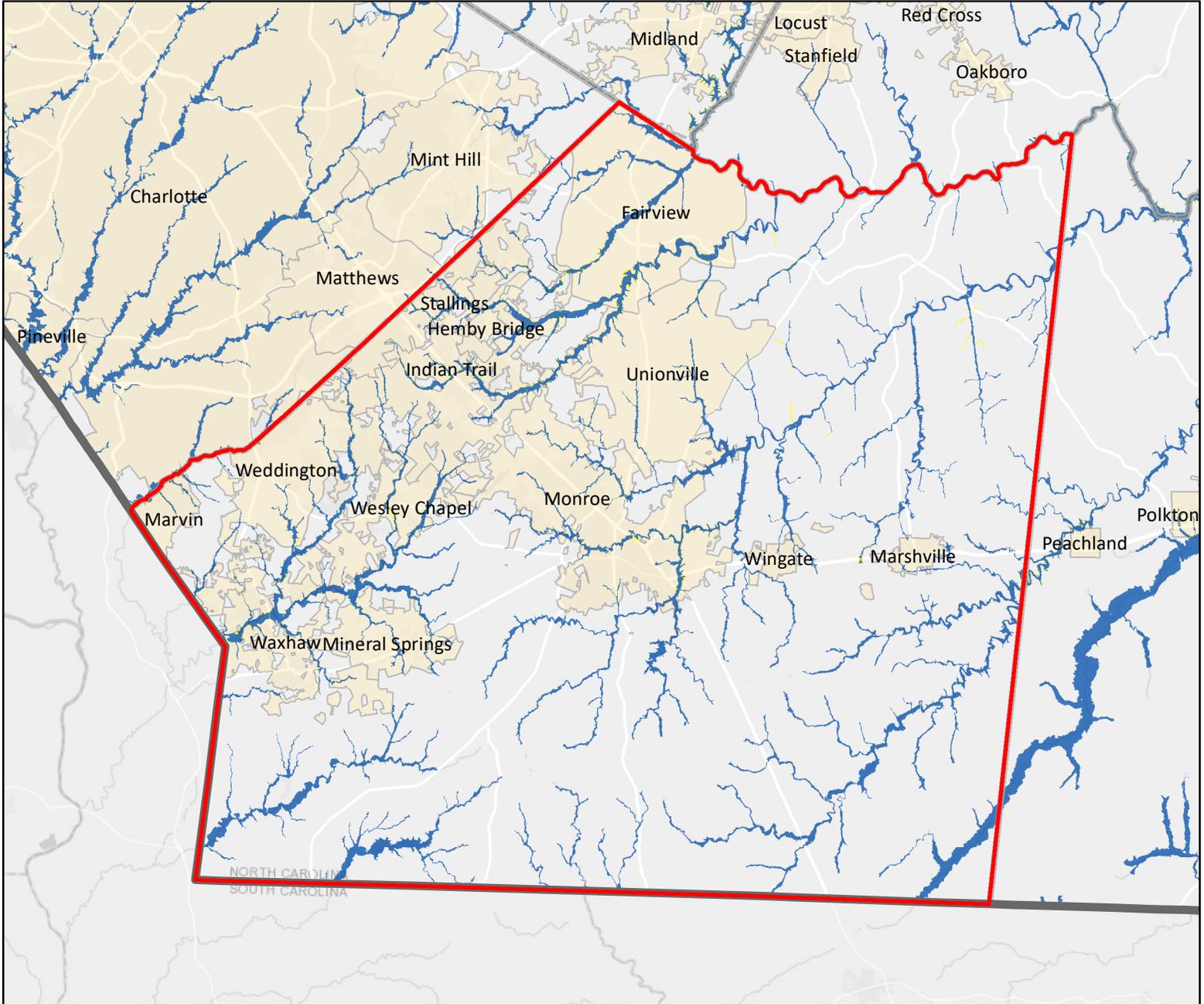
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Union County - Flood Hazard Areas



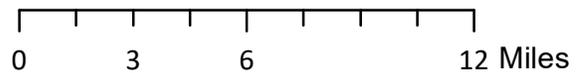
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

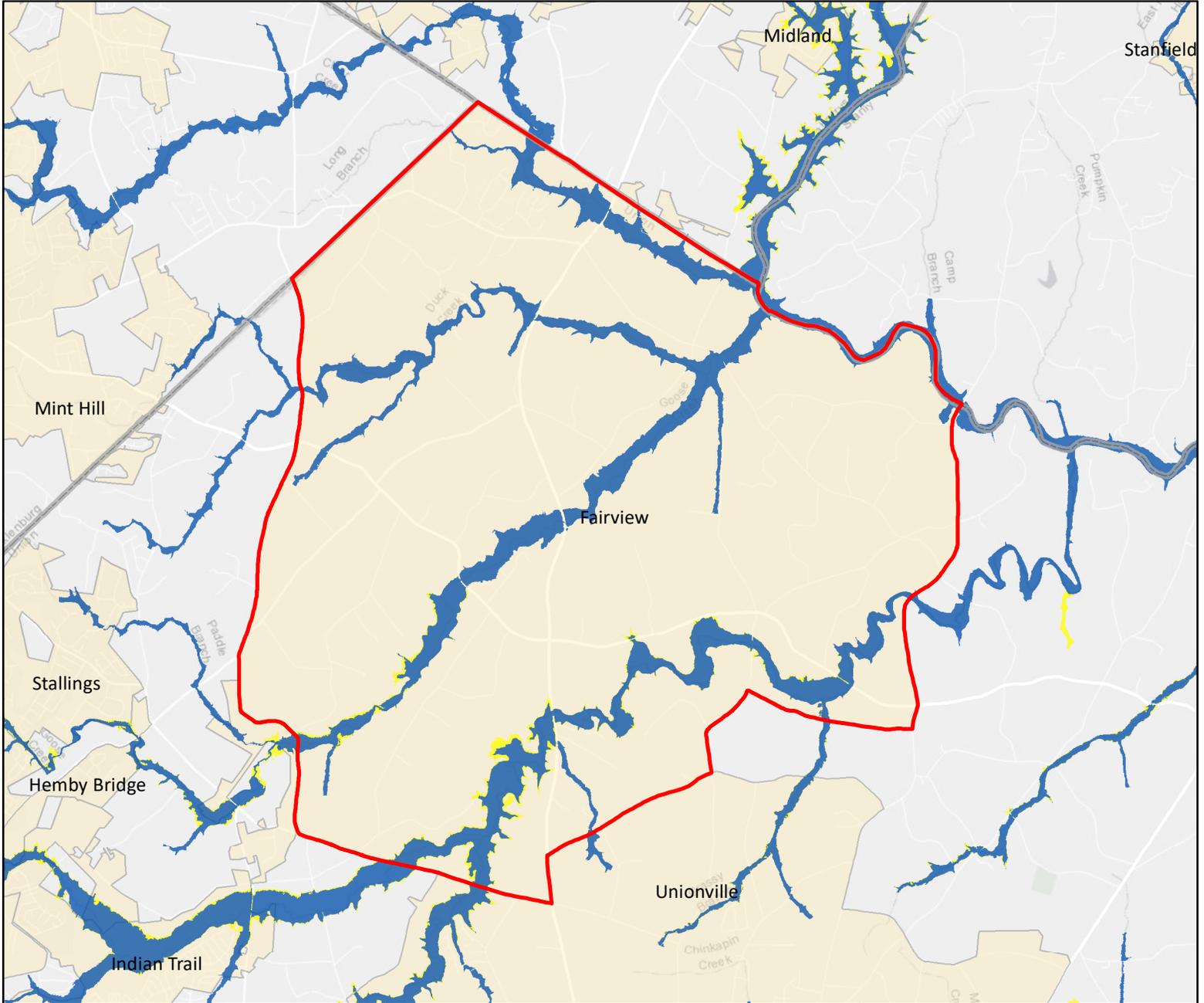
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Fairview - Flood Hazard Areas



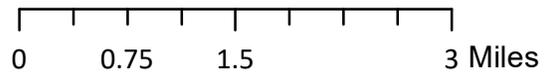
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

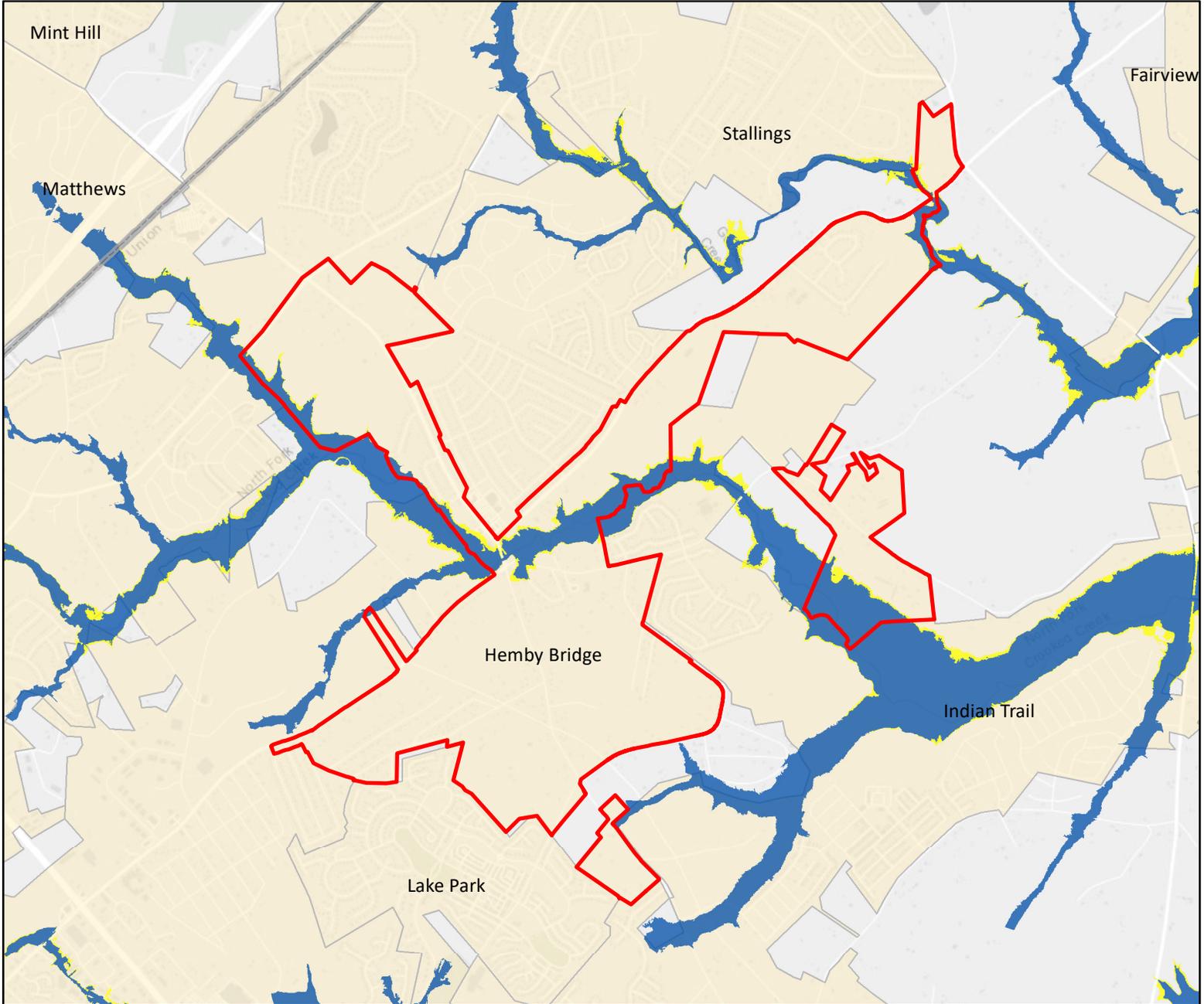
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Hemby Bridge - Flood Hazard Areas



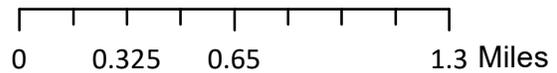
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

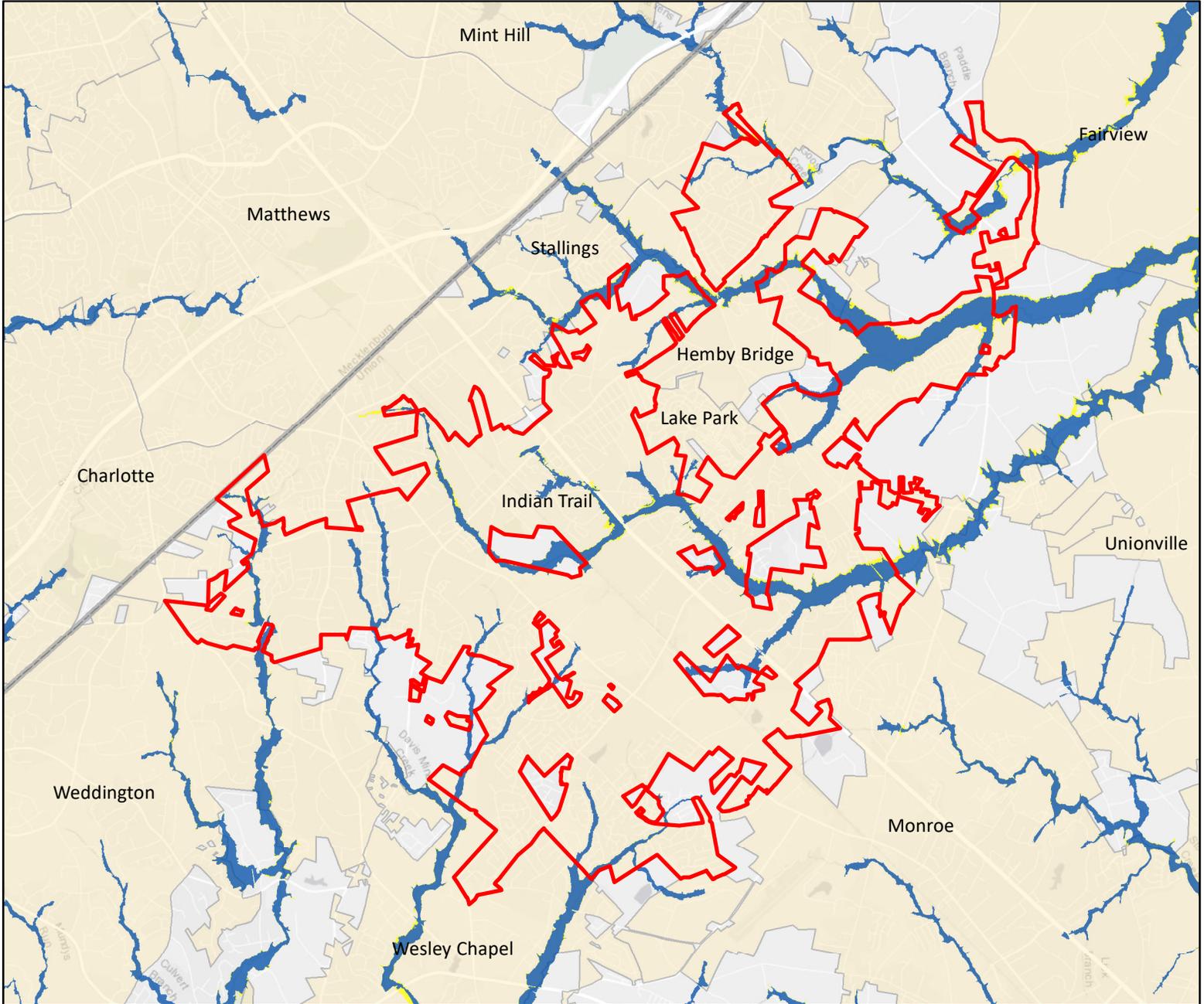
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Indian Trail - Flood Hazard Areas



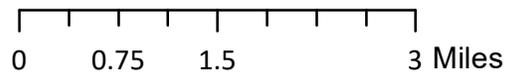
## Legend

- County Boundary
- Municipal Boundary
- Major Roads

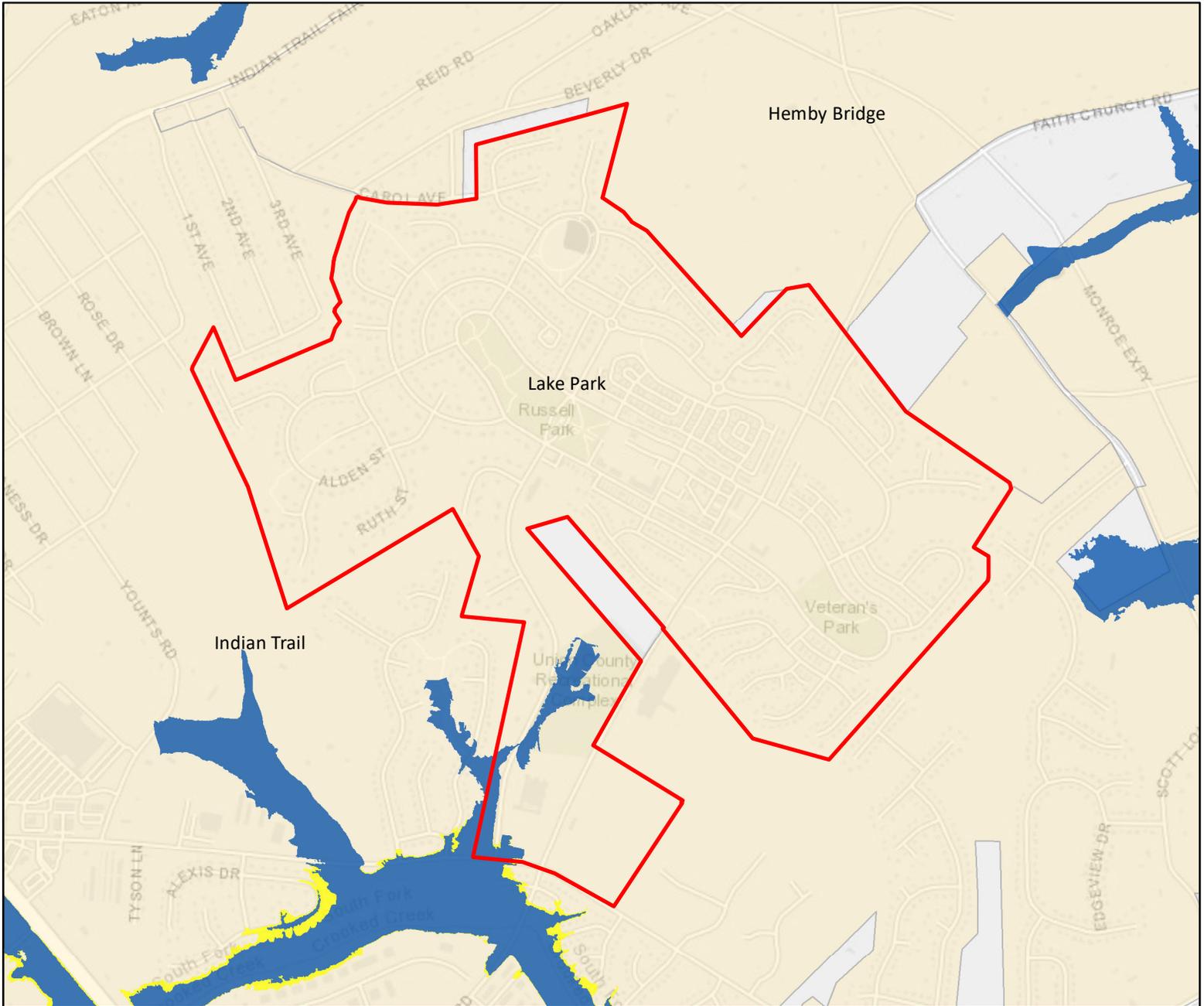
## Flood Zone

- 100 Year Flood Zone
- 500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Lake Park - Flood Hazard Areas



## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

## Flood Zone

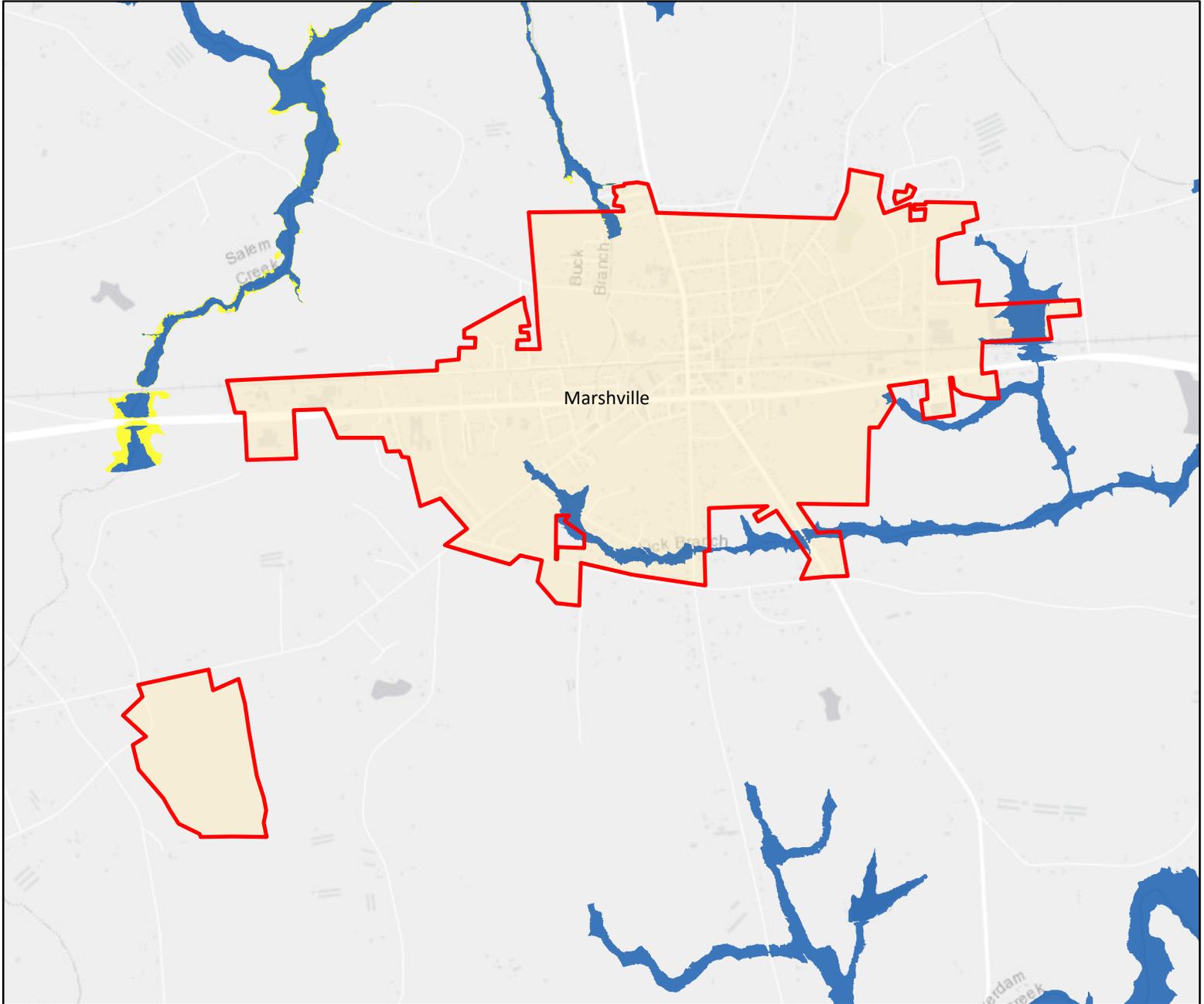
-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program

0 0.125 0.25 0.5 Miles



# Marshville - Flood Hazard Areas



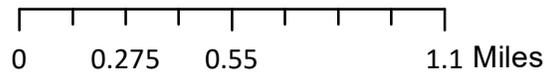
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

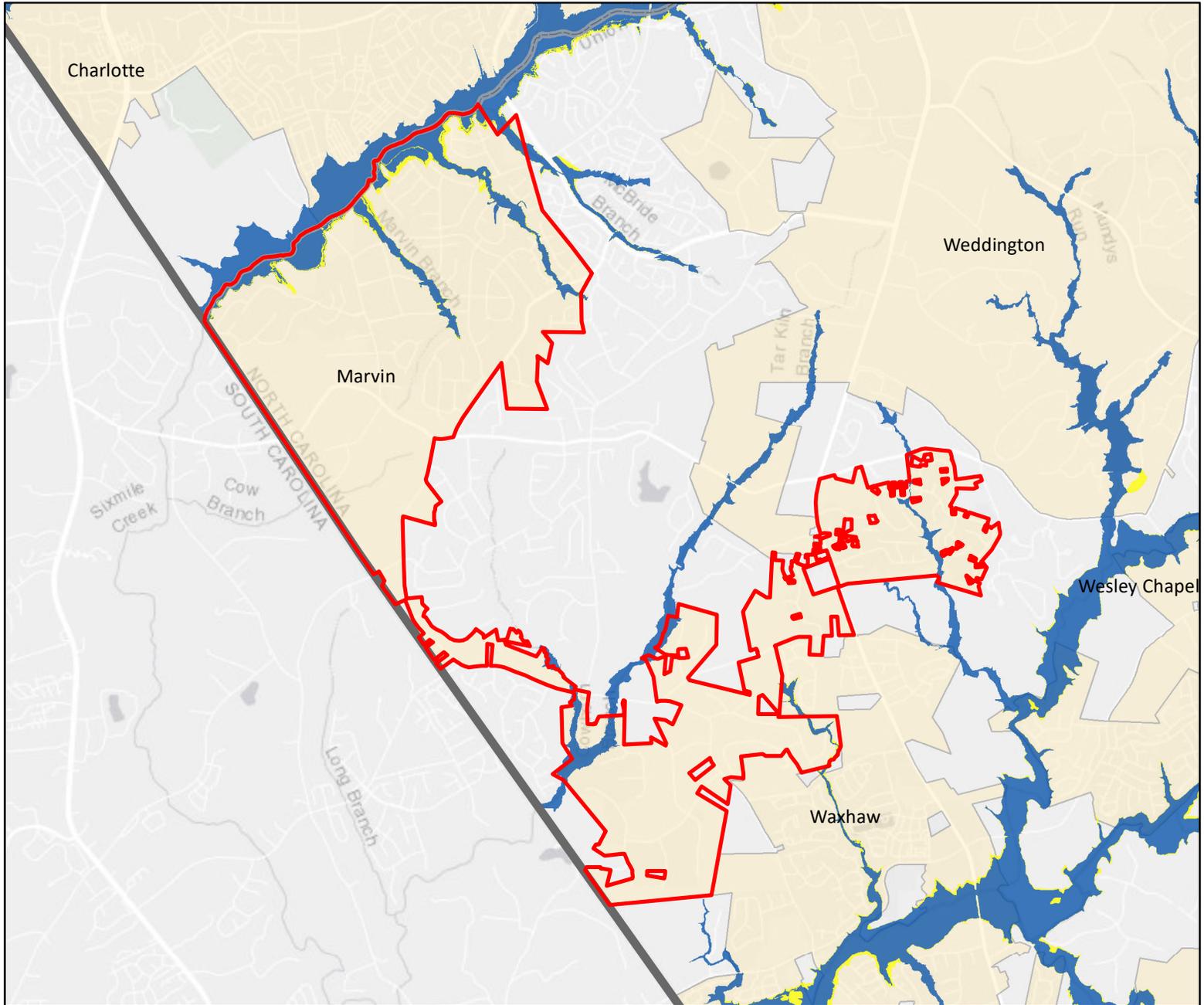
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Marvin - Flood Hazard Areas



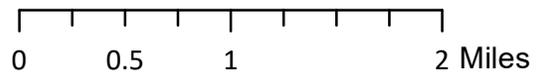
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

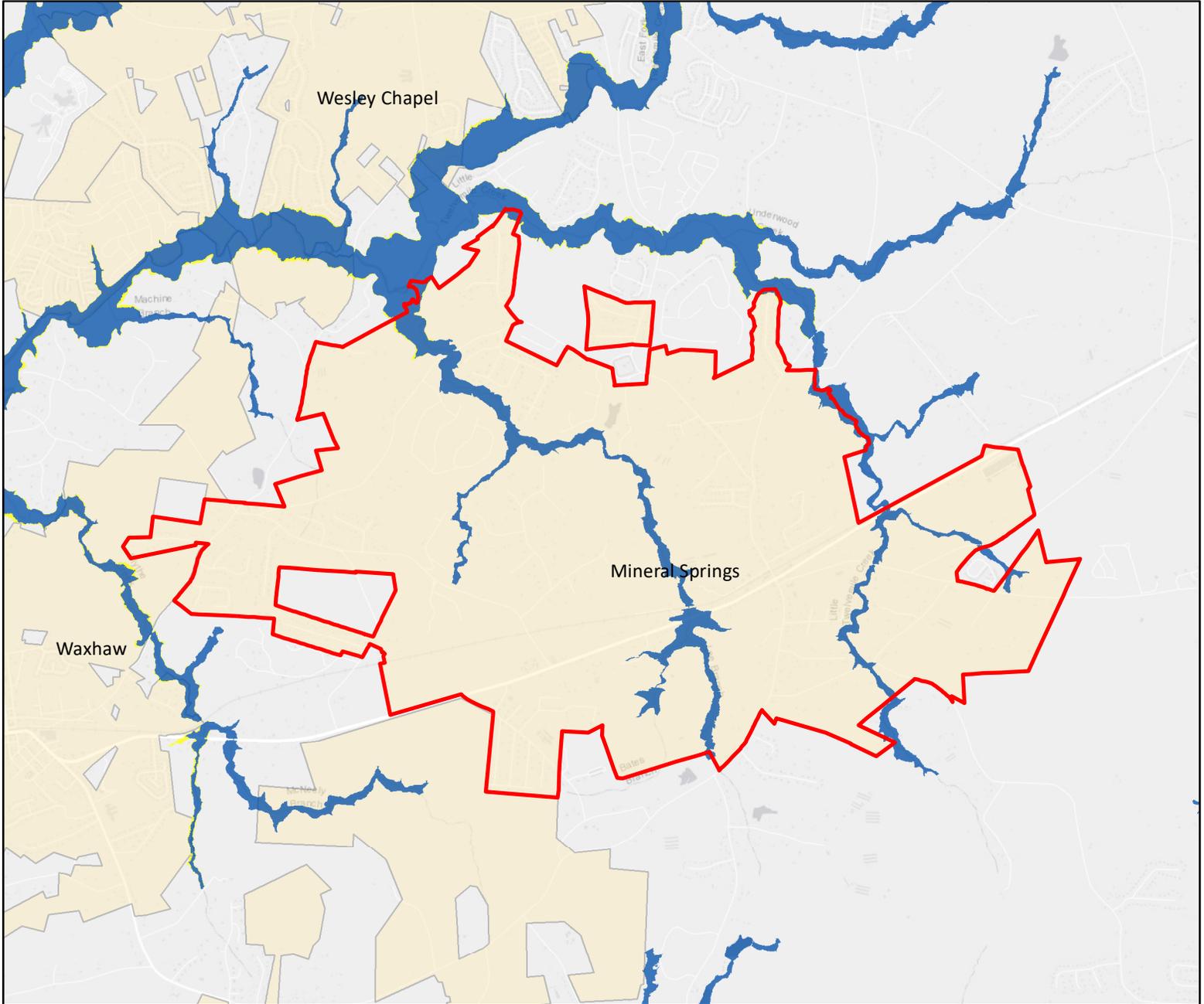
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Mineral Springs - Flood Hazard Areas



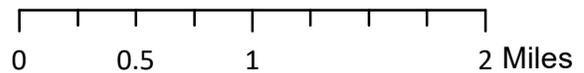
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

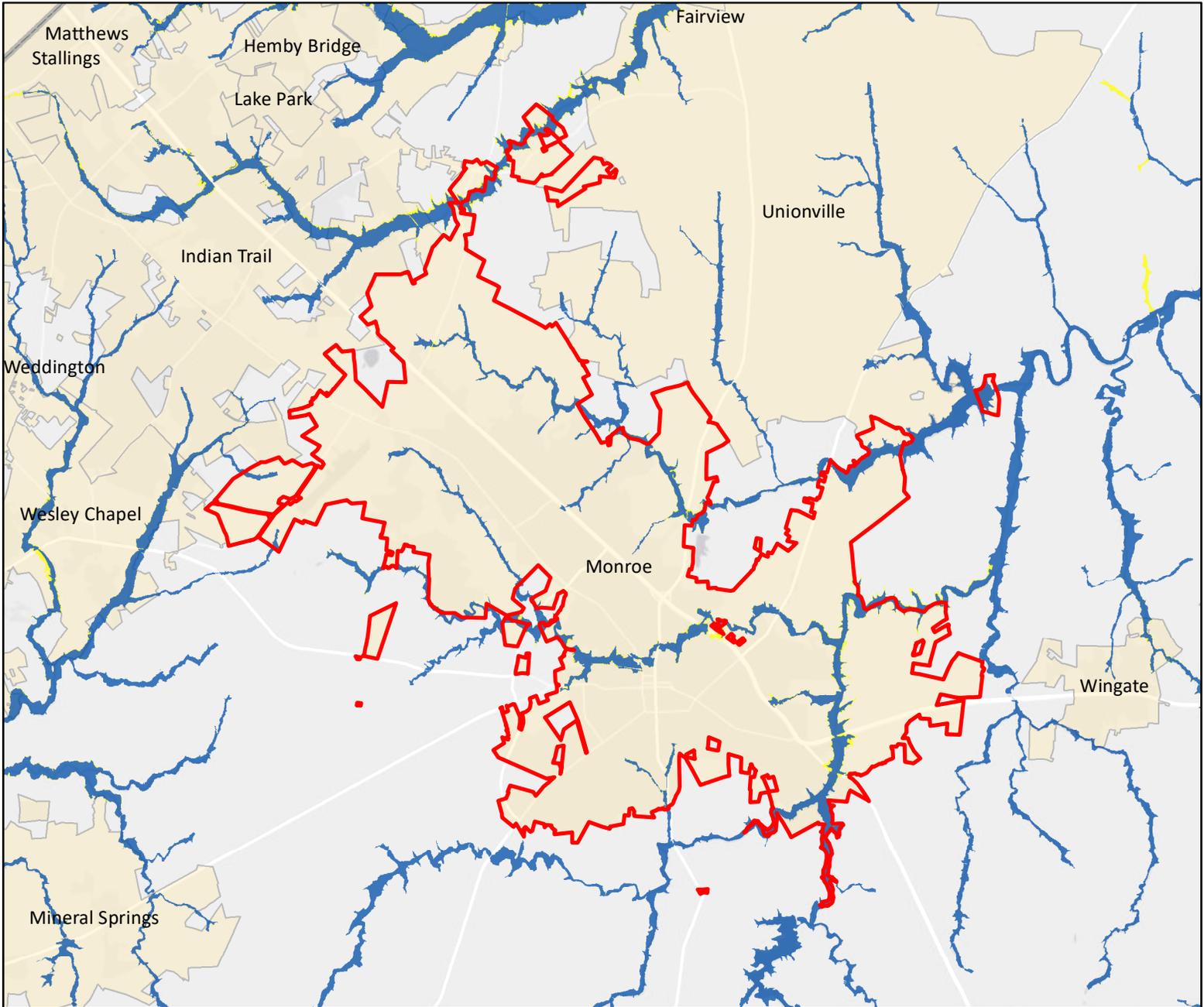
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Monroe - Flood Hazard Areas



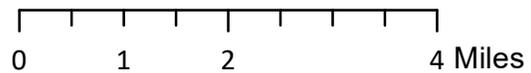
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

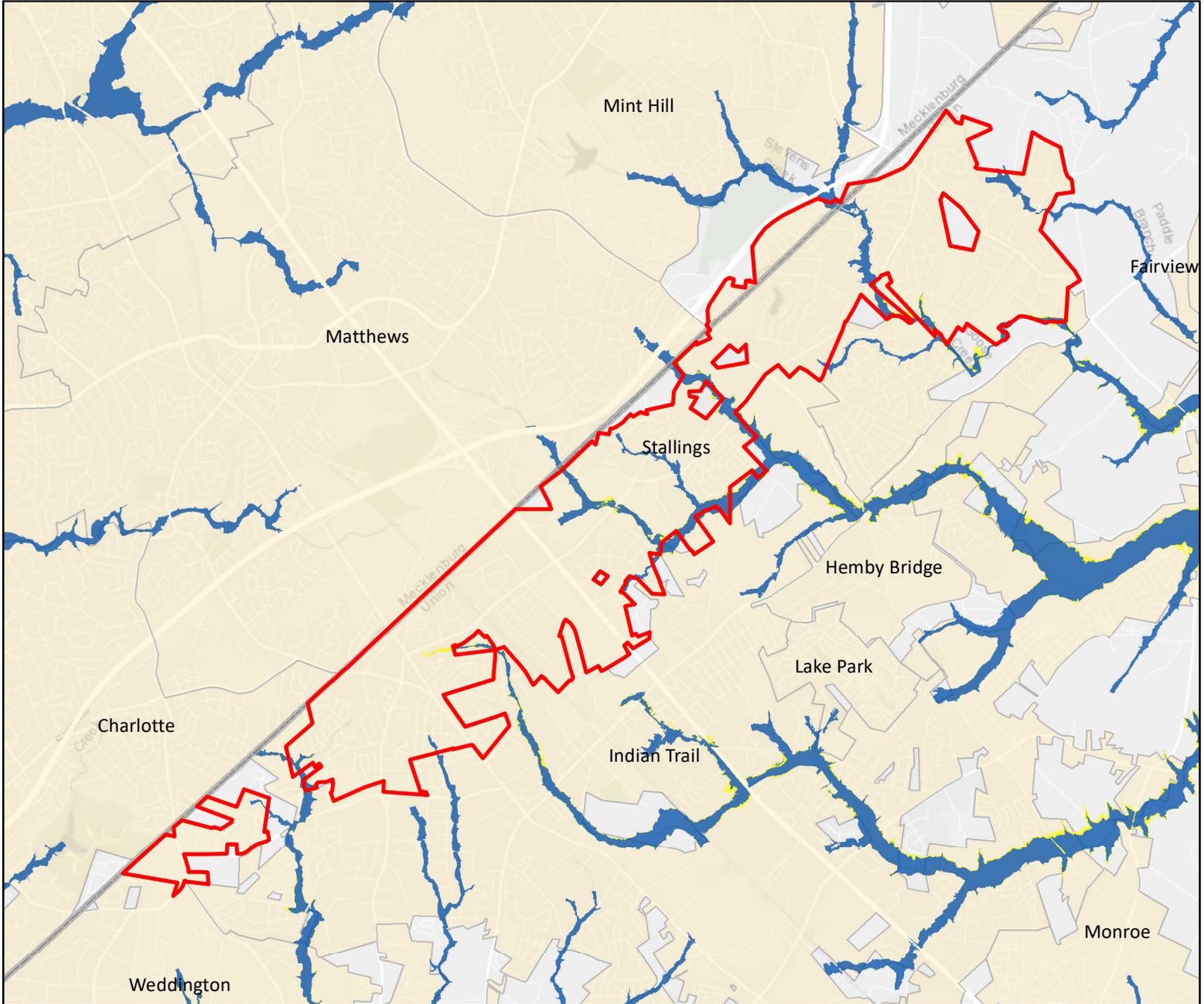
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Stallings - Flood Hazard Areas



## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

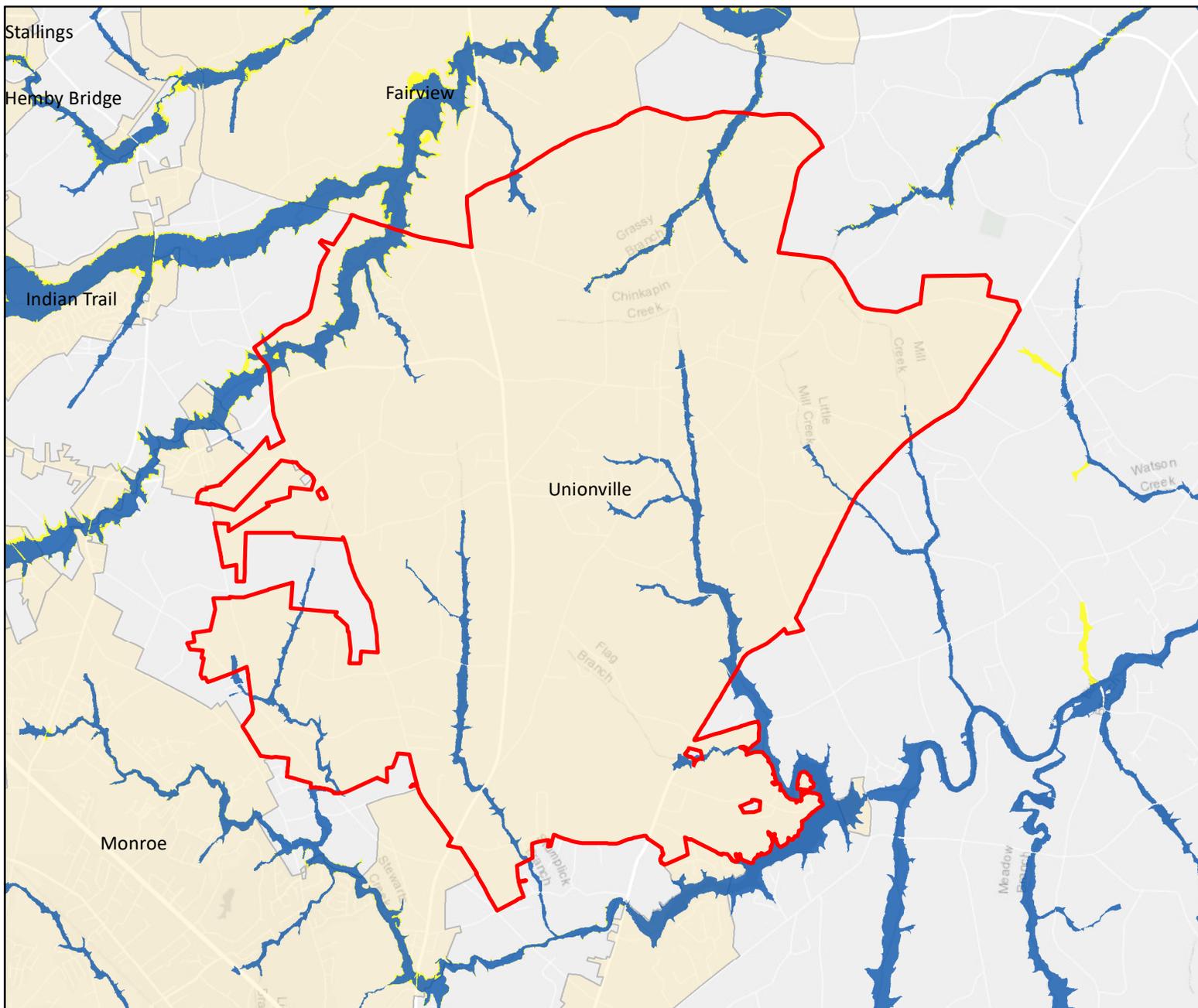
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Unionville - Flood Hazard Areas



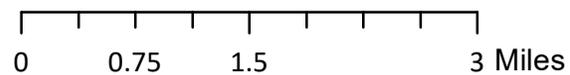
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

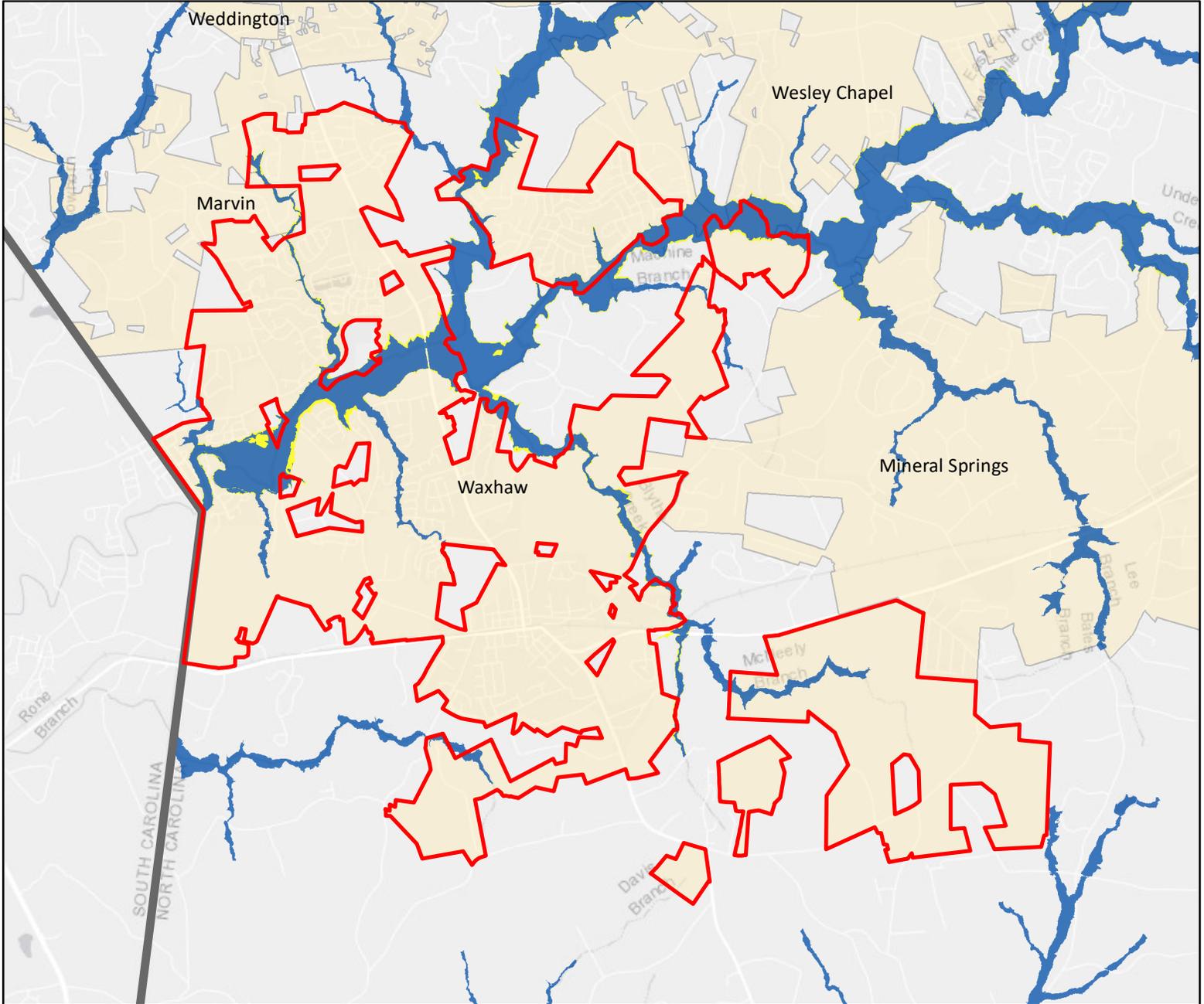
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Waxhaw - Flood Hazard Areas



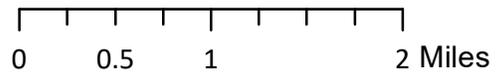
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

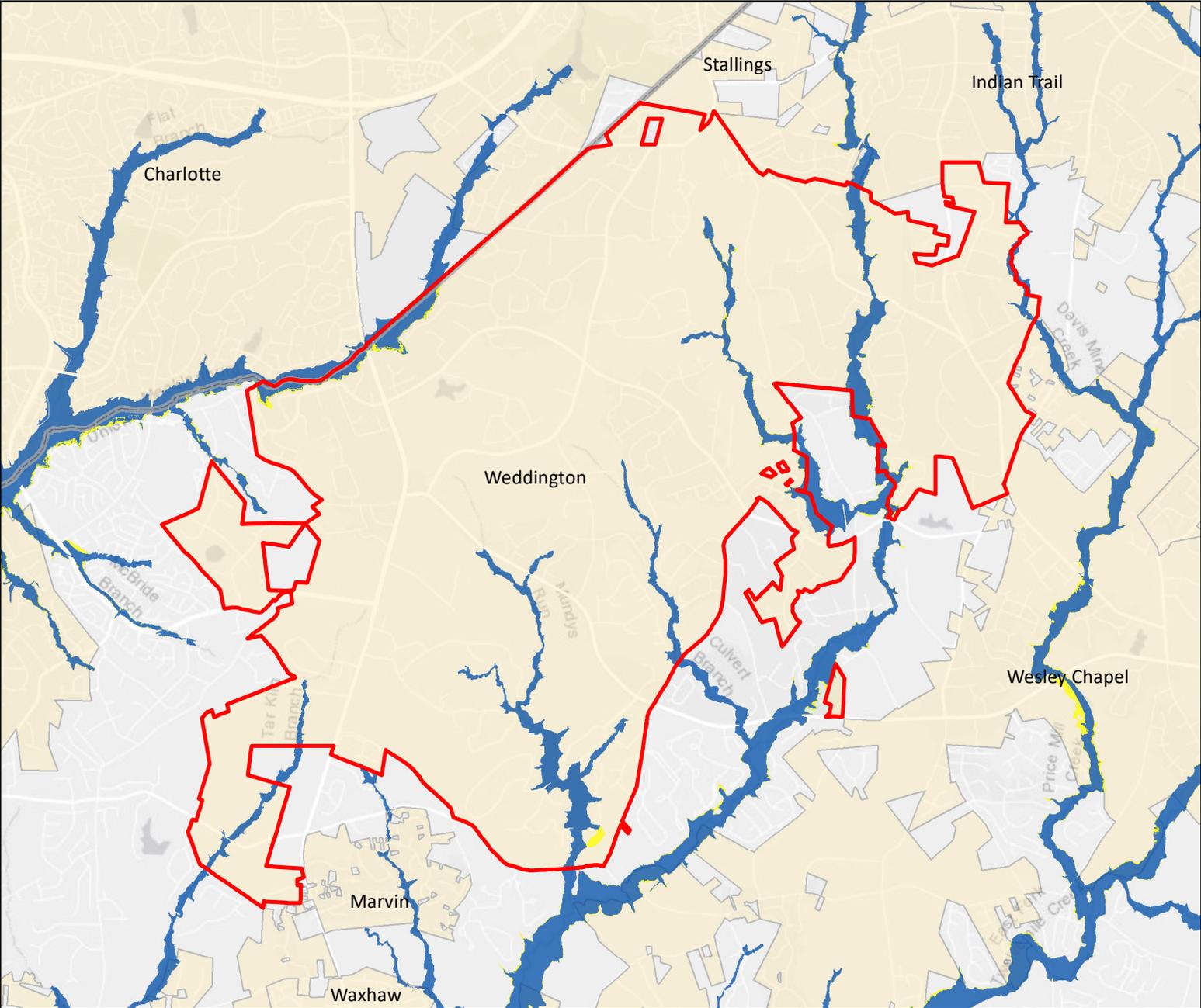
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Weddington - Flood Hazard Areas



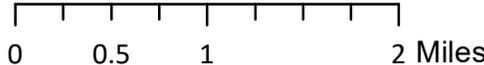
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

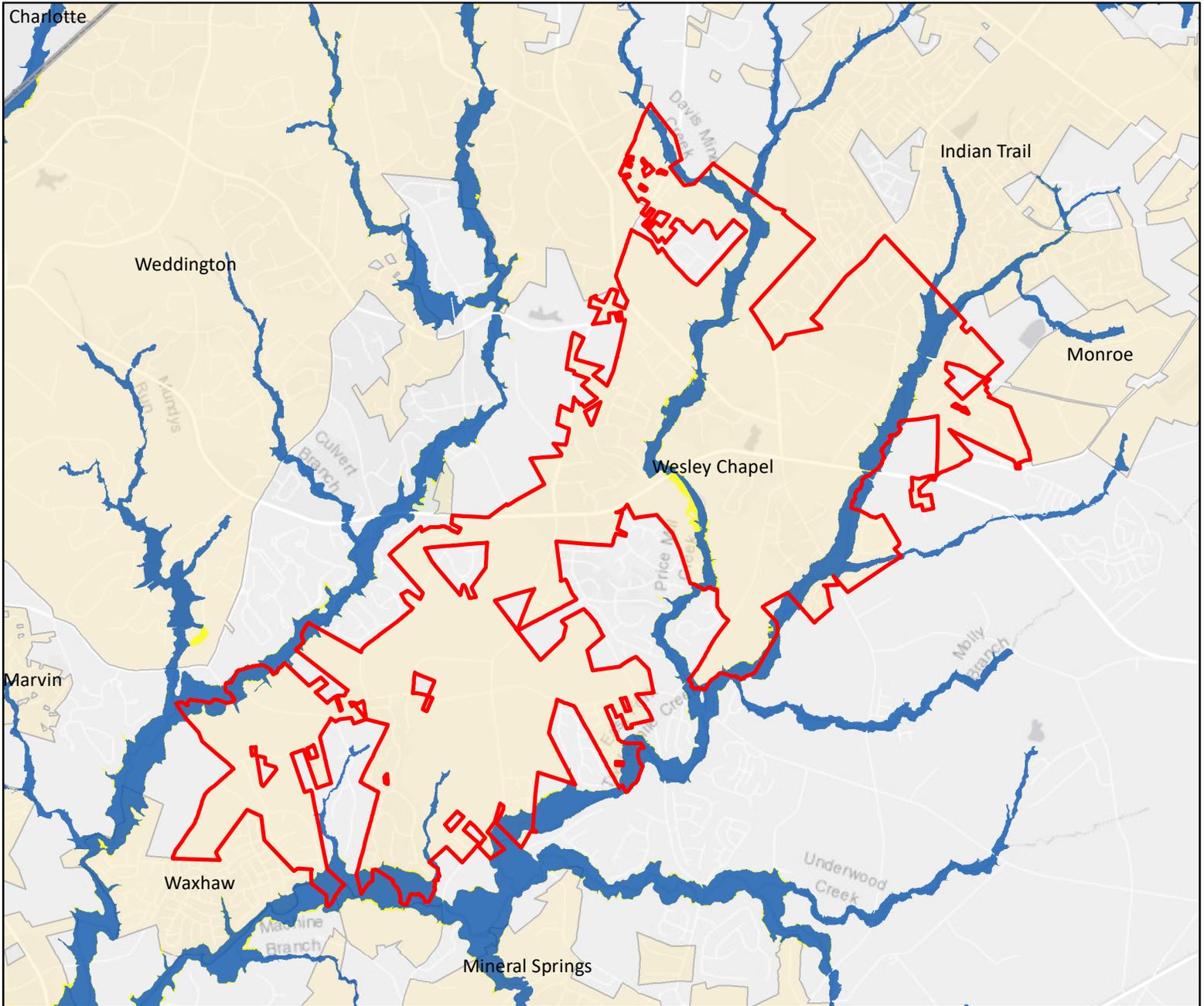
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Wesley Chapel - Flood Hazard Areas



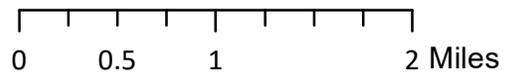
## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

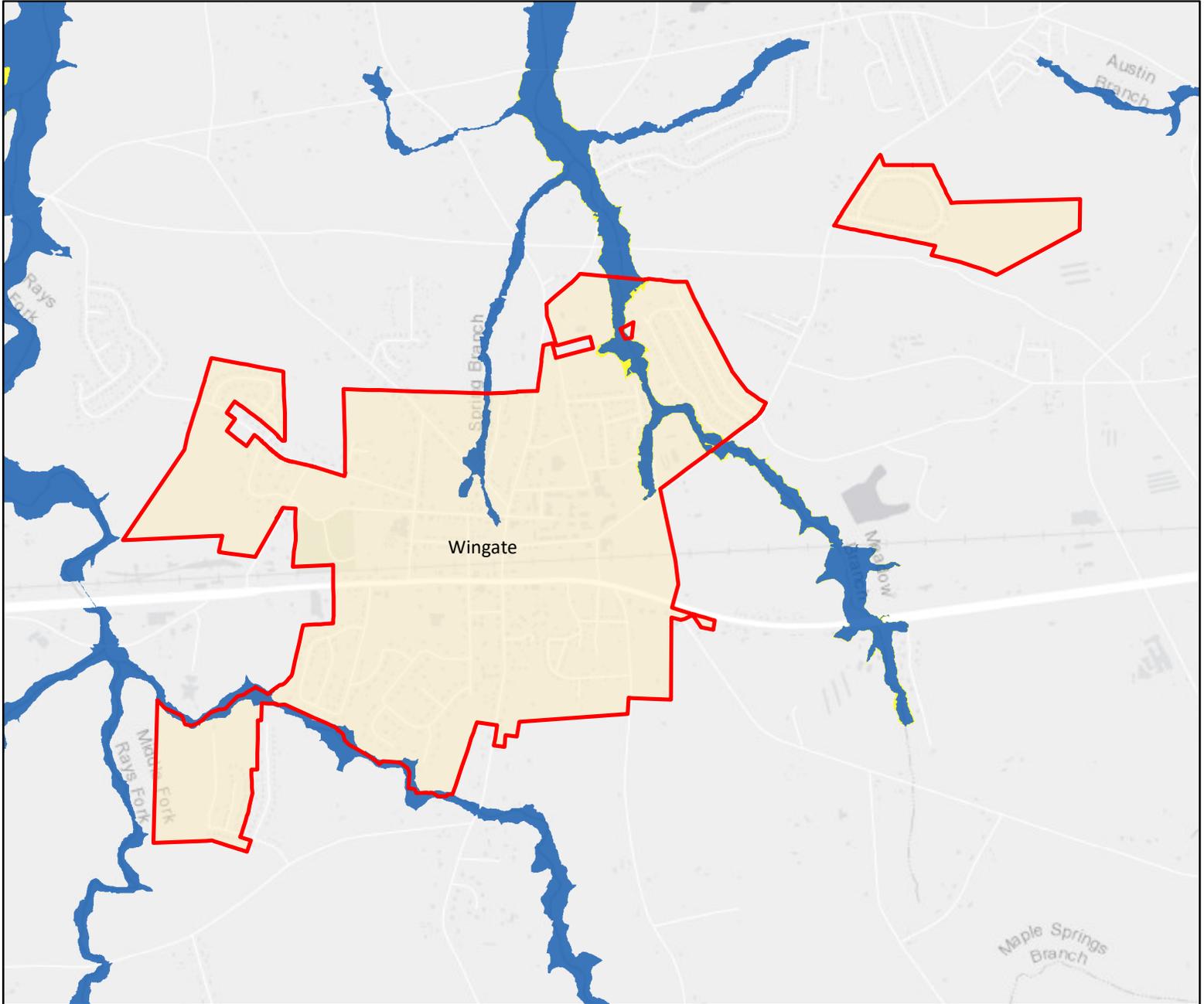
## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program



# Wingate - Flood Hazard Areas



## Legend

-  County Boundary
-  Municipal Boundary
-  Major Roads

## Flood Zone

-  100 Year Flood Zone
-  500 Year Flood Zone

Data Source: North Carolina Floodplain Mapping Program

0 0.275 0.55 1.1 Miles



# Appendix G:

## NCEI Storm Event Data

This section of the Plan includes the historic storm event data as reported to the National Centers for Environmental Information.

- ◆ G.1 – Cold/Wind Chill
- ◆ G.2 – Drought
- ◆ G.3 – Extreme Heat
- ◆ G.4 – Flood
- ◆ G.5 – Hail
- ◆ G.6 – Heavy Rain
- ◆ G.7 – Heavy Snow
- ◆ G.8 – High Wind
- ◆ G.9 – Ice Storm
- ◆ G.10 – Lightning
- ◆ G.11 – Sleet
- ◆ G.12 – Tornado
- ◆ G.13 – Thunderstorm
- ◆ G.14 – Winter Storm

**TABLE G.1: COLD/WIND CHILL EVENT DESCRIPTIONS (1996-2019)**

Location	Date	Description
STANLY	2/3/1996	-
CABARRUS	4/1/1997	Several cold snaps following the relatively warm late winter caused temperatures to dip well into the 20s at times yielding substantial damage to the apple crop and perhaps other crops.
UNION	4/1/1997	Several cold snaps following the relatively warm late winter caused temperatures to dip well into the 20s at times yielding substantial damage to the apple crop and perhaps other crops.
CABARRUS	1/6/2014	An arctic cold front blasted through the western Carolinas during the morning of the 6th, bringing gusty winds and the coldest air mass to have affected the region since 1994. By early evening, winds of 10 to 20 mph, with stronger gusts combined with temperatures falling into the 20s and teens to produce wind chill values below 0 across the Piedmont and foothills. Although wind gradually diminished overnight, low temperatures fell into the single digits across the Piedmont and foothills. The low temperature of 6 at the Charlotte/Douglass International Airport shattered the previous daily record of 12 that had stood for more than a century.
UNION	1/6/2014	An arctic cold front blasted through the western Carolinas during the morning of the 6th, bringing gusty winds and the coldest air mass to have affected the region since 1994. By early evening, winds of 10 to 20 mph, with stronger gusts combined with temperatures falling into the 20s and teens to produce wind chill values below 0 across the Piedmont and foothills. Although wind gradually diminished overnight, low temperatures fell into the single digits across the Piedmont and foothills. The low temperature of 6 at the Charlotte/Douglass International Airport shattered the previous daily record of 12 that had stood for more than a century.
CABARRUS	1/7/2015	A strong arctic cold front moved through the western Carolinas during the morning and afternoon of the 7th, bringing gusty winds and very cold air to the Piedmont and foothills. By late evening, sustained winds of 5 to 15 mph combined with air temperatures in the teens to yield wind chill values near 0. Although winds gradually diminished overnight, air temperatures fell to around 10 degrees in many areas by daybreak, and wind chills of 0 to 5 above lingered until temperatures began warming during late morning. However, temperatures remained at or below freezing in many areas throughout the 8th. Record daily lows were set in the Charlotte area on the morning of the 8th.
CABARRUS	3/16/2017	The 2017 growing season began early across western North Carolina, due to an unusually warm February and early March that saw average temperatures of almost 10 degrees above normal. An episode of cold arctic high pressure in the middle of March led to a hard freeze on the morning of the 16th, when low temperatures in the lower to mid 20s were reported. This caused significant damage to berry, wheat, apple, and peach crops. While subsequent days of freezing temperatures caused further damage, the vast majority of the damage occurred on the 16th.
UNION	3/16/2017	The 2017 growing season began early across western North Carolina, due to an unusually warm February and early March that saw average temperatures of almost 10 degrees above normal. An episode of cold arctic high pressure in the middle of March led to a hard freeze on the morning of the 16th, when low temperatures in the lower to mid 20s were reported. This caused significant damage to berry, wheat, apple, and peach crops. While subsequent days of freezing temperatures caused further damage, the vast majority of the damage occurred on the 16th.

**TABLE G.2: DROUGHT EVENT DESCRIPTIONS**

Location	Description
7/1/1998	Dry weather continued through much of the month of July, affecting crops during the critical part of the growing season. Corn and other vegetables sustained the most damage, but a dollar amount was not available at the time of this writing.
10/1/1998	The drought which began during the summer continued through October. The only significant rainfall during the month occurred on the 7-8th. Cities and counties began to restrict water usage and streamflows for several mountain locations were reduced to the lowest seen in 50 years.
11/1/1998	Dry weather persisted into the late fall with rainfall deficits between 5 and 10 inches. This affected late season crops and caused water shortages. Water usage restrictions were initiated in many communities.
7/1/1999	A long-term dry spell became a drought in July. Without any widespread rain events, the only relief came in the form of widely scattered afternoon and evening thunderstorms. But even those were few and far between. The lack of rainfall lowered water tables significantly and significant damage to crops began to occur. The North Carolina northern foothills and northwest piedmont were affected first, followed by the southern foothills and southern piedmont. Dollar amounts of the damage were unavailable at the time of this writing.
8/1/1999	The drought worsened during the month of August as high evaporation rates and little rainfall occurred. The most severe conditions by the end of the month had developed in the foothills and piedmont. Water restrictions began in several communities, and for some, the first time in memory. Hay and late crops dried up in many counties. Ponds and wells began to dry up as well, affecting homeowners, farmers, and businesses such as nurseries. In addition, boaters were running aground on recreational lakes due to low water levels.
9/1/1999	Rainfall continued to be scarce across much of western North Carolina through the month of September, prolonging the drought conditions which existed all summer. However, some areas in the piedmont picked up some rain from the remnants of Hurricane Dennis early in the month and from Hurricane Floyd itself two weeks later. Although this rain brought some relief, more wells ran dry and many more areas began mandatory water restrictions.
10/1/1999	The return of some rainfall as well as lower evaporation rates due to the change of seasons, resulted in the drought easing somewhat. Drought classifications were lowered in some cases, and some places lifted water restrictions. However, the drought had not ended by the end of the month.
8/1/2000	The 2-year drought was reaching a critical stage by late summer. Many 80 to 100-foot wells were going dry. Area lakes were at record low levels causing property damage to docks, boats, etc.
9/1/2000	Overall, drought conditions continued across western North Carolina despite some locations receiving near their month's average rainfall. Low stream flow and municipal water supply remained the largest issues with many towns and cities enacting water restrictions. Citizens were quoted as saying this is the driest, they have ever seen it. Despite the drought conditions, impact on crops seemed to be minimal.
10/1/2000	Effects of the drought intensified as many areas received absolutely no rain during the month, setting records for the longest stretch without measurable rainfall in several locations. Wells and mountain streams continued to dry up and lake levels continued to drop. Many communities were forced to start more stringent water conservation measures.
11/1/2000	The long-term drought continued to affect the region. Rainfall during the month was near or slightly above normal, but this had little effect on the ground water levels. Numerous wells dried up during the fall, and well borers and drillers could not keep up with the demand. Large lakes reported record low levels and some communities continued or initiated water control measures.
2/1/2001	The long-term drought's impact became more severe, even during the winter, as water levels in lakes dropped and stream flow on rivers reached the lowest in memory. More and more communities began water restrictions and started preparing for a busy fire weather season.
3/1/2001	Despite beneficial rain during March, the drought continued to grip most of the area. Severe water restrictions were implemented in parts of the North Carolina piedmont, where reservoir had

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Description
	dropped to all-time low levels. In Concord, food establishments were asked to use paper and plastic products to conserve water.
4/1/2001	Some relief to the long-term drought occurred at mid-month, but for the most part, the rainfall deficit for the three-year period actually grew larger by the end of April. Mandatory water restrictions continued at a few mountain locations, with voluntary water restrictions urged at many others. Numerous wells went dry during April.
5/1/2001	Unprecedented drought conditions continued. Some rivers and lakes reached record-low levels. Well-drilling companies in the North Carolina piedmont were recording twice as much business as usual.
8/1/2001	The effects of the long-term drought became more severe, especially in the North Carolina piedmont. Critical water conditions were beginning to concern officials and residents of Charlotte.
12/1/2001	Very little active weather during December signaled that the drought was still present - and becoming critically important to more and more people. The Charlotte area recorded an all-time record dry calendar year with just 26.23 inches of rainfall during 2001. Records have been kept in the area since 1878. Many communities initiated either mandatory or voluntary water restrictions. At Kings Mountain, NC - a new pump was required at Lake Moss because the water level dropped below 2 of the 3 existing pumps. Record low ground water supplies, lake levels, and stream flows were reported across all of Western North Carolina.
8/1/2002	The water supply situation reached crisis levels in some communities, as the effects of the long-term drought continued to plague western North Carolina. Particularly hard hit were several Piedmont communities along the Interstate 77 corridor. The city of Shelby was forced to buy water from surrounding communities and even from private companies and citizens. In Statesville, emergency construction of wells and a dam was necessary to prevent the city from running out of water, as the South Yadkin River reached historically low levels. Water levels on area lakes were as much as 10 feet below full pond. Most of the larger towns and cities along the I-77 corridor had imposed mandatory water restrictions by the end of the month, including the Charlotte metro area.
5/1/2004	A period of dry weather that began in August of 2003 resulted in moderate drought conditions across portions of western North Carolina by late spring of 2004. Streamflow and lake levels began to run below normal, and a few communities instituted water restrictions.
5/1/2007	The effects of an extended period of dry weather were exacerbated by an abnormally dry May, with many locations reporting one of the driest Mays in recorded history. By the end of May, many climatological stations were reporting yearly rainfall deficits as high as 10 inches. The result was severe to extreme drought conditions across much of western North Carolina by the end of the month. Water restrictions were implemented in some counties across extreme western North Carolina. The very dry conditions added to agriculture hardships caused by a hard freeze and widespread damaging winds in April.
6/1/2007	Despite an increase in thunderstorm activity, drought conditions persisted across much of western North Carolina. The persistent drought continued to cause hardships to agricultural interests that were still recuperating from the April freeze. Dollar values for the drought damage should be included in either the August or September Storm Data for this region.
7/1/2007	Drought conditions persisted across much of western North Carolina during July. By the end of July, voluntary water restrictions were instituted in almost all North Carolina counties along and west of I-77. Some mandatory restrictions were introduced in Union County, NC. Agricultural interests continued to be especially hard hit. The absence of rain negatively affected the hay crop, creating concern for the loss of livestock. Dollar values for the drought damage should be included in either the August or September Storm Data for this region.
8/1/2007	Severe to extreme drought conditions persisted across much of western North Carolina during August. By the end of the month, voluntary water restrictions continued in almost all North Carolina counties along and west of I-77. Stream flows and groundwater levels approached record low levels. Water levels on some reservoirs decreased by as much as 1 foot every 10 days. Agricultural interests continued to be especially hard hit, and the North Carolina governor requested federal disaster aid

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Description
	by the end of the month. Dollar values for the drought should be included in either the September or October Storm Data for this region.
9/1/2007	Extreme drought conditions persisted across western North Carolina through September, as the region experienced another month of well-below normal precipitation. By the end of the month, most locations were running a yearly rainfall deficit of 11-17 inches. Stream flows and groundwater levels were near record low levels, with many streams running at 5 percent or less of normal flow. Water levels on area reservoirs were some of the lowest in recorded history. Agricultural interests continued to be especially hard hit. Farmers continued to struggle to feed livestock due to a lack of hay and poor pasture conditions, forcing many cattle to be sold or slaughtered. Agricultural and other losses attributed to the drought are estimated to be in the hundreds of millions of dollars. County-based losses for the growing season will be included in next month's Storm Data.
10/1/2007	Unusually dry weather continued across western North Carolina through October. Although a soaking rain near the end of the month resulted in near-normal monthly precipitation for the mountains, the piedmont saw another month of well-below normal rainfall. Most areas were on pace to break yearly rainfall deficit records. By the end of the month, exceptional drought conditions were reported across the majority of the area. Water flow on area streams continued at 3 to 6 percent of normal, while lake levels remained at near-record lows. Although most cities and towns were requesting voluntary water restrictions be observed, mandatory restrictions were ordered in quite a few communities. In some areas, the water situation was becoming dire, with Monroe, NC officials reporting that water supplies would be exhausted by early 2008 if significant rain did not occur. Also, private wells were beginning to dry up in many areas. Agriculture continued to be severely impacted by the drought. As of this writing, county by county dollar estimates of drought damage have not been made available.
11/1/2007	November provided no relief from the effects of the long-term drought. In fact, another month of well-below normal rainfall made an already dire situation even worse. Many locations remained on pace to set annual records for rainfall deficit. By the end of the month, the vast majority of the region was experiencing exceptional drought conditions. Streamflow on area rivers remained extremely low, generally less than 10 percent of normal. Meanwhile, lakes continued to gradually fall toward record low levels.
12/1/2007	The latter half of December saw a transition to a wetter pattern across the southeast. Most observing stations in western North Carolina reported above normal monthly rainfall for the first time since January 2007. However, this was not enough to put much of a dent in the long-term drought as extreme to exceptional drought conditions persisted into the New Year. Although the increase in rainfall did allow for some recharge of area streams, many were still running at less than 25 percent of normal flow at the end of the month.
1/1/2008	January saw a return to dry weather across western North Carolina. Most observing stations across the region reported a rainfall deficit of 1 to 2 inches during the month, resulting in another month of exceptional drought conditions across most of the area. Water levels on area lakes remained within a foot or two of record low stages. However, rivers and streams remained somewhat recharged from the December rains, with streamflow on most waterways running 25 to 75 percent of normal.
6/1/2008	Although near normal rainfall was observed across much of the area during the late winter and early spring, another period of abnormally dry weather in May and June exacerbated severe to extreme drought conditions over the western Carolinas and northeast Georgia. Much of the area saw less than 2 inches of rain during this period of time. By the end of the month, much of the mountains and foothills of western North Carolina were running 10 inches below normal annual rainfall. Total rainfall deficits since the beginning of 2007 were around 20 inches or more in the hardest hit areas. By the end of the month, flow on almost all major streams was running less than 10 percent of normal. Many area crops suffered.
7/1/2008	Unusually dry weather continued through the month of July, with severe to extreme drought conditions persisting across the area. Afternoon and evening thunderstorms provided some degree of relief across portions of the North Carolina piedmont, but locations across Upstate South Carolina

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Description
	<p>and extreme western North Carolina reported annual rainfall deficits of nearly 11 inches by the end of the month. Mandatory water restrictions were instituted across much of the North Carolina foothills. Water well levels began to descend below record low levels, most of which were recorded during the 1999-2002 drought. The vast majority of major streams across the area continued to run 1-10 percent of normal flow. Agriculture continued to be hard hit, with some areas reporting a 100 percent loss of the corn crop.</p>
8/1/2008	<p>Dry weather persisted across much of the area for most of August, although portions of the North Carolina Piedmont began to see relief from the dry conditions early in the month, due to an increase in daily thunderstorm activity. Elsewhere, exceptional drought conditions persisted and even expanded slightly westward to cover more of far western North Carolina and northeast Georgia. During the early part of the month, flows on most of the major streams across the area were running at record low levels, with the French Broad River setting a minimum flow record that had stood for almost 100 years. Only a handful of streams were running at more than 1 to 7 percent of normal. Groundwater levels were 2-5 feet below normal. Significant agricultural impacts persisted, with losses to summer crops, including hay, estimated at 30%. The dry weather also affected the livestock industry, due to shortages of pasture crops necessary for feeding. By the end of the month, Tropical Storm Fay had dropped up to 11 inches of rainfall across the area, providing some relief from the drought conditions, especially across the North Carolina Piedmont.</p>
9/1/2008	<p>The heavy rain brought by Tropical Storm Fay in late August provided some relief to the drought conditions across the area. This was particularly true across the North Carolina piedmont, where improving conditions were aided by normal September rainfall. However, another dry month resulted in a persistence of extreme to exceptional drought conditions across the North Carolina mountains and foothills. Voluntary water restrictions remained widespread during the month. A few communities held onto mandatory restrictions early in the month, but many of these were lifted by the end of the month. Well water remained near record low levels in many areas, while lake levels persisted well below normal stages. Rainfall from Fay resulted in some improvement in streamflows, although most rivers and major streams remained at less than 25 percent of normal, with many still running at less than 10 percent of normal. By the end of the month, government officials had requested a federal disaster declaration for most of the counties in the area, due to crop damages.</p>

**TABLE G.3: EXTREME HEAT**

Date	Location
6/29/2012	A very hot and humid airmass that spent several days building west of the Appalachians finally made it east of the mountains, bringing very hot conditions to foothills and Piedmont of North Carolina. The high temperature at Charlotte-Douglas International Airport hit 104 degrees on both the 29th and 30th, tying the all-time high. The heat index hit 105 degrees. Excessive heat affected areas east of Charlotte. The ASOS at Monroe, NC reported a heat index value of 110 degrees on 30th. Lower dewpoints over the foothills resulted in sub-advisory and warning level heat index values. The heat lasted through July 1st, before thunderstorms brought somewhat cooler conditions.
7/1/2012	Oppressive heat continued the first day of July, with Charlotte-Douglas International Airport tying its all-time record high temperature of 104 degrees for a 3rd consecutive day. The ASOS at Monroe reported a high temperature of 105 degrees with a max heat index of at least 111 degrees. Once again, Hickory in the foothills failed to reach even heat advisory criteria. Widespread thunderstorms developed during the afternoon hours, bringing a few days of relief from the heat.
7/22/1998	Excessive heat plagued central North Carolina during July 22 through July 23. Maximum temperatures reached the 98 to 103-degree range combined with dew points in the 78 to 80-degree range with little wind to give heat index values of around 110 degrees for several hours each afternoon. To make matters worse, the minimum temperatures did not fall below 80 at several locations and those that did achieved that feat for only an hour or two. Strong thunderstorms ended the 2-day excessive heat ordeal on the evening of the 23 when rain cooled the environment enough to send temperatures into the lower 70s at most locations.
6/29/2012	A very hot and humid airmass that spent several days building west of the Appalachians finally made it east of the mountains, bringing very hot conditions to foothills and Piedmont of North Carolina. The high temperature at Charlotte-Douglas International Airport hit 104 degrees on both the 29th and 30th, tying the all-time high. The heat index hit 105 degrees. Excessive heat affected areas east of Charlotte. The ASOS at Monroe, NC reported a heat index value of 110 degrees on 30th. Lower dewpoints over the foothills resulted in sub-advisory and warning level heat index values. The heat lasted through July 1st, before thunderstorms brought somewhat cooler conditions.
7/1/2012	Oppressive heat continued the first day of July, with Charlotte-Douglas International Airport tying its all-time record high temperature of 104 degrees for a 3rd consecutive day. The ASOS at Monroe reported a high temperature of 105 degrees with a max heat index of at least 111 degrees. Once again, Hickory in the foothills failed to reach even heat advisory criteria. Widespread thunderstorms developed during the afternoon hours, bringing a few days of relief from the heat.
7/8/2012	Hot and humid conditions affected parts of the North Carolina Piedmont during the day. The high temperature at the Monroe ASOS was 100 degrees, with a heat index as high as 109 degrees. At Charlotte-Douglas International Airport the high was 101 and the heat index rose to 108 degrees.
7/8/2012	Hot and humid conditions affected parts of the North Carolina Piedmont during the day. The high temperature at the Monroe ASOS was 100 degrees, with a heat index as high as 109 degrees. At Charlotte-Douglas International Airport the high was 101 and the heat index rose to 108 degrees.

**TABLE G.4: FLOOD EVENTS**

Location	Date	Description
Cabarrus County		
Cabarrus County	1/23/2002	Persistent overnight and morning rainfall resulted in the flooding of a couple of roads. One was northeast of Concord, and another southeast of Mt. Pleasant.
Cabarrus County	3/20/2003	After morning flash flooding, moderating rainfall contributed to slower rises, but continued and additional flooding along numerous creeks and streams into the evening hours. Flooding was quite severe from Kannapolis to Concord, as well as across southern and eastern sections of the county. A nursing home and a school had to be evacuated due to rising water. At least 10 roads were closed across the county.
Cabarrus County	4/10/2003	After a night of moderate to heavy rainfall, flooding developed during the morning along some creeks and streams between Kannapolis and Concord, causing several roads to be closed. Water levels on the Rocky River increased to 20 feet above normal. Significant flooding also occurred along the Irish Buffalo Creek. In some areas, boats were required to ferry people to and from work.
Cabarrus County	4/18/2003	Persistent heavy rainfall resulted in slow rises and eventual flooding in the southern part of the county. Several fields were flooded, and 12 roads were closed.
Cabarrus County	5/22/2003	Persistent heavy rainfall resulted in slow rises along creeks and streams, which culminated in flooding that lasted for much of the day. Flooding began during the morning near Harrisburg, where a bridge and a road were flooded. Flooding slowly worsened through the afternoon and expanded to areas from Harrisburg to Midland, and from Kannapolis to Concord.
Cabarrus County	5/25/2003	Slow rises along creeks and streams culminated in a few flooded roads in the Harrisburg and Mt Pleasant areas.
Cabarrus County	9/8/2004	After earlier flash flooding, general flooding continued through the early afternoon. The Rocky River continued to be the main stream affected, but gradual rises eventually culminated in flooding along additional streams as well.
Cabarrus County	9/28/2004	Although moderating rainfall rates resulted in more gradual rises along creeks and streams, flooding expanded and became widespread later in the morning. By mid-morning, numerous roads were closed. A school in Cabarrus County was evacuated when it was threatened by rising water. In Rowan County, several motorists had to be rescued after driving their vehicles through flood water.
Cabarrus County	6/2/2005	Flooding first began along several creeks in the Midland area, including Clear, Muddy, and Little Meadow, as well as some small tributaries of the Rocky River. Later in the morning, the Rocky River flooded in the northwest part of the county, near Poplar Tent Rd. Several roads were closed due to high water, including Hopewell Church Rd, where several homes were surrounded by high water.
Cabarrus County	7/4/2005	Heavy rain falling over Rowan County produced flooding along Irish Buffalo Creek near Kannapolis. This required evacuation of around 70 people from a nursing home and a mobile home park.
COUNTYWIDE	9/1/2000	Heavy rain from slow-moving thunderstorms caused a considerable amount of standing water and minor flooding on secondary roads.
CONCORD	7/22/2002	A few streets were flooded.
COUNTYWIDE	12/15/2005	Flooding developed after an extended period of moderate to heavy rain. Approximately 7 roads were closed due to high water conditions.
CONCORD	11/22/2006	Flooding developed along portions of the Rocky River, some of its tributaries, and along other streams, including Back Creek when 4 to 5 inches of rain fell in

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Description
		about an 18 hour period. Several roads were closed, including Mt Pleasant Rd, Pharr Mill Rd, and Stallings Rd, and highway 200 in Harrisburg.
KANNAPOLIS	8/27/2008	Although flash flooding ended across the area by mid-morning, stream levels remained elevated, and in some cases continued to slowly rise into the afternoon hours. In fact, the South Fork River did not crest until mid-evening. Numerous roads remained closed through the day.
GLASS	7/22/2009	Although heavy rain ended, water levels remained high from the city limits of Concord southwest to Stough Rd for several hours during the early morning.
ROBERTA MILLS	11/11/2009	Flooding continued along portions of Back Creek and the Rocky Broad River into the evening hours. Total rainfall amounts of 4-5 inches occurred, mostly within a 24-hour period.
ROBERTA MILLS	1/26/2010	Although heavy rainfall ended over the county during the early morning hours, runoff from the rainfall caused high water conditions to persist until after sunrise. The main stream affected was the Rocky River, which went well above its established flood stage.
ROBERTA MILLS	2/5/2010	A gauge on The Rocky River exceeded established flood stage above Irish Buffalo Creek, indicating flooding of Pharr Mill Rd and Mount Pleasant Rd.
HARRISBURG	12/23/2013	The Rocky River went into flood during the afternoon hours of the 23rd after widespread rainfall of around 3 inches fell over the headwaters of the river. Several roads were flooded along the Rocky River, including Stallings Road, Pharr Mill Road and Mt Pleasant Road. Back Creek also flooded a road near the intersection of Robinson Church and Stallings Roads near Middleton and Rocky Meadows Subdivisions.
ROCKY RIVER	3/7/2014	Emergency Manager reported flooding of Stallings Rd and Pharr Mill Rd.
MT PLEASANT ARPT	3/7/2014	Emergency Manager reported multiple roads flooded across the extreme eastern portion of Cabarrus County, particularly in the Midland and Mount Pleasant areas.
ROCKY RIVER	10/3/2015	Although rain began to taper off by late-morning, runoff from earlier rainfall resulted in a stream gauge on the Rocky River exceeding flood stage during late morning, indicating that Back Creek was likely flooding Pharr Mill Rd and Stallings Rd.
ROCKY RIVER	11/2/2015	County comms and stream gauges reported flooding developed across mainly the southern part of the county, after about 3 inches of rain fell in a 36-hour period, with most of that falling during the morning of the 2nd. Water from the Rocky River backed into Back Creek, flooding Stallings Rd, Pharr Mill Rd, and Rocky River Rd in Harrisburg. Other closed roads included Bethel Ave Exd, Hopewell Church Rd, and Pine Bluff Rd, all in Midland.
ROCKY RIVER	11/10/2015	After more than two inches of rain fell across much of Cabarrus County in about 24 hours, a stream gauge on the Rocky River near Irish Buffalo Creek exceeded the established flood stage, eventually by more than a foot. This indicated water backing into Back Creek from the Rocky River was causing flooding of Stallings Rd and Pharr Mill Rd, and that the Rocky River was likely flooding Poplar Tent Rd.
ROCKY RIVER	12/23/2015	After 2.5 to 4 inches of rain fell over Cabarrus County in about 2 days, a stream gauge on the Rocky River exceeded established flood stage during the late evening of the 23rd, and remained there through the morning of the 24th. High water backing into Back Creek resulted in flooding of Pharr Mill Rd as well as Stallings Rd.
ROBERTA MILLS	12/30/2015	Although heavy rain tapered off across Cabarrus County by late afternoon, runoff from the earlier heavy rainfall, along with the occasional moderate to

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Description
		heavy rain shower, resulted in only slow recession of flood water into the evening hours.
MIDLAND	12/30/2015	While flood waters receded across much of Cabarrus County, continued runoff resulted in persistent flooding along the Rocky River and some of its tributaries through the morning of the 31st. Affected roads included Pharr Mill, Stallings, Hopewell Church, Bowman Barrier, Cox Mill Roads and portions of Highway 200.
ROCKY RIVER	4/24/2017	Gradual stream rises developing as a result of 4 to 6 inches of rain falling over about a 48-hour period resulted in flooding of streams and roads across Cabarrus County during the morning of the 24th and continuing through much of the day. The main streams impacted were tributaries of the Rocky River, including Back Creek, Irish Buffalo Creek, and Dutch Buffalo Creek.
ROCKY RIVER	9/16/2018	Although heavy rain ended across Cabarrus County during the evening flooding continued along the Rocky River and its tributaries through daybreak.
ROCKY RIVER	10/11/2018	A stream gauge on the Rocky River near Irish Buffalo Creek exceeded its established flood stage after widespread rainfall of around 2 inches fell within the basin throughout the morning of the 11th. Multiple tributaries of the river overflowed and flooded roads, including Pharr Mill Rd and Stallings Rd.
ROCKY RIVER	11/13/2018	A stream gauge on the Rocky River near Irish Buffalo Creek exceeded its established flood stage after widespread rainfall of around 2 inches occurred within the basin over a period of several hours. Multiple tributaries of the river overflowed and flooded roads, including Pharr Mill Rd and Stallings Rd.
ROCKY RIVER	11/15/2018	A stream gauge on the Rocky River near Irish Buffalo Creek exceeded its established flood stage after widespread rainfall 1 to 2 inches fell within the basin, which was already saturated due to an extended period of wet weather. Multiple tributaries of the river overflowed and flooded roads, including Pharr Mill Rd and Stallings Rd.
ROCKY RIVER	12/20/2018	A stream gauge on the Rocky River near Irish Buffalo Creek exceeded its established flood stage after widespread rainfall of around 2 inches fell within the basin in about 24 hours. Multiple tributaries of the river overflowed and flooded roads, including Pharr Mill Rd and Stallings Rd.
ROCKY RIVER	2/22/2019	A stream gauge on the Rocky River near Irish Buffalo Creek exceeded its established flood stage after widespread rainfall of around 2 inches fell within the basin in about 24 hours. Multiple tributaries of the river overflowed and flooded roads, including Pharr Mill Rd and Stallings Rd.
<b>Stanly County</b>		
Stanly County	1/6/1998	River Flooding began on the Rocky River at Norwood during the evening and continued for 2 days. The crest at Norwood was 17.1 feet or 2.1 feet above the flood stage of 15 feet. Heavy rain during the afternoon and evening in the Rocky River basin produced the flooding that affected mainly farmland adjacent to the river.
Stanly County	1/27/1998	A soaking rain fell over central North Carolina during January 27 into the early afternoon hours of January 28th. The rain became heavy in many locations during the 28th. Flooding caused many rural county roads to become impassable and many had to be closed.  In addition to the rapid rises in streams and creeks in these counties, river flooding was well underway due to the excessive rainfall for the month of January. Continuous storm systems brought heavy precipitation to central North Carolina during the month, with a major storm ending the month with flooding and river flooding.

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Description
Stanly County	2/17/1998	The Rocky River at Norwood crested at 7.0 feet above flood stage during February 17th.
Stanly County	3/20/2003	Persistent heavy rain brought widespread flooding across central North Carolina, beginning in the morning of March 20 and continuing into the afternoon. Numerous roads across the area had to be closed due to flooding, and numerous creeks overflowed their banks. Rainfall amounts were mainly between 2 and 4 inches in less than 12 hours. The heaviest rain fell in Forsyth County, where major flooding occurred along Muddy Creek, Mill Creek, and Grassy Creek, and several water rescues were needed.
Stanly County	4/10/2003	Persistent showers and thunderstorms produced heavy rain and flooding across the Piedmont of North Carolina. Several creeks and streams overflowed their banks, leading to road flooding and numerous road closures. Some basements of homes were flooded in Guilford County, and a water rescue was made in Moore County.
MISENHEIMER	2/5/2010	Heavy rain resulted in widespread minor flooding across the county. Several roads were closed due to flooding including Matton Grove Road at Wesley Chapple road, Mountain View Church Road and East Park Road. Hill Ford Bridge at Hill View Road was also under water.
STANFIELD	3/7/2014	Multiple roads flooded in the county.
NORWOOD	9/17/2018	Heavy rainfall of 6 to 8 inches caused widespread flooding across the county. Combined with additional rainfall upstream, the rainfall caused all-time record major flooding along the Rocky River near Norwood. Flooding damaged approximately 142 structures throughout the county, destroying 3 and resulting in over \$3.63 million in property damage and at least \$20 million in crop damage. Numerous roads were flooded all throughout the county. The Rocky River overflowed the Highway 52 bridge and reached the base of the Plank Road bridge.
<b>Union County</b>		
Union County	1/27/1996	Prolonged rain became heavier following the ice. the rain increased into the night when some thunderstorms moved in from the west. Rainfall became excessive, more than 3 and 4 inches in some cases, causing flooding to begin by mid evening. At Asheville the flooding caused a wall to collapse onto several parked cars causing extensive damage. Numerous roads were closed around the mountains and foothills. Several major rivers flooded including the French Broad and the Oconoluftee. Evacuations were required in several counties because of flooding. In this event the flooding was not severe in the northern mountains.
Union County	8/31/2002	Pebble Creek overflowed its banks, flooding a golf course in the northwest part of the county. Many roads were also flooded.
Union County	10/13/2002	Heavy morning rainfall resulted in flooding in at least one subdivision. A retention pond overflowed in Savannah Hills, resulting in flooding of roads in the neighborhood.
Union County	3/6/2003	A number of small streams and roads flooded throughout the county.
Union County	3/20/2003	After early morning rain caused flash flooding across the area, moderating rainfall resulted in slower rises, but continued and additional flooding along creeks and streams. Numerous roads flooded, and several motorists were stranded due to high water.
Union County	4/10/2003	After a night of moderate to heavy rainfall, some overflowing creeks began flooding adjacent roads and low bridges. The flooding gradually worsened throughout the day and evening.

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Description
Union County	9/28/2004	After earlier flash flooding, moderating rain rates led to more gradual rises along creeks and streams, but general flooding continued. Numerous small streams and low-lying areas remained flooded through late morning.
Union County	6/2/2005	After a night of moderate to heavy rain, flooding developed along some creeks in the northern part of the county during the morning. The first stream that flooded was Goose Creek, which flooded near the intersection of highways 601 and 218. Flooding from the South Fork of Crooked Creek later threatened a home on station road. Several roads were closed because of high water, including Goldmine, Mill Grove, and Matthew-Weddington roads.
MONROE	7/24/1999	Clusters of slow-moving thunderstorms developed during the afternoon on another hot and humid summer day. Some of the storms became severe, producing large hail the size of nickels and quarters, and straight-line winds which downed numerous trees. In Kannapolis, the roof of a commercial building was blown off. The Gastonia area experienced a severe thunderstorm which lasted nearly an hour. Numerous trees and power lines were downed, some of which fell on a trailer and homes. Urban flooding in normally flood-prone areas stranded a few cars and lightning strikes caused several house fires. In rural areas around Monroe, small streams briefly came out of their banks and flooded typical flood-prone areas.
COUNTYWIDE	6/23/2006	High water conditions continued for several hours after flash flooding ended, as moderate to occasionally heavy rainfall continued across the county. A motorist drove into high water on East Sandy Springs and required rescue. This prompted the county to close 6 roads in the area.
MONROE	11/22/2006	Numerous roads and bridges flooded when 4 to 6 inches of rain fell in about an 18-hour period. Poor drainage and stream flooding were involved, as Twelvemile Creek, Crooked Creek, Stewarts Creek, Bearskin Creek, and several other streams overflowed their banks. Two men had to be rescued when their car was swept off of Ridge Rd by flood water from Crooked Creek.
INDIAN TRAIL ARPT	3/1/2009	Quite a few roads were closed due to flood water across central and northern portions of the county. Some flooding was the result of overflowing streams, while some was caused by poor drainage. Affected roads included but were not limited to Macedonia Church Rd, Antioch Church Rd at Highview Rd, Howey Bottoms Rd at Duncan Rd, and Jackson and Benton Streets in the city of Monroe.
FAIRVIEW	2/5/2010	A stream gauge along Goose Creek indicated the stream briefly exceeded established flood stage, flooding a few roads in locations near the junction of highway 218 and highway 601.
FAIRVIEW	7/12/2010	Flooding continued in the Goose Creek Basin through the evening, and progressed downstream to Fairview, where additional flooding developed near the highway 218 and 601 junction.
INDIAN TRAIL ARPT	7/15/2014	Although heavy rainfall ended across northern Union County by 9 pm, flooding continued in the Goose Creek basin, as excessive runoff continued to work its way downstream, with a stream gauge near Fairview eventually exceeding the established flood stage after 1 AM on the 16th.
INDIAN TRAIL ARPT	8/18/2015	Although heavy rain ended in the Crooked Creek basin by late evening of the 18th, the stream remained out of its banks until well after midnight, flooding several roads, especially at Ridge Rd, which was actually covered in water until daybreak of the 19th.
FAIRVIEW	8/19/2015	Although heavy rain ended in the Goose Creek basin by mid-evening of the 19th, continued runoff resulted in the stream remaining out of its banks and

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Description
		flooding several roads, including the intersection of Highways 218 and 601, until well after midnight.
WESLEY CHAPEL	11/2/2015	County comms and emergency manager reported flooding developed across the central part of the county during the afternoon, after more than 3.5 inches of rain fell in about a 36-hour period, with much of that falling during the morning and early afternoon of the 2nd. The main streams involved included tributaries of Twelvemile Creek, which flooded multiple roads, including Shannon Rd between Mineral Springs and Weddington. Many homes along Shannon Rd were cut off from passable roads by early evening. Public reported portions of Griffin Memorial Park flooded by Bearskin Creek. A small stream feeding into Lake Lee flooded a bridge. Portions of Stack Rd in Monroe and Potter Rd in Waxhaw were also closed due to high water.
WEDDINGTON	11/19/2015	After more than 2.5 inches of rain fell across much of Union County in about 24 hours, county comms reported flooding developed, especially across the western part of the county. Flooded roads included Antioch Church Rd in Weddington, Shannon Rd, Bigham Rd, and Billy Howell Rd in Waxhaw, and Trinity Church Rd and Medlin Rd near the South Carolina border.
INDIAN TRAIL	12/22/2015	County comms reported quite a bit of flooding developed, mainly across the northwest part of the county after around 2 inches of rain fell in about a 12-hour period. The main streams affected included South Fork Crooked and Twelvemile Creek and tributaries. Crooked Creek flooded portions of Sardis Church Rd, Lawyers Rd, and Friendly Baptist Church Rd. Additional roads flooded included Shannon Rd (due to flooding of Little Twelvemile Creek), Austin Chaney Rd, and multiple roads off Highway 74 in the Indian Trail area.
FAIRVIEW	12/30/2015	Although heavy rainfall tapered off across Union County by early evening, continued runoff from the earlier heavy rainfall resulted in only slow recession of flood water through the evening hours.
INDIAN TRAIL ARPT	4/24/2017	Public reported the South Fork of Crooked Creek overflowed its banks and flooded a portion of Lawyers Rd.
OLIVE BRANCH	9/16/2018	Although heavy rain ended across Union County during the evening, EM reported high water conditions continued through the overnight, as waters were slow to recede in light of the 7 to 13 inches that fell across the county in about 24 hours. During the morning of the 17th, an 88-year-old man drowned when he drove his vehicle through a swollen tributary on Landsford Dr.

**TABLE G.5: HAIL EVENTS**

Location	Date	Size	Description
<b>Cabarrus County</b>			
Cabarrus County	4/28/1959	1.25	
Cabarrus County	4/13/1970	1.75	
Cabarrus County	6/21/1970	2	
Cabarrus County	5/16/1982	1	
Cabarrus County	3/8/1983	1.25	
Cabarrus County	4/14/1984	1.75	
Cabarrus County	6/4/1985	1.75	
Cabarrus County	6/5/1985	4.5	
Cabarrus County	6/5/1985	1	
Cabarrus County	6/5/1985	0.75	
Cabarrus County	6/5/1985	1	
Cabarrus County	4/24/1987	1	
Cabarrus County	8/29/1987	0.75	
Cabarrus County	7/8/1990	1	
Cabarrus County	8/7/1991	0.88	
Cabarrus County	4/30/1992	1.75	
Concord	5/19/1993	0.75	
Mt Pleasant	5/1/1995	0.88	
NE Concord	7/6/1995	1	Several reports of trees down.
CONCORD	8/28/1997	1	Severe thunderstorms caused wind damage and hail in the southern Piedmont. Trees were blown down in scattered locations from Kings Mountain across Gaston county, to the Charlotte-Douglas International Airport area. A more powerful downburst apparently occurred around Mineral Springs where 20 to 25 trees were downed, homes suffered damage, and a business was partly unroofed.
HARRISBURG	3/20/1998	1	Deep low pressure moved through the Tennessee and Ohio River Valleys on the 20th, pushing a strong cold front east across western North Carolina. Severe thunderstorms developed in a very unstable airmass during the morning in the mountains and the piedmont during the mid-afternoon. Straight-line wind damage resulted in several downed trees. A weak, short-lived tornado was observed by a woman in Mint Hill to briefly touchdown in front of her stopped car. Tornado damage was confined to trees and power lines. Hail up to 2 inches in diameter did quite a bit of damage - especially in the Mint Hill area where dollar amounts were

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Size	Description
			unknown, but considered very high. Hail piled up to a depth of 2 feet in Pineville and twin rope funnel clouds were observed as well. A couple of roads were washed out in western Caldwell county as excessive rain fell on the higher elevations of the county.
MIDLAND	4/3/1998	1.75	A strong spring storm system moved northeast through the Tennessee Valley on the 3rd. A couple thunderstorms along the occluded front that passed across the mountains became severe and produced hail up to quarter size. Other severe thunderstorms developed along a thermal-moisture boundary in the piedmont and produced hail up to 2 inches in diameter.
KANNAPOLIS, CONCORD	5/7/1998	2.75	Supercell thunderstorms developed in a highly sheared atmosphere in eastern Tennessee then moved east across the mountains, foothills and western piedmont of North Carolina. These long-lived, cyclic supercells produced a considerable amount of large hail and some damaging winds in the mountains.
KANNAPOLIS	5/8/1998	0.75	An isolated severe thunderstorm downed three large trees and produced grape size hail.
CONCORD	5/27/1998	0.75	A frontal boundary in the area again provided the focus for thunderstorm development during the afternoon of the 27th. Many storms became severe across western North Carolina and produced hail ranging in size between dimes and quarters. Severe straight-line winds downed numerous trees and power lines, some on houses, in Sylva and Brevard. A few cars were damaged as well. Several trees and power lines were downed in Cornelius later in the afternoon. Lightning struck an apartment in Hickory and caused an attic fire.
KANNAPOLIS	5/2/2000	0.75	A cluster of strong to severe thunderstorms tracked east across the western piedmont during the early evening. The storms produced dime to golf ball size hail and some wind damage. The most severe storm occurred in Lincoln county where golf ball size hail fell for 10 minutes and piled high enough to survive the night and still be on the ground the next morning. Icy roads and dense fog developed along NC Hwy 27 East out of Lincolnton as a result of the hail's longevity. Scattered trees and limbs were also blown down around Lincolnton and south of Denver.
CONCORD	5/13/2000	1	Thunderstorms developed in the mountains in the early afternoon with several becoming severe a few hours later. Other severe thunderstorms moved into or developed in the foothills and piedmont during the early evening. Hail up to the size of walnuts and some wind damage occurred in the mountains and foothills. Several trees were blown down near Fairview. In Cleveland county, 1.5-foot diameter trees were blown down in Belwood, and a number of structures were damaged in Polkville. Just west of Lincolnton several trees and power lines were downed, some on mobile homes. Lightning from the storm in Lincolnton knocked out power to the 911 center. Numerous trees and power lines were downed and a couple of storage buildings were blown over northeast of Gastonia. In Dallas, a trailer park sustained damage to a storage building, 3 young Bradford pear trees, underpinning, a power meter, and heavy doghouse. Mecklenburg county police reported 7 to 10 trees downed north of Charlotte. Considerable damage occurred in Cabarrus county with numerous trees blown down through the northern and central parts of Concord. Winds were estimated as high as 70 mph in western Cabarrus county due to a significant number of downed trees, with many on houses and some blocking roads. Crews had to work most of the night to clear trees and restore power. A deputy said he observed a tornado touch down, lift, and touch down again before ending as a waterspout over Coddle Creek Reservoir. However, there was not enough evidence to confirm the event as a tornado.
CONCORD	4/1/2001	0.75	
HARRISBURG	7/5/2001	1.25	Half-dollar-sized hail reported at Lowes Motor Speedway.

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Size	Description
HARRISBURG	7/3/2002	1	
HARRISBURG	7/4/2002	0.88	Reported on Highway 49.
CONCORD	7/22/2002	0.75	
CONCORD	5/3/2003	1	
MT PLEASANT	5/3/2003	0.88	
HARRISBURG	5/3/2003	0.75	
KANNAPOLIS	6/7/2005	1	
MT PLEASANT	4/22/2006	0.75	Penny size hail and large tree limbs down on Lentz Harness Shop Rd.
KANNAPOLIS	5/14/2006	1.75	
CONCORD	5/14/2006	1.75	Golf ball hail reported at exit 60 on Interstate 85.
CONCORD	5/14/2006	1.75	Golf ball hail reported at exit 60 on Interstate 85.
CONCORD	5/18/2006	1	
CONCORD	5/18/2006	0.75	
KANNAPOLIS	5/18/2006	1	
CONCORD	6/10/2006	1.75	
HARRISBURG	6/10/2006	1	Quarter size hail near the intersection of Rocky River Rd and Hickory Ridge Rd.
CONCORD	6/12/2006	0.75	
MT PLEASANT	8/7/2006	0.75	Reported at the intersection of Mount Pleasant Rd and highway 49.
CONCORD	4/15/2007	1	Severe thunderstorms developed during the early afternoon hours over the foothills and western Piedmont of North Carolina.
KANNAPOLIS	5/12/2007	0.75	Severe storms produced large hail over the North Carolina Foothills and Piedmont during the afternoon hours.
CABARRUS	6/24/2007	0.75	Reported on highway 601 south of Concord.
KANNAPOLIS	6/25/2007	0.88	Scattered severe storms developed over western North Carolina during the afternoon and evening hours.
CONCORD	6/26/2007	0.75	Scattered severe storms developed over western North Carolina. Most of the storms occurred during the late afternoon and evening hours.
MT PLEASANT	4/20/2008	0.75	Reported on Pickens Rd.
ROBERTA MILLS	4/26/2008	0.75	Reported at Poplar Tent Rd and I-85.
CONCORD	4/26/2008	0.88	Scattered severe storms affected western North Carolina during the afternoon and evening hours.
CONCORD	5/9/2008	1	Severe storms developed over western North Carolina during the evening hours and produced large hail.
GLASS	5/11/2008	1	Reported at the intersection of highway 73 and Odell School Rd.
CONCORD	5/11/2008	2.75	An isolated supercell thunderstorm developed over the South Mountains in the North Carolina Piedmont. The storm then tracked east, producing large to very large hail and brief tornadoes during its 3-hour lifetime. There was quite a bit of hail damage, particularly in the city of Concord in Cabarrus County, though no damage estimates were available.
NORTH CONCORD	5/11/2008	1.75	Reported on Kidd Ct.
CABARRUS	5/11/2008	0.88	Reported at Branch View Rd and South Union Rd.
JACKSON PARK	5/11/2008	1	Reported at highway 601 and highway 29.
CONCORD	5/11/2008	1	An isolated supercell thunderstorm developed over the South Mountains in the North Carolina Piedmont. The storm then tracked east, producing large to very large hail and brief tornadoes during its 3 hour lifetime. There was quite a bit of hail damage, particularly in the city of Concord in Cabarrus County, though no damage estimates were available.

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Size	Description
MT PLEASANT	5/11/2008	1.75	Hail covered the ground.
GLASS	5/20/2008	0.88	Reported on Golden Desert Ct.
CONCORD	5/20/2008	0.75	Several clusters of severe thunderstorms developed over western North Carolina during the afternoon and evening hours ahead of a cold front.
CONCORD	5/20/2008	1	Several clusters of severe thunderstorms developed over western North Carolina during the afternoon and evening hours ahead of a cold front.
CONCORD	5/20/2008	0.75	Several clusters of severe thunderstorms developed over western North Carolina during the afternoon and evening hours ahead of a cold front.
CONCORD	5/20/2008	0.75	Several clusters of severe thunderstorms developed over western North Carolina during the afternoon and evening hours ahead of a cold front.
CONCORD	5/20/2008	0.75	Several clusters of severe thunderstorms developed over western North Carolina during the afternoon and evening hours ahead of a cold front.
MIDLAND	6/11/2008	0.88	Scattered severe storms affected western North Carolina during the evening hours.
CONCORD	6/22/2008	1	Hail lasted for several minutes.
ROBERTA MILLS	6/22/2008	1	Severe storms developed over the North Carolina mountains during the early afternoon hours. The storms progressed eastward during the afternoon and evening affecting much of western North Carolina.
WEST CONCORD	6/22/2008	0.88	Severe storms developed over the North Carolina mountains during the early afternoon hours. The storms progressed eastward during the afternoon and evening affecting much of western North Carolina.
WATTS XRDS	4/10/2009	1	Elevated thunderstorms produced large hail over the Piedmont and foothills of western North Carolina.
ROBERTA MILLS	4/10/2009	1.25	Numerous hail reports were received in this area. Reports included penny size hail near the Lowes Motor Speedway, several quarter size hail reports in the Concord area and half dollar size hail in Mount Pleasant.
NORTH CONCORD	7/22/2009	0.75	Hail was reported near I-85 on the north side of town.
CABARRUS	7/23/2009	0.75	Scattered thunderstorms developed over the North Carolina Foothills. A few of the storms produced large hail and wind damage.
JACKSON PARK	3/28/2010	1	Hail, up to the size of quarters, was reported to be covering the ground.
MT PLEASANT ARPT	6/29/2010	1.25	Scattered thunderstorms developed over western North Carolina during the afternoon hours. With moderate wind shear over the region, a couple multicell severe storms developed.
WATTS XRDS	7/20/2010	0.88	Scattered thunderstorms developed in a moist airmass over western North Carolina during the afternoon hours. A few of the thunderstorms produced small areas of wind damage and a little small hail.
JACKSON PARK	5/27/2011	1.75	Golf ball size hail fell from International Dr near I-85 into Kannapolis.
JACKSON PARK	6/11/2011	1	Quarter size hail near the intersection of Poplar Tent Rd and George Liles Parkway.
MT GILEAD	6/11/2011	0.75	Dime size hail fell at the intersection of Centergrove Rd and Camp Julia Rd.
ROBERTA MILLS	6/11/2011	0.75	Dime size hail was reported on Bruton Smith Blvd.
KANNAPOLIS	6/28/2011	1.5	Larger than half dollar size hail on highway 127 in the Viewmont community.
JACKSON PARK	9/2/2011	0.88	While the wind shear was fairly weak over western North Carolina, a very unstable atmosphere and hot temperatures resulted in scattered thunderstorm activity over the region. A few of the storms produced areas of damaging straight-line winds and even some large hail as they drifted slowly to the south.
CONCORD	9/27/2011	0.75	Scattered showers and thunderstorms developed late in the day along a strong cold front. A few of the storms produced wind damage and small hail.
MIDLAND	3/24/2012	0.88	Multiple reports of up to nickel size hail were received along highway 601 north of Midland.

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Size	Description
HARRISBURG	5/21/2013	1	Scattered, disorganized thunderstorms developed over the North Carolina Piedmont, and eventually the mountains, during the afternoon hours. A few of the storms became severe, producing large hail and wind damage.
CONCORD	6/13/2013	1.5	Large hail was reported near Concord.
BARRIERS MILL	6/28/2013	1	Quarter size hail was reported a few miles south of Mount Pleasant.
CONCORD	5/10/2014	1	Two public reports of quarter size hail were received from the Concord area.
MT PLEASANT	6/10/2014	1	EM reported quarter size hail near Mount Pleasant. Public reported nickel to quarter size hail off North Dr (1 NNE).
MT PLEASANT	6/10/2014	0.88	FD and county comms reported nickel size hail in the Mount Pleasant area.
CONCORD	6/11/2014	0.75	HAM radio operator reported 3/4 inch hail on Firelight Ct at Highway 601.
WATTS XRDS	9/2/2014	0.75	Public reported 3/4 inch hail on Rock Olive Dr.
GLASS	4/20/2015	1	Multiple spotters and public reports of dime to quarter size hail were received between Kannapolis and Concord. Public reported quarter size hail 8 6 NNW Mount Pleasant.
HARRISBURG	4/20/2015	1	Spotter and the public reported quarter size hail near Harrisburg.
FLOWS STORE	4/20/2015	0.88	FD reported nickel size hail.
CONCORD	6/22/2015	0.75	Public reported 3/4 inch hail near downtown Concord.
WEST CONCORD	5/2/2016	1	Public reported quarter size hail at the intersection of Highways 49 and 601.
CONCORD	5/2/2016	0.75	Public reported 3/4 inch hail in downtown Concord.
CABARRUS	7/19/2016	0.75	Public reported 3/4 inch hail near Midland.
GLASS	3/1/2017	1	Public reported quarter size hail near Bethpage Rd and South Main St. At least one other report of nickel to quarter size hail was received in the Kannapolis area.
KANNAPOLIS	3/1/2017	1	HAM radio operator reported quarter size hail on south Main Street.
HARRISBURG	3/21/2017	2.5	Public reported golf ball to tennis ball size hail near Harrisburg.
ROCKY RIVER	3/21/2017	2.75	Public reported ping pong ball to baseball size hail covering the ground on Moss Creek Drive.
CONCORD	7/23/2017	0.88	Spotter reported nickel size hail near Concord.
KANNAPOLIS	5/4/2019	1.5	Public reported quarter size hail in the Kannapolis area. Emergency manager reported ping pong ball size hail on Pless St in Concord.
ROBERTA MILLS	5/4/2019	1	Public reported quarter size hail.
FLOWS STORE	5/11/2019	0.88	Spotter reported nickel size hail near Geneva Road and Lower Rocky River Road.
<b>Stanly County</b>			
Stanly County	6/26/1961	2	
Stanly County	5/20/1967	1.75	
Stanly County	6/22/1978	1.75	
Stanly County	7/16/1981	2	
Stanly County	3/8/1983	1	
Stanly County	3/8/1983	1.75	
Stanly County	6/6/1985	1.25	
Stanly County	8/29/1987	1.75	
Stanly County	8/29/1987	2.75	
Stanly County	8/29/1987	2.75	
Stanly County	8/29/1987	2.75	
Stanly County	5/16/1988	1.75	
Stanly County	9/10/1990	0.75	
Stanly County	10/25/1990	0.88	

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Size	Description
Stanly County	4/24/1992	0.75	
Albemarle	3/24/1993	1.75	
Oakboro	5/19/1993	0.75	
Locust	9/25/1994	1	
Near Albemarle	4/30/1995	1.75	Sheriff's Department reported golf ball-size hail in the north-eastern part of the county.
ALBEMARLE	5/24/1996	1.5	
BADIN	6/13/1997	0.75	DIME SIZE HAIL FELL IN BADIN AND ALBEMARLE.
NORWOOD	4/3/1998	1	
STANFIELD	4/3/1998	0.75	
MILLINGPORT	5/27/1998	0.75	
OAKBORO	6/10/1998	0.88	
OAKBORO	7/22/2000	0.75	Dime size hail reported on NC 138.
OAKBORO	3/31/2002	1.25	
LOCUST	7/1/2002	0.75	
BADIN	5/3/2003	0.88	
AQUADALE	5/3/2003	2.75	
ALBEMARLE	5/3/2003	1.75	
RICHFIELD	4/22/2006	0.75	PENNY SIZE HAIL REPORTED ON ROUTE 49 IN RICHFIELD.
RICHFIELD	5/14/2006	2.5	
NEW LONDON	5/18/2006	0.75	
ALBEMARLE	6/23/2006	0.75	Reported near Lake Tillery.
ALBEMARLE	6/23/2006	0.75	
ALBEMARLE	8/3/2006	0.75	Reported on US HWY 52.
ALBEMARLE	4/15/2007	1	Three rounds of severe weather struck Central North Carolina from the morning hours through the afternoon and into the evening. Widespread reports of damaging winds and large hail occurred with a rapidly intensifying surface low and attendant cold frontal passage. A powerful 70 knot low-level jet also aided in the initial round of severe storms. Thunderstorms re-developed in the late afternoon and evening hours as an amplifying upper level shortwave trough rotated across Central North Carolina.
NEW LONDON	5/9/2007	0.75	Reported at New London High School on Highway 52.
ALBEMARLE	5/12/2007	0.75	In addition to penny size hail, a 16 to 18 inch diameter tree limb fell onto a house.
ALBEMARLE	6/11/2007	0.75	Upper jet dynamics associated with a 80 to 90 kt jet max combined with surface heating triggered thunderstorms across central and western portions of the piedmont.
ALBEMARLE	6/24/2007	1	Scattered thunderstorms developed in the mountains and foothills during peak diurnal heating and moved east into the western piedmont.
RICHFIELD	3/15/2008	0.75	Penny size hail was reported in Richfield.
NORWOOD	3/15/2008	1	Quarter size hail was reported in Norwood.
LAMBERT	4/20/2008	0.75	Over the course of two day, several shortwave vorticity maxes rotated across the area as a closed upper low spun rotated through the region. Severe thunderstorms developed amidst steepening mid level lapse rates and peak afternoon heating. The severe storms resulted in mainly large hail, ranging from penny to golf ball size hail with an isolated flash flooding.
MILLINGPORT	4/20/2008	1	Quarter size hail was reported near the Lambert community.
NEW LONDON	5/9/2008	0.88	Nickel size hail was reported at 44009 Hearne Road in New London.
MILLINGPORT	5/11/2008	0.75	Penny size hail was reported on Highway 73, two miles west of Plyer.

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Size	Description
LOCUST	5/20/2008	1.75	Numerous thunderstorms developed across central North Carolina when a cold front and associated shortwave trough moved through central North Carolina during strong daytime heating. The severe storms produced widespread reports of large hail with only scattered thunderstorm wind damage.
MILLINGPORT	5/20/2008	0.88	Numerous thunderstorms developed across central North Carolina when a cold front and associated shortwave trough moved through central North Carolina during strong daytime heating. The severe storms produced widespread reports of large hail with only scattered thunderstorm wind damage.
ALBEMARLE ARPT	5/20/2008	1.5	Numerous thunderstorms developed across central North Carolina when a cold front and associated shortwave trough moved through central North Carolina during strong daytime heating. The severe storms produced widespread reports of large hail with only scattered thunderstorm wind damage.
NORWOOD	7/8/2008	1	Quarter-size hail was reported along a stretch of Highway 52 from northwest of Norwood to Price Street.
AQUADALE	7/23/2008	0.75	Pre-frontal convection broke out across central North Carolina early in the day, as a weak cold front approached from the west. Another round of storms developed late in the afternoon and evening with the approach of the upper level trough. There were a few reports of penny-size hail and minor thunderstorm wind damage.
HALLS FERRY JCT	4/10/2009	1.75	A swath of hail was reported ranging from quarter to golf ball size hail starting near Rogers Road and ending near NC Highway 740 and US Highway 52 near New London.
ALBEMARLE ARPT	5/5/2009	0.75	Penny sized hail was reported at the intersection of North Carolina Highway 24 and United States Highway 52.
PORTER	5/5/2009	0.88	Penny sized hail was reported along North Carolina Highways 24/27/73, near Tillery Lake.
ST MARTIN	7/20/2009	1	A cluster of convection developed across central North Carolina as a large upper trough and upper jet translated east across the area. Large severe hail up to the size of golf ball was reported with thunderstorm wind damage responsible for structural damage to area homes in Moore County.
LOCUST	6/15/2010	0.75	Locust Fire Department reported a period of hail up to penny size.
LOCUST	6/15/2010	0.88	Nickel size hail was reported near Locust Elementary School.
ALBEMARLE ARPT	5/11/2015	1	Quarter size hail was reported southwest of Albemarle.
LAMBERT	7/23/2015	1	An area of low pressure tracked along a stalled weak frontal boundary across southern portions of central North Carolina and produced scattered showers and storms. a few of the storms became severe and produced damaging winds and quarter size hail.
COTTONVILLE	5/11/2019	1	A line of showers and thunderstorms developed ahead of a mid level disturbance and associated cold front during the afternoon. A portion of the line across the southwest Piedmont of central North Carolina tracked along a outflow boundary, which helped intensify the line and produce large hail and a tornado in Stanly County.
<b>Union County</b>			
Union County	6/3/1982	1.75	
Union County	3/8/1983	1.75	
Union County	6/7/1985	1	
Union County	6/7/1985	1	
Union County	5/25/1986	0.75	
Union County	8/3/1986	0.75	
Union County	4/15/1987	0.88	

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Size	Description
Union County	4/16/1987	1.75	
Union County	5/1/1987	1.75	
Union County	6/18/1987	0.75	
Union County	8/29/1987	1.75	
Union County	8/29/1987	1.75	
Union County	5/17/1988	0.75	
Union County	5/17/1988	0.75	
Union County	4/29/1989	1.5	
Union County	4/30/1989	0.75	
Union County	4/30/1989	1.75	
Union County	5/5/1989	2	
Union County	6/5/1989	0.75	
Union County	4/1/1990	1	
Union County	4/1/1990	1	
Union County	5/2/1990	1.25	
Union County	5/21/1990	0.75	
Union County	3/13/1991	0.75	
Union County	7/3/1992	0.75	
Waxhaw	3/24/1993	1	
Houston	4/16/1993	1	
Stallings	8/27/1994	1.75	Golfball sized hail fell in the town of Stallings.
Waxhaw	9/1/1994	1.75	Golfball-size hail reported near Waxhaw in western Union County.
New Salem, Indian Trail	5/1/1995	1.75	Golf ball-size hail at Highway 218 and 205.
Waxhaw	5/19/1995	0.75	
Indian Trail	6/12/1995	1.5	
MINERAL SPG	3/15/1996	0.75	A developing squall line caused large hail in the mountains before moving into South Carolina. As the storm system moved rapidly east it again caused damage in North Carolina - this time in the piedmont around Gastonia. A 30 foot section of the roof was blown off the loading dock at Eastridge Mall. Wind damage was also reported in Bessemer City and large hail fell in Union county.
WAXHAW	3/16/1996	0.75	Large hail fell in a number of locations. From Cleveland county into Lincoln county hail accumulated to a couple of inches in a few places. The hail was smaller around Gaston and Union counties.
WAXHAW	3/29/1997	1.25	Severe thunderstorms caused large hail.
MINERAL SPG, MONROE	7/5/1997	1.75	A cluster of severe thunderstorms developed in the evening southeast of Charlotte. Large hail caused extensive damage to cars in Monroe.
INDIAN TRAIL	7/16/1997	0.75	Severe thunderstorms developed mainly in the foothills of North Carolina during the afternoon. Damaging winds up to 75 mph downed trees and power lines. U.S. Highway 74 in Henderson county was blocked for 2 hours due to a large oak tree that fell across the road. Another large tree in Cleveland county fell onto 2 pickup trucks, totalling them. Three houses were damaged by fallen trees, a car was damaged by a collapsed convenience store canopy and trees blocked roads near Indian Trail. Power outages were scattered across the region, some due to lightning. Up to 4300 people were without power in Union county.
STURDIVANTS	9/10/1997	0.75	A severe thunderstorm blew down power lines and caused large hail.
WEDDINGTON, MONROE	6/10/1998	0.75	A warm front pushing north through western North Carolina helped initiate heavy rain and severe thunderstorms during the morning of the 10th. Many reports of trees down and large hail were received from the western piedmont. A car was

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Size	Description
			blown off the road near Kings Creek. Chicken houses were damaged near Taylorsville allowing ten thousand chickens to run free. Numerous trees were uprooted in Monroe and wind-blown golf ball size hail broke windows and damaged cars. Heavy rain in a short period of time resulted in some urban flooding from the Belmont and Mount Holly areas, to the south side of Charlotte. Numerous roads were flooded and several motorists required rescue in different parts of the city. Lightning severely damaged a church in Millersville, but no damage estimate was available. Several homes were struck by lightning in the Charlotte area, causing extensive damage. In Wingate, one house was severely damaged and two others minorly damaged by lightning. Lastly, a lightning strike in Highlands ignited a fire that burned a large house and its contents, including a Corvette. No damage estimates were given.
WEDDINGTON, MINERAL SPRING	6/24/1998	0.88	Multi-cell thunderstorms again developed in the early evening and moved south across the southern mountains and piedmont. A few became severe and produced large hail up to golf ball size, as well as damaging winds. Wind damage was confined to downed trees and power lines. The hardest hit area was northeast of Brevard where roads were blocked.
MONROE	7/20/1998	0.75	A cluster of severe thunderstorms developed west into Cabarrus county, producing numerous microbursts that downed trees and power lines as they moved slowly south over the course of an hour and fifteen minutes. Especially hard hit was the area from Concord into the southern and eastern portions of the county. The storms eventually moved into Union county and produced dime size hail west of Monroe. Lightning strikes also caused several house fires in Iredell, Cabarrus and Union counties until late in the evening. One house in Union county was a total loss.
WINGATE, WAXHAW	5/13/1999	1.75	Scattered thunderstorms developed during the afternoon and evening of the 13th and a few pulsed to severe levels. In Henderson county, golf ball size hail covered Highway 280 and a large tree fell onto a house in Hendersonville, causing significant damage to the house and outdoor furniture. Dime to golf ball size hail was reported in Union county along with a measured wind gust to 85 mph. Quarter size hail was reported late in the evening in Avery county. There was a public report of a sighting of a very weak tornado that appeared to make a brief touchdown, but caused no damage, north of Marion. Due to insufficient data in support of this report, an official tornado event will not be entered.
MARSHVILLE	8/1/1999	1	Clusters of severe thunderstorms rumbled through the southern piedmont of North Carolina during the late afternoon and evening hours. Straight-line winds produced by these storms downed many trees and some power lines. One house in Mt. Ulla was damaged by a downed tree. A citizen near Pineville reported twin gustnadoes separated by 30 seconds, which spun up along the gust front of one of the severe thunderstorms. The wind from the gustnadoes pinned the man against the outside wall of his home, chewed up tree limbs and downed a few trees, and threw a 40-foot section of a tree over his house. A neighbor measured the wind associated with the first gustnado at 70 mph with a hand held anemometer. Large hail and straight-line winds broke windows in Marshville.
MINERAL SPG, MONROE, WAXHAW	4/17/2000	0.75	Thunderstorms erupted in the afternoon and evening across western North Carolina. Several clusters of storms became severe and produced hail ranging in size from dimes to golf balls. The general public in Linville was quoted as saying the hailstorm was the worst ever seen due to the amount that covered the ground. Golf ball size hail dimpled cars in Waxhaw. Some damaging straight-line winds occurred as well with one tree falling on a car in Mecklenburg county and several trees downed in Waxhaw.

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Size	Description
WAXHAW, MONROE	5/25/2000	1.25	Two severe thunderstorms affected Union county late in the afternoon and then later on in the evening. Large hail fell in and south of Waxhaw in the afternoon. Quarter size hail was reported west of Monroe and straight-line winds blew down trees and power lines in Waxhaw later in the evening.
INDIAN TRAIL MONROE	6/4/2000	1	Quarter size hail fell from a lone severe thunderstorm shortly after midnight.
WAXHAW	4/1/2001	1.75	
WAXHAW	5/19/2001	0.75	
WEDDINGTON	5/25/2001	0.75	A strong cold front dropped into the region on the 25th, resulting in numerous severe weather reports.
MONROE, INDIAN TRAIL, FAIRVIEW	3/31/2002	0.88	
WEDDINGTON	7/4/2002	0.88	
UNIONVILLE	4/10/2003	0.88	
MONROE	5/15/2003	1	Hail fell near highway 74.
UNIONVILLE	5/25/2003	0.75	
NEW SALEM	5/31/2003	1.75	
STALLINGS	7/13/2003	0.75	
MARSHVILLE	8/5/2004	0.88	
MONROE	4/3/2006	0.75	
STALLINGS	7/2/2006	1.5	
STALLINGS	4/12/2007	1.25	Large hail reported on Stallings Rd and Aurora Bvd in the Stallings area.
WAXHAW	6/12/2007	0.88	Scattered severe storms developed over western North Carolina for a second day in a row. The storms mainly produced large hail.
MINERAL SPG	8/22/2007	1.75	A few severe storms affected the western Piedmont of North Carolina during the afternoon hours.
NEW SALEM	3/15/2008	0.88	Severe storms affected the far southern Piedmont of North Carolina during the late afternoon hours.
WAXHAW	6/1/2008	0.75	Large hail affected the western Piedmont of North Carolina with an isolated severe thunderstorm.
MONROE	6/10/2008	0.75	Reported on highway 200.
WAXHAW	6/11/2008	0.88	Hail reported near the intersection of Nesbit Rd and highway 200.
UNIONVILLE, WAXHAW, FAIRVIEW	6/11/2008	1	Scattered severe storms affected western North Carolina during the evening hours.
WAXHAW, MONROE	7/8/2008	0.88	Several severe storms affected western North Carolina during the afternoon and evening hours.
MARVIN	7/23/2008	0.88	Scattered severe storms developed during the evening hours over western North Carolina.
MONROE	8/2/2008	1.75	A cold front triggered several severe storms over western North Carolina during the afternoon and evening hours.
MINERAL SPRING	2/18/2009	0.75	A small cluster of thunderstorms produced isolated large hail over the western North Carolina Piedmont.
WINGATE	6/10/2009	0.88	Several clusters of thunderstorms produced areas of severe weather over parts of western North Carolina during the afternoon and evening hours. Some flash flooding was also observed over the region.
WAXHAW	4/27/2010	0.75	Dime size hail was reported along Maggie Robinson Rd.
MONROE	6/15/2010	1	Thunderstorms erupted in the lee trough over the North Carolina foothills during the early afternoon hours. The storms produced areas of damaging straight-line winds and large hail over much of the foothills and western piedmont.

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Size	Description
INDIAN TRAIL, MARSHVILLE	7/13/2010	0.88	A couple thunderstorms developed a little ahead of a cold front over western North Carolina during the afternoon hours. A long lived multicell severe storm produced most of the severe weather. The storm exhibited supercell characteristics for short periods of time, during which it produced two brief tornadoes.
WAXHAW, ALTON, INDIAN TRAIL, WESLEY CHAPEL, MINERAL SPRING	4/9/2011	1.75	Thunderstorms initiated over the mountains of North Carolina during the afternoon hours. As the afternoon progressed, several supercell thunderstorms developed which tracked southeast across the foothills and piedmont along a slow-moving surface cold front. With unusually steep lapse rates over the region, several of the storms produced large hail. Fortunately, the supercells were a little elevated in nature, and only one, brief, weak tornado developed. Still, hail ranging up to the size of a softballs did quite a bit of damage over the region.
WINGATE	5/13/2011	1	Penny to quarter size hail was reported at Wingate University.
SHALETON	9/5/2011	1	Quarter size hail fell at Sardis Church Rd and Unionville-Indian Trail Rd.
WAXHAW	4/26/2012	1	Thunderstorms developed during the afternoon along an outflow boundary from an MCS that crossed the region earlier in the day. The afternoon and evening storms produced large hail and some straight-line wind damage.
MINERAL SPRING	5/14/2012	1.75	Numerous reports of quarter to golf ball size hail were received from near Mineral Springs to the northwest side of Monroe. The largest hail reported fell near Mineral Springs.
WAXHAW ARPT	7/1/2012	1.75	Golf ball size hail was reported near the intersection of Nesbit Rd and Potter Rd S.
ALTON	7/5/2012	1	Quarter size hail fell on Bruce Thomas Rd near Stack Rd.
UNIONVILLE	7/9/2012	0.88	Scattered thunderstorms developed along a southward moving cold front during the afternoon hours. A few of the thunderstorms caused wind damage and dropped large hail.
FAIRFIELD	8/2/2012	1.75	Half dollar to golf ball size hail fell over northeast Union County.
FAIRVIEW, STALLINGS	6/13/2013	1	A line of thunderstorms developed over eastern Tennessee ahead of a cold front. The line pushed east across the mountains and then across the foothills and piedmont during the afternoon and early evening hours. The line formed in an airmass characterized by high instability and moderate wind shear, and several of the storms produced areas of straight-line wind damage and one rare tornado in the North Carolina Mountains. The storms also produced large hail over the foothills and piedmont.
UNIONVILLE	6/13/2013	1.75	Golf ball size hail was reported near Unionville.
WAXHAW	5/23/2014	1.75	Public reported golf ball size hail near Waxhaw.
STALLINGS	5/29/2014	1	Public reported quarter size hail.
ALTON	6/21/2014	1	Spotter reported quarter size hail.
WINGATE	5/2/2016	1	Public reported quarter size hail via Social Media.
INDIAN TRAIL	5/3/2016	1	Public reported quarter size hail at Porter Ridge Middle School.
MONROE	7/23/2017	1	Spotter reported quarter size hail south of Monroe.
INDIAN TRAIL	9/13/2019	1	Public reported brief quarter sized hail.

**TABLE G.6: HEAVY RAIN**

Location	Date	Description
<b>Cabarrus County</b>		
CONCORD	7/18/2003	Minor flooding of urban areas and some roads developed.
HARRISBURG	8/5/2006	Heavy rain from thunderstorms caused flooding due to poor drainage at the intersection of Hudspeth and Morehead Roads, prompting brief closure of the intersection. Also, the Rocky River briefly flooded a low spot on Pharr Mill Rd. Standing water was reported on numerous roads in the city.
CABARRUS	1/6/2009	Water from Clarke Creek briefly overflowed a bridge on Cox Mill Rd.
WEST CONCORD	8/19/2015	FD reported water flooded the basement of a home on Saddlewood Circle after about 2 inches of rain fell in a short period of time. The flooding was described as being the result of poor drainage.
<b>Stanly County</b>		
ALBEMARLE	2/3/1998	Heavy rain spread across central North Carolina during the evening of February 3rd and it continued until the afternoon of the 4th. Storm total rainfall amounts of 2 to 3 inches were common. Raleigh/Durham recorded 2.5 inches, Goldsboro recorded 2.25 inches, Fayetteville received 2.7 inches, and Rocky Mount had nearly 3.0 inches. There were widespread reports of flooding in low-lying, urban, and normally problematic areas. Several roads had to be closed for brief periods of time with the most numerous road closures in Sampson, Warren, Vance, Granville, Halifax, Scotland, Lee and Durham counties. No one was injured during this event.
ALBEMARLE	11/22/2006	Numerous secondary road closures and HWY 52N baricaded due to flood waters.
OAKBORO	11/22/2006	Water rescue on Hartswell Road. Driver in vehicle clung to tree for 50 minutes before rescue. Left vehicle before it was swept away.
<b>Union County</b>		
	4/30/1996	Thunderstorms produced heavy rain which caused some local flooding in and around Charlotte.
	4/30/1996	Thunderstorms produced heavy rain which caused some local flooding in and around Charlotte.
NEAR CHARLOTTE	4/30/1996	Thunderstorms produced heavy rain which caused some local flooding in and around Charlotte.
INDIAN TRAIL	6/16/2001	Heavy rainfall, up to 2.1 inches, in a short time caused a sewer system to overflow into the South Fork Crooked Creek. About 3600 gallons of raw sewage were spilled.
FAIRVIEW	8/16/2003	Several trees were uprooted and a well house was damaged in Fairview. Minor flooding occurred on a few roads in urban portions of Fairview and New Salem.
MONROE	6/23/2004	Heavy rain caused a couple of roads to flood due to poor drainage.
MONROE	11/21/2006	Water was reported over roads in flood-prone and low lying areas during the evening. Affected roads included Secrest, Hopewell Church, and Lawyers Rd.
MINERAL SPG	9/13/2014	County comms reported up to two feet of water standing on the road near the intersection of McWhorter Rd and Potter Rd S due to poor drainage after a couple of inches of rain fell in a short period of time.

**TABLE G.7: HEAVY SNOW EVENTS (2000-2019)**

Date	Location
<b>Cabarrus County</b>	
1/18/2000	Low pressure moved east across Tennessee and weakened as it ran into a surface high pressure ridge along the East Coast. Nevertheless, enough moisture was available to cause heavy snow to fall from Avery county, east across the northern foothills and northwest piedmont. Precipitation began as light rain in the mid-evening hours on the 17th, but quickly turned to snow as the atmosphere cooled to below freezing. Snowfall ranged between 3 and 6 inches across the area by noon on the 18th, with a narrow band of 1 to 3-inch accumulation of snow and sleet to the immediate south.
1/22/2000	A cold dome of arctic high pressure centered over the Mid-Atlantic States provided very cold and dry air to western North Carolina. Meanwhile, weak low pressure moved east along a frontal boundary stalled across the Gulf Coast States to the Georgia coast. Abundant moisture flowed north into the sub-freezing air over western North Carolina, resulting in light snow as early as the afternoon on the 22nd. Snow became heavy by mid-afternoon across the mountains and by evening across the foothills and piedmont. A general 4 to 7-inch snowfall occurred in the mountains with as much as 10 inches reported in Jackson county. Generally, 4 to 6 inches of snow fell across the foothills and piedmont, with a local maximum of 7 inches in western Lincoln county. Rowan county failed to meet heavy snow criteria with accumulations of up to 3 inches. Freezing rain and sleet mixed with the snow for a short time before the precipitation ended, and for the most part, caused little additional problems. The one exception was across southern Union county where freezing rain lasted all night and through much of the morning on the 23rd. Ice accumulations reached damaging levels there around 3 am, causing a large number of trees and power lines to fall throughout the morning. This in turn, resulted in widespread power outages.
1/24/2000	Low pressure rapidly deepened near the Carolina coast, wrapping abundant moisture back across the piedmont of the Carolinas. Snow fell all day and into the night, heavy at times south and east of Interstate 85. By the time snow ended, accumulations ranged from a trace to 4 inches to the immediate north and west of Interstate 85, to 4 to 8 inches from eastern Rowan county to Charlotte and Gastonia, and 10 to 14 inches across southeastern Mecklenburg county and all of Union county. Utility damage in Union county alone was above \$4 million, with damage in Monroe at more than \$1 million. This storm followed no more than 36 hours after the area received several inches of snow and ice from a previous storm over the weekend.
11/19/2000	Light to moderate snow started in the mountains and spread southeast, lasting through the day. Generally, 1 to 3 inches of snow fell, but some higher elevations of the central and southern mountains reported more than 4 inches.
1/3/2002	Flurries and light snow began in the early evening and became moderate to heavy by late evening on the 2nd. Heavy snowfall accumulations were reached across this portion of the foothills and piedmont overnight on the 3rd, with 4 to 6 inches observed by noon.
1/23/2003	Light snow began around midnight in the southwest piedmont of North Carolina. A burst of heavy snow during the pre-dawn hours resulted in total accumulations of 3 to 8 inches by mid-morning.
2/26/2004	Heavy snow began to fall across the foothills, piedmont, and northern mountains of North Carolina during the late morning. Although snowfall intensity decreased dramatically during the early-to-middle portion of the afternoon, heavy snow redeveloped during the late afternoon, and continued into the evening and overnight hours. Scattered thunderstorms contributed to intense snowfall rates of 2 to 3 inches per hour from time to time, especially in the piedmont, where total snowfall of 12-22 inches occurred. The heaviest amounts occurred in the southwest piedmont, particularly in southern portions of Charlotte metro. Thousands of people were stranded on I-77 during the early afternoon, and some required rescue. The weight of the snowfall caused damage to numerous roofs, while some roofs completely collapsed. Across the foothills and northern mountains, accumulations were considerably lighter, generally in the 4-8-inch range, although amounts of 10-16 inches fell along the Blue Ridge north of I-40.

**APPENDIX G: NCEI STORM EVENT DATA**

1/20/2009	Snow developed during the pre-dawn hours across the Piedmont. As snow continued to fall across the Piedmont, heavy snowfall amounts were reached across Cabarrus and Union Counties shortly before the snow completely tapered off. Accumulations ranged from 2-4 inches across the area, although a few higher amounts were reported in eastern portions of these counties.
3/1/2009	Rain changed to snow during the early evening across portions of the foothills and the western Piedmont of North Carolina. Snow became heavy at times throughout the evening, and up to 4 inches had accumulated across the area by 10 pm. Snow, heavy at times and accompanied by occasional lightning, continued into the late evening and early overnight hours. By the time the snow tapered off, accumulations of 3-6 inches were common across the area. However, localized amounts of up to 9 inches were reported, especially along a corridor extending from Shelby to Hickory. The heavy wet snow caused quite a few trees and power lines to fall, resulting in numerous power outages. Some structures received minor to moderate roof damage due to the weight of the snow. Some customers were without power for several days. A tree fell on the library in Belmont, NC, causing damage to the roof. Numerous traffic accidents also occurred.
12/25/2010	A developing coastal storm brought a mix of light rain and snow to portions of the piedmont of western North Carolina during Christmas afternoon. By early evening, precipitation had changed to all snow in most areas northwest of Charlotte, and by late evening, these areas had experienced a rare white Christmas. Shortly after midnight, the precipitation had changed to all snow in the Charlotte metro area. Snow continued to fall steadily overnight, with areas northwest of Charlotte reporting heavy snowfall totals by midnight, with heavy totals not reached until shortly before sunrise along the I-85 corridor. Total accumulations ranged from 2 to 5 inches across the area by the time the snow tapered off to flurries and light snow showers later in the morning.
1/10/2011	Moderate to heavy snow associated with a Gulf Coast storm system spread northward across the foothills and western piedmont of North Carolina during the early morning hours. The heavy snow accumulated quickly, and by sunrise parts of the southwest foothills and piedmont had received 4 inches of snow. The snow was lighter across the northern most foothills and piedmont, where only an inch or two of snow had fallen by mid-morning. The snow became lighter during the day, but continued to accumulate. By early afternoon, snowfall totals ranged from around 7 inches over the southern foothill and southwest piedmont locations, to around 3 inches over the northern most parts of the foothills and piedmont. During the afternoon, precipitation changed to light to moderate freezing rain, which continued into the evening hours. This added as much as a tenth to a quarter inch of ice to the heavy snowfall totals, resulting in sporadic power outages, particularly in the Charlotte metro area. Persistent cold air resulted in only gradual improvement in road conditions, with some businesses and schools remaining closed for several days.
1/17/2018	As a strengthening upper level disturbance and associated cold front approached the region from the Tennessee Valley, light precipitation developed across portions of the Piedmont and foothills of North Carolina during the early morning hours. While the precipitation started as rain or a rain/snow mix in most areas, a transition to snow had occurred in most locations by sunrise. As the snow band moved east throughout the morning, snowfall rates increased, with heavy snowfall accumulations reported by early afternoon. By the time the snow tapered off to flurries, total accumulation ranged from 3 to 6 inches across much of the area.
<b>Stanly County</b>	
1/19/1998	A soaking rain developed across central North Carolina during the overnight hours and gradually changed to snow. Two bands of heavy snow fell. The first band extended from Ansonville of the southern Piedmont northeast through Troy, Southern Pines, Pinehurst, and to Sanford. The second band stretched from Raleigh east through Zebulon, Bailey, Wilson, and Tarboro. Accumulations were in the 2 to 4 inch range with the most accumulations on grassy surfaces and in the trees. Warm ground temperatures, rain soaked ground, and air temperatures in the mid-30s throughout the storm limited snowfall totals significantly.
11/19/2000	An early season snowfall affected portions of central North Carolina on Sunday, November 19. It was the second earliest date that snow has been measured at Raleigh-Durham Airport and at the Piedmont Triad Airport. Rain began to fall in the late morning hours, then changed to a mixture of

**APPENDIX G: NCEI STORM EVENT DATA**

	rain, sleet, and snow before ending in the evening. The snowfall was heavy at times in some locations, and up to three inches was recorded. Most locations in central North Carolina received around 2 inches of snow on grassy surfaces. The snow and ice created hazardous driving conditions, leading to numerous accidents.
<b>Union County</b>	
1/18/2000	Low pressure moved east across Tennessee and weakened as it ran into a surface high pressure ridge along the East Coast. Nevertheless, enough moisture was available to cause heavy snow to fall from Avery county, east across the northern foothills and northwest piedmont. Precipitation began as light rain in the mid-evening hours on the 17th, but quickly turned to snow as the atmosphere cooled to below freezing. Snowfall ranged between 3 and 6 inches across the area by noon on the 18th, with a narrow band of 1 to 3-inch accumulation of snow and sleet to the immediate south.
1/22/2000	A cold dome of arctic high pressure centered over the Mid-Atlantic States provided very cold and dry air to western North Carolina. Meanwhile, weak low pressure moved east along a frontal boundary stalled across the Gulf Coast States to the Georgia coast. Abundant moisture flowed north into the sub-freezing air over western North Carolina, resulting in light snow as early as the afternoon on the 22nd. Snow became heavy by mid-afternoon across the mountains and by evening across the foothills and piedmont. A general 4 to 7-inch snowfall occurred in the mountains with as much as 10 inches reported in Jackson county. Generally, 4 to 6 inches of snow fell across the foothills and piedmont, with a local maximum of 7 inches in western Lincoln county. Rowan county failed to meet heavy snow criteria with accumulations of up to 3 inches. Freezing rain and sleet mixed with the snow for a short time before the precipitation ended, and for the most part, caused little additional problems. The one exception was across southern Union county where freezing rain lasted all night and through much of the morning on the 23rd. Ice accumulations reached damaging levels there around 3 am, causing a large number of trees and power lines to fall throughout the morning. This in turn, resulted in widespread power outages.
1/24/2000	Low pressure rapidly deepened near the Carolina coast, wrapping abundant moisture back across the piedmont of the Carolinas. Snow fell all day and into the night, heavy at times south and east of Interstate 85. By the time snow ended, accumulations ranged from a trace to 4 inches to the immediate north and west of Interstate 85, to 4 to 8 inches from eastern Rowan county to Charlotte and Gastonia, and 10 to 14 inches across southeastern Mecklenburg county and all of Union county. Utility damage in Union county alone was above \$4 million, with damage in Monroe at more than \$1 million. This storm followed no more than 36 hours after the area received several inches of snow and ice from a previous storm over the weekend.
11/19/2000	Light to moderate snow started in the mountains and spread southeast, lasting through the day. Generally, 1 to 3 inches of snow fell, but some higher elevations of the central and southern mountains reported more than 4 inches.
1/2/2002	Heavy snow started falling early in the evening and reached heavy snowfall accumulation status between 8 pm and midnight in this part of the piedmont. Accumulation totals reached 6 to 10 inches between Waxhaw and Monroe.
1/23/2003	Light snow began around midnight in the southwest piedmont of North Carolina. A burst of heavy snow during the pre-dawn hours resulted in total accumulations of 3 to 8 inches by mid-morning.
2/26/2004	Heavy snow began to fall across the foothills, piedmont, and northern mountains of North Carolina during the late morning. Although snowfall intensity decreased dramatically during the early-to-middle portion of the afternoon, heavy snow redeveloped during the late afternoon, and continued into the evening and overnight hours. Scattered thunderstorms contributed to intense snowfall rates of 2 to 3 inches per hour from time to time, especially in the piedmont, where total snowfall of 12-22 inches occurred. The heaviest amounts occurred in the southwest piedmont, particularly in southern portions of Charlotte metro. Thousands of people were stranded on I-77 during the early afternoon, and some required rescue. The weight of the snowfall caused damage to numerous roofs, while some roofs completely collapsed. Across the foothills and northern

**APPENDIX G: NCEI STORM EVENT DATA**

	mountains, accumulations were considerably lighter, generally in the 4-8-inch range, although amounts of 10-16 inches fell along the Blue Ridge north of I-40.
1/20/2009	Snow developed during the pre-dawn hours across the Piedmont. As snow continued to fall across the Piedmont, heavy snowfall amounts were reached across Cabarrus and Union Counties shortly before the snow completely tapered off. Accumulations ranged from 2-4 inches across the area, although a few higher amounts were reported in eastern portions of these counties.
3/1/2009	Rain changed to snow during the early evening across portions of the foothills and the western Piedmont of North Carolina. Snow became heavy at times throughout the evening, and up to 4 inches had accumulated across the area by 10 pm. Snow, heavy at times and accompanied by occasional lightning, continued into the late evening and early overnight hours. By the time the snow tapered off, accumulations of 3-6 inches were common across the area. However, localized amounts of up to 9 inches were reported, especially along a corridor extending from Shelby to Hickory. The heavy wet snow caused quite a few trees and power lines to fall, resulting in numerous power outages. Some structures received minor to moderate roof damage due to the weight of the snow. Some customers were without power for several days. A tree fell on the library in Belmont, NC, causing damage to the roof. Numerous traffic accidents also occurred.
12/25/2010	A developing coastal storm brought a mix of light rain and snow to portions of the piedmont of western North Carolina during Christmas afternoon. By early evening, precipitation had changed to all snow in most areas northwest of Charlotte, and by late evening, these areas had experienced a rare white Christmas. Shortly after midnight, the precipitation had changed to all snow in the Charlotte metro area. Snow continued to fall steadily overnight, with areas northwest of Charlotte reporting heavy snowfall totals by midnight, with heavy totals not reached until shortly before sunrise along the I-85 corridor. Total accumulations ranged from 2 to 5 inches across the area by the time the snow tapered off to flurries and light snow showers later in the morning.
1/10/2011	Moderate to heavy snow associated with a Gulf Coast storm system spread northward across the foothills and western piedmont of North Carolina during the early morning hours. The heavy snow accumulated quickly, and by sunrise parts of the southwest foothills and piedmont had received 4 inches of snow. The snow was lighter across the northern most foothills and piedmont, where only an inch or two of snow had fallen by mid-morning. The snow became lighter during the day, but continued to accumulate. By early afternoon, snowfall totals ranged from around 7 inches over the southern foothill and southwest piedmont locations, to around 3 inches over the northern most parts of the foothills and piedmont. During the afternoon, precipitation changed to light to moderate freezing rain, which continued into the evening hours. This added as much as a tenth to a quarter inch of ice to the heavy snowfall totals, resulting in sporadic power outages, particularly in the Charlotte metro area. Persistent cold air resulted in only gradual improvement in road conditions, with some businesses and schools remaining closed for several days.
1/17/2018	As a strengthening upper level disturbance and associated cold front approached the region from the Tennessee Valley, light precipitation developed across portions of the Piedmont and foothills of North Carolina during the early morning hours. While the precipitation started as rain or a rain/snow mix in most areas, a transition to snow had occurred in most locations by sunrise. As the snow band moved east throughout the morning, snowfall rates increased, with heavy snowfall accumulations reported by early afternoon. By the time the snow tapered off to flurries, total accumulation ranged from 3 to 6 inches across much of the area.

**TABLE G.8: HIGH WIND EVENTS**

Date	Description
<b>Cabarrus County</b>	
1/19/1996	An extremely strong cold front, preceded by heavy rain all day, moved through the mountains, foothills, and piedmont during the night. High winds affected the mountains first and then the foothills and piedmont as the front swept through. Prefrontal southeast winds were extremely high in the mountains with Flat Top mountain reporting gusts to 72 knots during the early evening. This was the highest wind in 20 years of record. Numerous trees and power lines were blown down in western North Carolina with a large number of power outages as a result. The gradient wind caused considerable damage in the foothills and piedmont as the front moved through.
9/6/1996	The fringes of Hurricane Fran caught the Piedmont with high winds especially in the eastern parts of these counties. A number of trees were downed with some power outages as a result. Some of the trees fell on structures. Damage was quite light compared with areas to the east.
2/24/1998	High gradient winds in the wake of an existing strong storm system combining with saturated soil conditions to blow down some trees and power lines across the foothills and piedmont.
3/3/1999	High winds, gusting between 50 and 70 mph, occurred just ahead of a strong cold front. The winds were mostly gradient, but convectively boosted in some cases. Most of the damage occurred in the piedmont where mobile homes and other structures were damaged. Numerous trees and power lines were downed as well.
3/28/2000	High winds following a cold front caused a number of problems during the afternoon. Numerous trees and power lines were downed and some light structural damage occurred. Several thousand people were without power for a while too. A man was injured when a wall toppled over onto him in Concord. Streets were blocked by the downed trees and power lines in Charlotte.
2/16/2001	A strong cold front crossed the region on the 16th, accompanied by gusty winds. Persistent high gradient winds following the frontal passage resulted in downed trees and power lines. Some of the resulting power outages were long-lived, and there was even some structural damage reported.
2/4/2002	High winds, mostly in the form of gusts rather than sustained winds, blew down a number of trees and some power lines during the afternoon and early evening. A number of brush fires were reported around the Charlotte metro area. Some trees blocked roads and some fell on structures. In Statesville, a limb fell on a power line, which in turn caused a house fire. In Cleveland, a sign was blown out of a fast food restaurant. In Rowan, a roof was blown off of an abandoned mobile home.
3/7/2004	As the cold front moved into the piedmont, wind damage continued and became more severe. Numerous trees and power lines were blown down, while roofs were torn off of some buildings. Some outbuildings and barns were damaged or destroyed. In Mecklenburg County, an 81-year-old man was killed in Huntersville, when a tree fell across the deck on which he was standing.
4/16/2007	After an intense, but relatively brief high wind event affected the mountains and foothills on the evening of the 15th, another widespread damaging high wind event developed during the day of the 16th. However, this particular event included much of the piedmont. Thousands of trees fell across the area, resulting in widespread power outages. Numerous trees fell on roads, homes, and vehicles. The Blue Ridge mountains and the foothills received the brunt of the strongest winds. In Highlands, NC, two homes were heavily damaged by fallen trees, while approximately 100 homes received minor to moderate damage. A tree fell on and severely damaged a home in Otto, NC. Two businesses received significant roof damage in Cashiers, NC. Three construction workers were injured in Mount Holly when an inflatable structure collapsed at a construction site. Five homes were damaged by fallen trees in Lincoln County, NC alone. Three homes were damaged in Iredell County and in In Catawba County, a 30-foot brick wall on top of a building in Newton was blown down, while sections of a metal roof were torn off a business in Viewmont.

**APPENDIX G: NCEI STORM EVENT DATA**

2/10/2008	As the polar vortex dropped into New England, an unusually tight gradient developed over western North Carolina. This gradient, combined with daytime heating, helped to mix down areas of strong winds during the afternoon hours. Numerous trees were reported down across the foothills and western Piedmont, some across roads and on homes. The gusty winds combined with ongoing drought conditions to produce numerous brush fires across the area during the afternoon.
<b>Stanly County</b>	
2/16/1998	Strong winds with gusts to 35 mph were common across central North Carolina during the night of the 16th and into the morning hours of the 17th. The strongest gust was recorded at Goldsboro (52 mph). Several trees were downed in almost all of the counties in central North Carolina from Winston-Salem to Raleigh/Durham to Goldsboro and Rocky Mount. A combination of the wind and very soggy soils led to many of the trees to fall. Several homes were damaged in Sampson, Wayne, Wake, and Cumberland counties.
3/7/2004	High winds just behind a fast-moving cold front produced extensive damage across central North Carolina. In addition to trees and powerlines being blown down, numerous structures sustained damage. A small airplane was blown over at RDU airport, and a portion of Terminal A was damaged. Trailers were turned over and roofs were blown off many buildings. Measured wind gusts were as high as 74 mph. Over 50,000 power outages were reported.
2/10/2010	Numerous trees were blown down countywide blocking many roads and highways. Widespread power outages were caused by the falling trees along with some minor property damage to roofs and small buildings.
<b>Union County</b>	
9/6/1996	The fringes of Hurricane Fran caught the Piedmont with high winds especially in the eastern parts of these counties. A number of trees were downed with some power outages as a result. Some of the trees fell on structures. Damage was quite light compared with areas to the east.
2/24/1998	High gradient winds in the wake of an exiting strong storm system combining with saturated soil conditions to blow down some trees and power lines across the foothills and piedmont. Some trees fell on structures and a steeple was blown off a church in Casar (Cleveland county).
9/15/1999	A tight pressure gradient between powerful Hurricane Floyd across eastern North Carolina and strong high pressure over the Ohio Valley and Great Lakes pulled cooler and very dry air south across the mountains and foothills of North Carolina on strong north winds. Henderson and Transylvania counties were particularly hard hit as winds gusting over 50 mph at times downed numerous trees and power lines - some on homes and vehicles. A person was injured in a car while driving near Zirconia when a tree fell on the vehicle. A large tent providing shelter at a fair in Henderson county was damaged. Numerous brush fires that started were fanned by the high winds. The Asheville Regional airport reported winds sustained at 45 mph with gusts to 54 mph around 9 am EST on the 16th. The wind abated in the mountains around noon.  Farther east, especially near and east of Interstate 77, winds more directly associated with Hurricane Floyd caused scattered damage. Winds gusting between 35 and 45 mph downed some trees and power lines. Trees fell on structures in Bessemer City and Gastonia. A warehouse under construction in Lowesville (Lincoln county) was destroyed.
2/4/2002	High winds, mostly in the form of gusts rather than sustained winds, blew down a number of trees and some power lines during the afternoon and early evening. A number of brush fires were reported around the Charlotte metro area. Some trees blocked roads and some fell on structures. In Statesville, a limb fell on a power line, which in turn caused a house fire. In Cleveland, a sign was blown out of a fast food resteraunt. In Rowan, a roof was blown off of an abandoned mobile home.
3/7/2004	As the cold front moved into the piedmont, wind damage continued and became more severe. Numerous trees and power lines were blown down, while roofs were torn off of some buildings. Some outbuildings and barns were damaged or destroyed. In Mecklenburg County, an 81-year-old man was killed in Huntersville, when a tree fell across the deck on which he was standing.

**APPENDIX G: NCEI STORM EVENT DATA**

---

12/10/2008	A localized area of intense winds developed across the Piedmont during the early evening in association with a small area of low pressure. Numerous trees and power lines were blown across the southern part of Union County in North Carolina, with the wind damage extending southward into the northwest Piedmont of South Carolina.
2/24/2016	Very strong west/northwest winds developed across the portions of the northern foothills and western Piedmont during the afternoon in the wake of a cold front. Numerous trees were blown down across the area, some of which fell on and took down power lines, resulting in scattered power outages. Some minor roof damage also occurred, including sections of roof peeled off small businesses in Lowell (Gaston County) and Shelby (Cleveland County) and off a mobile home near Love Valley (Iredell County).

**TABLE G.9: ICE STORM EVENTS**

Date	Description
<b>Cabarrus County</b>	
2/2/1996	Rain began to freeze in the southern foothills and most of the piedmont. Bridges and overpasses quickly became icy with numerous problems reported on highways and streets. Rain was falling so heavily that not much was accumulating as ice. However, by about noon, ice storm conditions began to develop quickly with numerous power outages reported. Areas west and north of Charlotte were hardest hit. Damage estimates for this major ice storm are a broad estimate and not reliable. Road repair/cleanup costs in North Carolina exceeded \$20 million. Numerous traffic accidents caused many injuries and some indirect fatalities.
12/24/1998	Freezing rain accumulated to damaging levels around midnight and by morning there were numerous power outages reported due to downed trees and power lines. Road problems were mostly limited to bridges and overpasses.
1/29/2000	Weakening low pressure in the Ohio River Valley, developing low pressure along the Gulf Coast and cold, arctic air in place across the Carolinas resulted in a wintry mess across western North Carolina. This was the last in a series of 5 winter storms that wreaked havoc on western North Carolina in an 11-day span. The ice storm in the mountains consisted mainly of a couple inches of sleet. However, the combined accumulation of the mixture of sleet and snow was generally 2 to 3 inches. Some freezing rain mixed in during the morning of the 30th. Across the foothills and piedmont, precipitation which briefly began as some light sleet and snow, turned quickly to freezing rain. The freezing rain was heavy enough across the southern piedmont, including the Charlotte area, to result in a 1/4 to 1/2-inch glaze. Scattered power outages resulted, with Gaston county reporting 2500 people without power. The entire Duke Power system reported 77,000 people without power.
12/4/2002	Freezing rain began over the extreme southern mountains of North Carolina during the early afternoon on the 4th, and had spread into the southwest piedmont by midafternoon. Resultant damage due to ice accumulation began during the mid-to-late afternoon. The intensity of the freezing rain increased after midnight, and by sunrise on the 5th, devastating ice accumulations of 1/2 to 1 1/2 inches were observed. The hardest hit area was Charlotte metro. Hundreds of thousands lost power, and the outages lasted for as long as 2 weeks in some areas.
<b>Stanly County</b>	
1/6/1996	
1/11/1996	
2/2/1996	
12/23/1998	An ice storm began during the afternoon of 12/23/98 and continued through the early morning hours on 12/25/98. Most of the precipitation fell in the form of freezing rain across central North Carolina causing power outages to approximately 500,000 people sometime during the period. The most severe ice accumulations were found in a southwest to northeast band across central North Carolina. This band extended from near Albemarle in Stanly county, northeast through the Asheboro area in Randolph county, and continued northeast to Raleigh/Durham and Halifax. Accumulations from 1/2 to 1 inch of ice occurred in these areas. With temperatures in the mid-20s, this made travel conditions nearly impossible on the night of the 23rd.
<b>Union County</b>	
2/2/1996	Rain began to freeze in the southern foothills and most of the piedmont. Bridges and overpasses quickly became icy with numerous problems reported on highways and streets. Rain was falling so heavily that not much was accumulating as ice. However, by about noon, ice storm conditions began to develop quickly with numerous power outages reported. Areas west and north of Charlotte were hardest hit. Damage estimates for this major ice storm are a broad estimate and not reliable. Road repair/cleanup costs in North Carolina exceeded \$20 million. Numerous traffic accidents caused many injuries and some indirect fatalities.

**APPENDIX G: NCEI STORM EVENT DATA**

---

2/13/1997	A winter storm brought a variety of weather woes to western and central North Carolina. Snow in the mountains gradually became heavy as it spread east with the highest accumulations in the higher elevations west and north of Asheville. Four to six inches fell with similar amounts in the mountainous parts of the foothill counties. Several inches fell in parts of the piedmont with up to 3 1/2 inches around Cherryville. In the foothills and piedmont, the snow changed to a sleet storm during the afternoon with several inches accumulations. Around Charlotte and Monroe freezing rain during the evening caused scattered power outages.
1/23/2000	A cold dome of arctic high pressure centered over the Mid-Atlantic States provided very cold and dry air to western North Carolina. Meanwhile, weak low pressure moved east along a frontal boundary stalled across the Gulf Coast States to the Georgia coast. Abundant moisture flowed north into the sub-freezing air over western North Carolina, resulting in light snow as early as the afternoon on the 22nd. Snow became heavy by mid-afternoon across the mountains and by evening across the foothills and piedmont. A general 4 to 7-inch snowfall occurred in the mountains with as much as 10 inches reported in Jackson county. Generally, 4 to 6 inches of snow fell across the foothills and piedmont. Freezing rain and sleet mixed with the snow for a short time before the precipitation ended, and for the most part, caused little additional problems. The one exception was across southern Union county where freezing rain lasted all night and through much of the morning on the 23rd. Ice accumulations reached damaging levels there around 3 am, causing a large number of trees and power lines to fall throughout the morning. This in turn, resulted in widespread power outages.
1/29/2000	Weakening low pressure in the Ohio River Valley, developing low pressure along the Gulf Coast and cold, arctic air in place across the Carolinas resulted in a wintry mess across western North Carolina. This was the last in a series of 5 winter storms that wreaked havoc on western North Carolina in an 11-day span. The ice storm in the mountains consisted mainly of a couple inches of sleet. However, the combined accumulation of the mixture of sleet and snow was generally 2 to 3 inches. Some freezing rain mixed in during the morning of the 30th. Across the foothills and piedmont, precipitation which briefly began as some light sleet and snow, turned quickly to freezing rain. The freezing rain was heavy enough across the southern piedmont, including the Charlotte area, to result in a 1/4 to 1/2-inch glaze. Scattered power outages resulted, with Gaston county reporting 2500 people without power. The entire Duke Power system reported 77,000 people without power.
12/4/2002	Freezing rain began over the extreme southern mountains of North Carolina during the early afternoon on the 4th, and had spread into the southwest piedmont by midafternoon. Resultant damage due to ice accumulation began during the mid-to-late afternoon. The intensity of the freezing rain increased after midnight, and by sunrise on the 5th, devastating ice accumulations of 1/2 to 1 1/2 inches were observed. The hardest hit area was Charlotte metro. Hundreds of thousands lost power, and the outages lasted for as long as 2 weeks in some areas.

TABLE G.10: LIGHTNING EVENTS

Location	Date	Description
<b>Cabarrus County</b>		
KANNAPOLIS	8/24/1996	
COUNTYWIDE	7/15/1997	Thunderstorms developed in the foothills and western piedmont of North Carolina during the afternoon. A couple became severe producing damaging winds which downed trees in Rowan county and large hail on the east side of Hickory. Persistent lightning in Cabarrus county resulted in countywide power outages for 4 hours.
COUNTYWIDE	7/20/1998	<p>An isolated severe thunderstorm in Waynesville downed numerous limbs and power lines. One thousand people power lost power as well. A cluster of thunderstorms moved from northern Cleveland county, east-southeast and became severe in the eastern portions, downing numerous trees. This cluster of severe thunderstorms moved across Gaston county, continuing to down trees and some power lines and leaving 6500 people without power for a while. The storms then moved into southern Mecklenburg county, blowing down 6 trees on the southwest side of Charlotte. Intense cloud to ground lightning from these storms that became nearly stationary struck 15 dwellings ranging from apartments to condominiums to houses in the Charlotte area. Damage was estimated near 1 million dollars as many homes were destroyed. Flash flooding occurred in South Charlotte late in the evening and continued into the early morning hours. One injured woman had to be rescued from her auto on South Blvd by a firefighter.</p> <p>Another cluster of severe thunderstorms developed west into Cabarrus county, producing numerous microbursts that downed trees and power lines as they moved slowly south over the course of an hour and fifteen minutes. Especially hard hit was the area from Concord into the southern and eastern portions of the county. The storms eventually moved into Union county and produced dime size hail west of Monroe. Lightning strikes also caused several house fires in Iredell, Cabarrus and Union counties until late in the evening. One house in Union county was a total loss.</p>
HARRISBURG	7/31/1999	Severe thunderstorms shortly after midnight produced damaging winds and a considerable amount of lightning across the southern piedmont of North Carolina. Scattered trees were downed, some on roads. At a Faith school, a grandstand was blown down and a ticket booth was blown over. Signs were blown away in the town, a screen door was torn off a business and trees were split in half. Downed trees also occurred in nearby Richfield and East Rowan. At the Concord Airport, 25 percent of a hangar's roof was blown off. Lightning strikes across the region caused numerous structure fires.
HARRISBURG	6/15/2001	Lightning caused a house fire, resulting in serious damage.
GLASS	8/5/2009	Lightning struck a home on Summit Ridge Ln, causing extensive damage.
KANNAPOLIS	3/30/2012	Lightning struck a vacant home near the intersection of Hilltop Ave and Pine St, starting a fire that destroyed the structure.
ROCKY RIVER	7/1/2012	Lightning started a fire at a home on Thistle Down Dr, heavily damaging the structure.
HARRISBURG	7/26/2016	Media reported a worker at the Charlotte Motor Speedway was injured when lightning struck a fence that he was touching.
<b>Stanly County</b>		
COUNTYWIDE	8/28/1997	LIGHTNING HIT SEVERAL FARM BUILDINGS IN THE COUNTY. MOST OF THE BUILDINGS WERE IN THE LOCUST AND STANFIELD AREAS. AT LEAST THREE OUTBUILDINGS WERE HIT AND DESTROYED.
NORWOOD	6/23/2006	
ALBEMARLE	7/27/2009	Lightning resulted in several house fires from Albemarle to New London. The entire town of Albermarle was without power.
ALBEMARLE	8/19/2010	A lightning strike caused a house fire in Albemarle. Fire fighters was able to contain the fire to the attic.

**APPENDIX G: NCEI STORM EVENT DATA**

Union County		
MONROE	4/29/1996	
MONROE	4/29/1996	Morning thunderstorms caused lightning strikes which partially burned two houses.
MONROE	7/30/1996	
MONROE	8/24/1996	Severe thunderstorms swept from the foothills through much of the piedmont causing widespread reports of large hail and damaging wind. Trees were blown down in all locations where wind damage was listed above and in Iredell county a tree crushed a mobile home. Power was out in much of the area. In Charlotte excessive rainfall caused flash flooding. The worst flooding was reported along Independence Avenue where at least one car dealership flooded. Thirty one cars were damaged or destroyed. Lightning caused power outages to 1000 homes around Concord and partially burned a home near Shelby. At Monroe lightning struck two trees, ran through a carport, cracked the wall of a house and injured one woman.
WINGATE	6/10/1998	A warm front pushing north through western North Carolina helped initiate heavy rain and severe thunderstorms during the morning of the 10th. Many reports of trees down and large hail were received from the western piedmont. A car was blown off the road near Kings Creek. Chicken houses were damaged near Taylorsville allowing ten thousand chickens to run free. Numerous trees were uprooted in Monroe and wind blown golf ball size hail broke windows and damaged cars. Heavy rain in a short period of time resulted in some urban flooding from the Belmont and Mount Holly areas, to the south side of Charlotte. Numerous roads were flooded and several motorists required rescue in different parts of the city. Lightning severely damaged a church in Millersville, but no damage estimate was available. Several homes were struck by lightning in the Charlotte area, causing extensive damage. In Wingate, one house was severely damaged and two others minorly damaged by lightning. Lastly, a lightning strike in Highlands ignited a fire that burned a large house and its contents, including a Corvette. No damage estimates were given.
COUNTYWIDE	7/20/1998	<p>An isolated severe thunderstorm in Waynesville downed numerous limbs and power lines. One thousand people power lost power as well. A cluster of thunderstorms moved from northern Cleveland county, east-southeast and became severe in the eastern portions, downing numerous trees. This cluster of severe thunderstorms moved across Gaston county, continuing to down trees and some power lines and leaving 6500 people without power for a while. The storms then moved into southern Mecklenburg county, blowing down 6 trees on the southwest side of Charlotte. Intense cloud to ground lightning from these storms that became nearly stationary struck 15 dwellings ranging from apartments to condominiums to houses in the Charlotte area. Damage was estimated near 1 million dollars as many homes were destroyed. Flash flooding occurred in South Charlotte late in the evening and continued into the early morning hours. One injured woman had to be rescued from her auto on South Blvd by a firefighter.</p> <p>Another cluster of severe thunderstorms developed west into Cabarrus county, producing numerous microbursts that downed trees and power lines as they moved slowly south over the course of an hour and fifteen minutes. Especially hard hit was the area from Concord into the southern and eastern portions of the county. The storms eventually moved into Union county and produced dime size hail west of Monroe. Lightning strikes also caused several house fires in Iredell, Cabarrus and Union counties until late in the evening. One house in Union county was a total loss.</p>
MARSHVILLE	7/29/1999	A severe thunderstorm downed trees in downtown Charlotte in the Charlotte Plaza. A lightning strike in Marshville sparked a blaze which destroyed a house.
MONROE	7/31/1999	Severe thunderstorms shortly after midnight produced damaging winds and a considerable amount of lightning across the southern piedmont of North Carolina. Scattered trees were downed, some on roads. At a Faith school, a grandstand was blown

**APPENDIX G: NCEI STORM EVENT DATA**

---

		down and a ticket booth was blown over. Signs were blown away in the town, a screen door was torn off a business and trees were split in half. Downed trees also occurred in nearby Richfield and East Rowan. At the Concord Airport, 25 percent of a hangar's roof was blown off. Lightning strikes across the region caused numerous structure fires.
MONROE	4/1/2001	Emergency management reported 2 large oak trees down. One tree fell on a horse trailer, the other on a house. The roof was torn off a small building. There was also some structural damage to a separate home, one house fire and one brush fire was started from lightning.
WEDDINGTON	7/29/2003	A person was injured when he was struck by lightning.
WEDDINGTON	8/14/2003	Flash flooding developed first in Indian Trail on the evening of the 14th, and quickly expanded to Weddington and Stallings. Twelve Mile Creek, which is normally 2 feet wide, overflowed its banks and expanded to a width of 50 feet, flooding Forest Lawn Dr. Numerous homes were threatened by flood water, and 16 homes received at least minor water damage. Some motorists and residents required rescue from their vehicles and homes. Several homes were also struck by lightning.
INDIAN TRAIL	8/16/2003	Two people were struck by lightning.
MONROE	5/23/2004	Lightning ignited some structural fires.
MONROE	7/19/2005	Lightning struck a home, igniting a fire which completely destroyed the structure and its contents.
WEDDINGTON	7/21/2009	Lightning struck a home, igniting a fire that destroyed much of the structure.
MINERAL SPRINGS	8/20/2009	Lightning struck a large home on Pimlico Ln, igniting a fire that caused enough damage to render the home uninhabitable.
MINERAL SPRINGS	4/9/2011	Lightning ignited a fire which damaged much of a home in Mineral Springs.
MONROE	8/2/2012	Lightning struck a tree on Church St, which fell on and damaged two vehicles.

**TABLE G.11: SLEET EVENTS**

Date	Description
<b>Cabarrus County</b>	
12/23/1998	Freezing rain and sleet developed early Wednesday morning and persisted through the morning of Christmas Eve. These areas would receive enough glaze by Christmas Eve morning to cause damage.
3/9/1999	Light snow and sleet fell during the morning, associated with a strong low-pressure area moving north through the Mississippi River Valley. Accumulations by noon ranged between 1 and 3 inches. Some light freezing rain mixed in from time to time as well.
2/16/2003	A light freezing rain developed over the piedmont and foothills of North Carolina during the early morning hours. By mid-morning, the precipitation began to intensify, and a transition to sleet occurred. The sleet accumulated rapidly to a depth of 1 inch in most locations, while periods of afternoon, evening, and overnight sleet increased total accumulations to around 2 inches in most areas. Numerous traffic accidents and road closures resulted.
1/25/2004	During the early afternoon, snow began to mix with sleet across the foothills and northern piedmont, before becoming all sleet later in the evening. In the southern piedmont, precipitation fell almost exclusively as sleet. Total sleet accumulations were generally between 1 and 2 inches across the area. A light freezing rain developed during the evening, which resulted in a thin glaze of ice on top of the layer of sleet. Very slick roads were responsible for hundreds of traffic accidents, some of which involved injuries and fatalities. Numerous injuries also occurred due to falls.
<b>Union County</b>	
12/23/1998	Freezing rain and some sleet developed early Wednesday morning and persisted through the morning of Christmas Eve. Some areas later received enough glaze to cause damage.
2/16/2003	A light freezing rain developed over the piedmont and foothills of North Carolina during the early morning hours. By mid-morning, the precipitation began to intensify, and a transition to sleet occurred. The sleet accumulated rapidly to a depth of 1 inch in most locations, while periods of afternoon, evening, and overnight sleet increased total accumulations to around 2 inches in most areas. Numerous traffic accidents and road closures resulted.
1/25/2004	During the early afternoon, snow began to mix with sleet across the foothills and northern piedmont, before becoming all sleet later in the evening. In the southern piedmont, precipitation fell almost exclusively as sleet. Total sleet accumulations were generally between 1 and 2 inches across the area. A light freezing rain developed during the evening, which resulted in a thin glaze of ice on top of the layer of sleet. Very slick roads were responsible for hundreds of traffic accidents, some of which involved injuries and fatalities. Numerous injuries also occurred due to falls.

**TABLE G.12: TORNADO EVENTS**

Location	Date	Description
<b>Cabarrus County</b>		
CONCORD	5/14/2006	The tornado briefly touched down along Cline School Rd in the Rimer community. Damage was mainly confined to downed trees, although the roof was torn off a barn. Power lines were also blown down in the area.
WEST CONCORD	5/11/2008	A tornado touched down briefly near the intersection of highway 49 and highway 601.
WATTS XRDS	12/11/2008	This tornado developed just south of the intersection of Mount Pleasant Rd North and Gold Hill Rd, where part of the roof and southwest side wall of a barn were lifted and tossed 20 to 30 yards. The tornado continued almost due north, roughly paralleling Mount Pleasant Rd, knocking a mobile home 5-10 feet off its foundation on Gold Hill Rd. The tornado continued its intermittent track to the north toward Klutz Rd, where a barn received some minor roof damage and a large hardwood tree snapped off and destroyed a travel trailer. The south side of a barn was torn off and lifted just north of Klutz Rd, with debris scattered up to 100 yards north of the structure. The tornado lifted shortly after this damage occurred. In addition to the structural damage, quite a few trees were snapped off or uprooted along the 2.5 mile track.
HARRISBURG	3/3/2012	This tornado moved into Cabarrus County from Mecklenburg County, south of Harrisburg and west of the Robinson Church Rd and Peach Orchard Rd intersection. The tornado affected several residential areas, damaging around 30 homes and destroying two homes which slid off their foundations. The tornado crossed Robinson Church Rd and Peach Orchard Rd, lifting just short of Hickory Ridge Rd.
GLASS	10/22/2019	Emergency manager reported a brief, weak tornado developed in the Davidson Rd/Sudbury Rd area of Davidson in extreme northwest Cabarrus County. Damage was primarily limited to multiple uprooted trees and at least one snapped tree. Some beehives were also overturned.
<b>Stanly County</b>		
LOCUST	9/29/1999	A tornado touched down briefly and took the entire roof off a brick ranch. No other damage was noted in the area. A spotter was tracking the funnel.
ALBEMARLE	9/29/1999	A second tornado, spawned by another thunderstorm, dropped a tornado 6 miles west of Albemarle. It destroyed a modular home, then did serious damage to the roof of a church. Several large trees were also taken down in the area. This was near the community of Lambert. The tornado then produced sporadic tree and roof damage on its way to the southern part of Albemarle. Several businesses were then heavily damaged and a lock and store facility was destroyed. The tornado then apparently dissipated.
MILLINGPORT	9/5/2011	The National Weather Service in Raleigh has confirmed that an EF-0 tornado touched down south of the Richfield area in Stanly County. The first touchdown occurred immediately south of Rogers Road where a swath of downed trees and power lines 100 yards across were located. The tornado continued northward tearing the roof off of four wooden outbuildings with metal sheet roofing. Two of the buildings were completely destroyed while the other two were intact despite considerable roof damage. Debris from these buildings was scattered for 200-300 yards in a circular pattern. Debris also included half inch-thick metal fencing that had been twisted and displaced one hundred yards. Many trees were snapped off near their bases. Beyond the outbuildings of the farm, the tornado continued northward, briefly lifting north of Sunnybrook Road.   Another brief touchdown was noted approximately 3 miles to the north and produced damage to several trees at a residence along NC Highway 49. Touchdown occurred south of Highway 49, continued across the road and lifted near the residence at 22221 Highway 49 just north of the road. No structural damage was found at this location.

**APPENDIX G: NCEI STORM EVENT DATA**

COTTONVILLE	5/11/2019	The tornado touched down near Plank Rd, just west of the intersection with Aldridge Rd. Large branches were broken and small trees were snapped on the northern side of Plank Rd. The tornado then moved southeast into the town of Cottonville, where large trees were uprooted and snapped. At the intersection between Plank Rd and Hardy Rd, the tornado appeared to reach maximum intensity, with numerous trees uprooted and some trees snapped at the trunk. The tornado then continued east along Hardy Road, with minor structural damage noted to farm outbuildings consistent with EF-0 damage. It then lifted and dissipated, as no further significant damage was evident.
<b>Union County</b>		
Stallings	4/12/1995	Two miles south of Stallings, on Chestnut Road, a small tornado produced significant damage to a barn and a large outbuilding. The roof on a small local business also received damage. Numerous trees were blown down. One injury occurred when the wind slammed a door on a resident's hand.
MONROE	4/13/1996	A tornado touched down briefly and caused significant damage to a house, destroyed several outbuildings, damaged a mobile home, and blew down a few trees. The damage was surveyed the next day and convergent rotary wind damage was quite evident. The funnel was observed as it approached the residence.
MONROE	7/4/2001	A gustnado" formed along a gust front ahead of a line of thunderstorms. The small tornado destroyed a 70 X 70 barn by lifting its roof and carrying it 100 yards and dropping it to the ground. A refrigerator inside the barn had its door removed and a large post
BAKERS	4/16/2011	An area of weak tornado damage began on the north side of Monroe, just west of highway 74 along Williams Rd. Part of the metal roof was blown off a building and some trees were blown down here. The tornado skipped northeast across highway 74 and damaged some outbuildings and blew out the plastic roof covering of an outdoor garden center. The tornado continued northeast, blowing down a few trees as it approached Secret Shortcut Rd. Part of an outbuilding was destroyed just west of Red Fox Run Rd. The tornado continued over Secret Hill Dr and Barbee Farm Dr, uprooting pine trees, snapping small trees and causing minor structural damage to homes. As the tornado continued northeast, it may have lifted briefly near Maple Hill Rd before touching down again near the intersection of Ridge Rd and Concord Highway. The metal roof of an outbuilding was tossed about 100 yards and some trees uprooted in a wooded area at this location. The tornado appeared to lift shortly thereafter, just before the intersection of Concord highway and Sikes Mill Rd.
UNIONVILLE	9/5/2011	This brief, weak tornado touched down at a farm site just southwest of the intersection of Ridge Rd and C.J. Thomas Rd. The tornado traveled around one-half mile before lifting near Bernard Thompson Rd. A few barns received roof damage and some trees were blown down.
ALTON	12/28/2015	NWS Storm Survey found the path of a brief, weak tornado that touched down along Jug Broome Rd south of Monroe and moved northeast for less than a mile before lifting along E Sandy Ridge Rd. Five sheds and outbuildings were damaged or destroyed and multiple trees downed. The wall of one home sitting on concrete blocks was shifted about one foot. Additionally, a camper was rolled on its side.
ALTON	5/24/2017	NWS storm survey found a weak tornado tracked northeast from Lancaster County, SC into Union County in a rural area west of South Rocky River Rd. Two walls and much of the roof was blown off a barn off in this area, which was the most significant damage associated with the tornado. Otherwise, damage was primarily confined to numerous downed trees, damage or destruction to multiple outbuildings, and minor structural damage to multiple homes as the tornado tracked northeast, lifting near Joe Collins Rd.

**TABLE G.13: THUNDERSTORM EVENTS**

**APPENDIX G: NCEI STORM EVENT DATA**

Location	Date	Description
<b>Cabarrus County</b>		
Randolph	7/6/1995	Several reports of trees down.
Stanly	7/6/1995	Trees were knocked down.
Granville	7/6/1995	Trees down on Beltown Road.
Person	7/6/1995	Trees were knocked down.
CONCORD	4/30/1996	An area of severe thunderstorms moved across the Charlotte metro area causing scattered wind damage. A roof was blown off a business in the south part of town and trees and power lines were downed. Trees and power lines were also blown down near Concord and Monroe.
HARRISBURG	5/11/1996	
CONCORD	5/11/1996	Severe thunderstorms moved northeast across the Piedmont. Numerous trees and power lines were downed all along this path. A second swath of damage began along the Rowan/Cabarrus county line. Numerous trees were downed in the Spencer/East Spencer area. A large number of homes were damaged by downed trees and power lines. Sheds were blown away and some light structural damage occurred. In Granite Quarry similar damage was reported with roofs of carports and garages blown off. These damage paths extended to High Rock Lake. Two fatalities were reported on the lake but these were not related to the storm.
CONCORD	5/28/1996	A squall line, plus one or two isolated severe storms, moved from South Carolina into the North Carolina foothills and piedmont. Damage was mostly limited to downed trees and power lines but light structural damage was reported. In northern Mecklenburg county some outbuildings were destroyed and a farm animal killed. Trees fell onto homes near Shelby and power was out for thousands of customers all night.
MIDLAND	6/20/1996	A tree fell during a severe thunderstorm and destroyed a mobile home.
CONCORD	7/15/1996	Severe thunderstorms developed along the foothills and piedmont and became more powerful as they moved east. Trees were blown down in areas listed above and east of Troutman underpinning was blown out from under a mobile home. Roofs of houses, outbuildings and a garage were destroyed by the wind in this same area. Power outages were common. Up to 10,000 customers were without power. Some trees fell on cars and houses.
HARRISBURG	8/3/1996	Thunderstorms produced some flooding in the mountains where several bridges were flooded out. Winds gusts were estimated to 50 knots at Hot Springs by an employee of NCDC. A steady state thunderstorm moved across northern Mecklenburg county leaving quite a bit of damage to homes resulting from downed trees. Wind and hail damage was likely more than the \$50,000 listed above. The storm had weakened considerably by the time it reached Harrisburg but was still strong enough to blow down a few trees. Lightning severely damaged a home at Hickory.
MIDLAND	4/27/1999	A backdoor cold front moving southwest across the western piedmont of North Carolina and a warm front moving north across the mountains provided the focus for strong to severe thunderstorm activity during the afternoon and evening. The severe thunderstorms produced mainly large hail ranging in size between dimes and half dollars. However, there was one report of damaging winds which blew down trees late in the evening in Cabarrus county.
KANNAPOLIS	7/24/1999	Clusters of slow-moving thunderstorms developed during the afternoon on another hot and humid summer day. Some of the storms became severe, producing large hail the size of nickels and quarters, and straight-line winds which downed numerous trees. In Kannapolis, the roof of a commercial

**APPENDIX G: NCEI STORM EVENT DATA**

		building was blown off. The Gastonia area experienced a severe thunderstorm which lasted nearly an hour. Numerous trees and power lines were downed, some of which fell on a trailer and homes. Urban flooding in normally flood-prone areas stranded a few cars and lightning strikes caused several house fires. In rural areas around Monroe, small streams briefly came out of their banks and flooded typical flood-prone areas.
HARRISBURG	7/31/1999	Severe thunderstorms shortly after midnight produced damaging winds and a considerable amount of lightning across the southern piedmont of North Carolina. Scattered trees were downed, some on roads. At a Faith school, a grandstand was blown down and a ticket booth was blown over. Signs were blown away in the town, a screen door was torn off a business and trees were split in half. Downed trees also occurred in nearby Richfield and East Rowan. At the Concord Airport, 25 percent of a hangar's roof was blown off. Lightning strikes across the region caused numerous structure fires.
CONCORD	7/31/1999	Severe thunderstorms shortly after midnight produced damaging winds and a considerable amount of lightning across the southern piedmont of North Carolina. Scattered trees were downed, some on roads. At a Faith school, a grandstand was blown down and a ticket booth was blown over. Signs were blown away in the town, a screen door was torn off a business and trees were split in half. Downed trees also occurred in nearby Richfield and East Rowan. At the Concord Airport, 25 percent of a hangar's roof was blown off. Lightning strikes across the region caused numerous structure fires.
MT PLEASANT	9/9/1999	A line of thunderstorms crossed the foothills and piedmont during the afternoon, producing a large amount of lightning, gusty winds and hail. A few storms became severe briefly as they produced dime size hail or damaging wind. A large oak tree was downed across power lines on Sherrills Ford Road west of Salisbury. Another tree was blown down and blocked a lane on Interstate 85 near Spencer. Three trees were downed in the Mt Pleasant vicinity and one house under construction was destroyed when collapsed by the wind. A combination of lightning activity and gusty winds near 50 mph at times caused scattered power outages and trees limbs to fall. These reports came mainly from southern Cleveland county through western Lincoln county and into Catawba county.
MT PLEASANT	9/29/1999	A weak boundary and a favorable shear profile was sufficient to produce 3 supercell thunderstorms in a row which tracked east northeast across the Charlotte metro area and through Cabarrus county. Funnel clouds were observed with 2 of the storms across extreme eastern Cabarrus county. About 4 miles north of where one of the funnel clouds was seen, the severe thunderstorm produced damaging wind which blew down a half dozen trees. Flash flooding developed in the same areas of eastern Cabarrus county due to the repeat thunderstorms. Some roads were washed out and several major intersections were flooded.
MIDLAND	5/19/2001	At least three trees down, one on a power line.
CONCORD	8/18/2001	A few trees and power lines brought down southeast of town, along NC Highway 24/27 and on Reed Mine Road.
MT PLEASANT	4/22/2006	
CONCORD	6/10/2006	Numerous trees down, some on homes and power lines, from the city to the area near Flowes Store Rd and Highway 601.
CONCORD	6/12/2006	Seven power poles blown down along Pitts School Rd. A barn was blown down near the intersection of Shelton and Poplar Tent Rds.
CONCORD	6/12/2006	Large tree limbs down.
HARRISBURG	7/22/2006	Tree down on Robinson Church Rd and a few large limbs down in the area.

**APPENDIX G: NCEI STORM EVENT DATA**

KANNAPOLIS	3/4/2008	Several trees and power lines blown down between Kannapolis and Mount Pleasant.
CONCORD	6/22/2008	Trees were blown down.
ROCKY RIVER	6/22/2008	Trees were blown down near the intersection of Stough Rd and highway 49.
CABARRUS	6/28/2008	Trees blown down on Sam Black Rd.
MT PLEASANT	7/8/2008	Numerous trees were blown down in the Mount Pleasant area, with damage being most concentrated in the Mount Olive Rd area.
CONCORD	7/8/2008	A tree was blown down on a house off Virginia St in Concord, which caused significant damage to the roof. Another tree was blown down on Hillindale St.
MT PLEASANT	7/22/2008	Two trees were blown down.
JACKSON PARK	4/5/2011	Multiple trees were blown down from west of Concord, through the city, and across the Mount Pleasant area. One tree fell on a home west of Concord.
NORTH CONCORD	4/28/2011	Two large pine trees were blown down on Southcircle Dr. Another tree was blown onto a home on Kannapolis Highway about 3.5 miles northwest of Concord.
CONCORD	6/11/2011	A few trees were blown down around Concord.
KANNAPOLIS	6/18/2011	Large tree limbs were blown down in the Kannapolis area.
MT PLEASANT	6/18/2011	Public reported large tree limbs blown down in the Mount Pleasant area.
JACKSON PARK	6/21/2011	Multiple trees were blown down on the west side and east side of Concord.
ROBERTA MILLS	8/11/2011	Six aircraft were damaged and at least one tree blown down at Concord Regional Airport. Large tree limbs were also blown down near Concord Mills.
ROBERTA MILLS	9/2/2011	Part of the roof was blown off a warehouse on Lyles Lane. Witnesses in the area reported extreme winds and a small rotary wind that may have been a gustnado.
CONCORD	9/2/2011	Multiple trees were blown down on the north and west side of Concord. Several power poles were also snapped along highway 29 south of town.
CONCORD	9/27/2011	Part of a roof was blown off a vacant warehouse in Concord and trees were blown down at McGill Ave and Kerr St.
ROBERTA MILLS	10/19/2011	The FAA reported that wind blew a small helicopter onto its side at the Concord Regional Airport.
KANNAPOLIS	6/22/2012	A few trees were blown down in the Kannapolis area with one tree down on power lines on Southeast Ave.
KANNAPOLIS	7/27/2012	Multiple power lines were blown down across Kannapolis, with at least two of those having been brought down by large tree limbs.
BARRIERS MILL	6/18/2015	FD reported two tree and multiple power lines blown down near Mount Pleasant.
HARRISBURG	6/19/2015	FD reported one tree and multiple large limbs blown down, some onto power lines in the Harrisburg area.
ROBERTA MILLS	6/20/2015	Spotter reported multiple trees down west of Concord. Another spotter reported multiple large trees down near Newport Dr and South Main St in Kannapolis. Public reported parts of roofing peeled off the YMCA building in Kannapolis.
HARRISBURG	6/22/2015	Public reported a tree down just south of the Charlotte Motor Speedway, and another tree down in Harrisburg proper, via social media.
WEST CONCORD	6/22/2015	EM reported dozens of trees and some power lines blown down across the city of Concord. Trees or large limbs fell on homes on Burrage Rd, Queens Rd, Brookwood Ave, McKinnon Ave near Church St, Long Ave, and May St. Two vehicles were also destroyed by falling trees on May St.
CONCORD	8/19/2015	County comms reported a few trees blown down in the Concord area when two severe storms moved over the city within a few minutes of each other.

**APPENDIX G: NCEI STORM EVENT DATA**

WEST CONCORD	9/4/2015	County comms reported multiple trees blown down southwest of Concord. Media reported some billboards damaged near Charlotte Motor Speedway.
CABARRUS	4/24/2017	Newspaper reported a combination of gusty winds and saturated soils from more than 48 hours of moderate to heavy rain caused a tree to fall on a home on Bethel Church Rd, resulting in significant damage that made the home uninhabitable.
ROBERTA MILLS	6/13/2017	County comms reported a tree blown down on Blackberry Trail and another tree down on Memory Ln.
HARRISBURG	7/5/2017	FD reported a tree blown down on a car on Sherborne Dr.
CONCORD	9/1/2017	Local law enforcement reported several trees and some power lines blown down in Concord.
WEST CONCORD	5/4/2019	County comms reported several trees blown down on Highway 601 near the intersection of Highway 49.
HARRISBURG	5/11/2019	Law enforcement reported numerous trees blown down along with multiple power lines across southern Cabarrus County.
JACKSON PARK	6/20/2019	County comms reported numerous trees blown down in the Concord area.
JACKSON PARK	7/4/2019	Fire dept reported a tree blown down on power lines on Meadowview Ave SW and at Hoover Ave at Reed St.
WEST CONCORD	10/31/2019	County comms reported a couple of trees blown down.
<b>Stanly County</b>		
	5/13/1995	Trees down on the Montgomery County line and at the edge of the Pee Dee River south of Morrow Mountain State Park.
BADIN	4/30/1996	Strong thunderstorm winds toppled trees and blew down power lines in the Badin area.
ALBEMARLE	7/15/1996	Trees down.
NRN HALF	7/15/1996	Trees down north of Albemarle.
ALBEMARLE	9/29/1999	The same thunderstorm that spawned a tornado in Locust produced a downburst on the out skirts of Albemarle which damaged three mobile homes.
ALBEMARLE	5/22/2001	Six trees were blown down across Gene, Gurley, and Yadkin Brick Roads.
NEW LONDON	4/17/2006	NUMEROUS TREE DOWN ACROSS NORTHERN PORTIONS OF THE COUNTY.
STANFIELD	6/11/2006	Trees down near Love Mill Road and Talley Road.
NORWOOD	6/23/2006	Power lines down.
ALBEMARLE	8/3/2006	Several reports of trees and power lines down on SR-27.
NEW LONDON	8/30/2006	Trees reported down.
NORWOOD	11/16/2006	Trees down near Norwood.
OAKBORO	3/4/2008	Fifteen to twenty trees were blown down. A trailer was also moved 150 FEET by wind speeds estimated at 65 to 70 mph.
ALBEMARLE	3/4/2008	Several trees were reported blown down across Albemarle.
NORWOOD	3/4/2008	Severe winds estimated at 60 to 70 mph blew off an awning off of a gas station.
ST MARTIN	5/20/2008	Straight line winds downed trees onto St Martin Road northeast of Oakboro.
AQUADALE	7/6/2008	Trees were blown down on Highway 138 between Oakdale and Aquadale.
NORWOOD	7/8/2008	Several trees were blown down in the Norwood area.
RICHFIELD	7/8/2008	Several trees were blown down in the Richfield area.
ALBEMARLE ARPT	7/8/2008	One tree was blown down at the intersection of Aquadale and Morgan Roads.
RICHFIELD	7/22/2008	Several trees were blown down near Highway 52 and Old Salisbury Road.
BADIN	7/31/2008	One tree was blown down at the corner of Henderson Street and Valley Drive.

**APPENDIX G: NCEI STORM EVENT DATA**

ST MARTIN	8/7/2008	A severe thunderstorm knocked a tree onto a house just northeast of Oakboro.
STANFIELD	4/5/2011	Several trees were blown down along a swath from just west of Stanfield to near Badin.
NORWOOD	6/11/2011	Large tree limbs were blown down across Quail Trail Road.
LOCUST	6/18/2011	Numerous trees were blown down in Locust.
FINGER	6/18/2011	Several trees were blown down in Finger.
NEW LONDON	7/4/2011	Trees and power-lines were blown down, with one down tree on Highway 52 North.
OAKBORO	7/13/2011	Numerous trees were reported down throughout Stanly County.
ALBEMARLE	7/31/2011	Several trees were blown down along the wind swath, including down trees on Lowder Street and NC Highway 205. One tree was also reported down on a home. There was no information available regarding monetary damages.
PALESTINE	8/6/2011	One tree was blown down on Palestine Road.
ALBEMARLE	9/2/2011	A tree was blown down a few miles north of Albemarle on Snuggs Park Road.
LAMBERT	3/3/2012	Two old barns were blown down and one home on Substation Road sustained minor damage.
LOCUST	3/24/2012	Two trees were blown down in Locust.
HALLS FERRY JCT	5/22/2012	One tree was reported down on Old Salisbury Road.
NEW LONDON	5/22/2012	One tree was reported down on Herlocker Road.
NEW LONDON	7/3/2012	Trees were blown down across North Carolina Highway 740 near New London.
ALBEMARLE	7/6/2012	Several trees were reported down across roads and power lines near Albemarle, with one tree reported to have fallen on a home.
PALMERVILLE	7/9/2012	One tree was blown down on power-lines resulting in scattered power outages in New London and Badin.
PALMERVILLE	7/18/2012	Several trees were blown down on Palmerville Road near Badin.
BIG LICK	7/19/2012	A tree downed several power lines on NC 24/27 near Oakboro. Also, several power outages were reported in Albemare.
RED CROSS	7/27/2012	A couple of trees were blown down along a swath from near Oakboro to near Badin, with one tree falling on a home near Badin. Monetary damages were unknown.
PALMERVILLE	8/8/2012	One tree was reported down onto a house. No other information was available.
ALBEMARLE ARPT	8/8/2012	Power-lines were reported down.
ALBEMARLE	8/17/2012	A couple of trees were blown down just west of the city of Albemarle.
NORWOOD	6/2/2015	One tree was blown down on Piney Point Road in Norwood.
LOCUST	7/20/2015	A tree and several power lines were blown down on Carol Avenue in Locust.
ALBEMARLE	9/4/2015	Numerous trees were blown down along a swath from Old Salisbury Road in North Albemarle to Lakewood Drive in Oakboro.
STANFIELD	4/6/2017	Numerous trees were blown down along a swath from Stanfield to Badin, several of which were blocking roads.
OAKBORO	5/5/2017	Trees were reported down on both lanes of Griffin Green Boulevard.
ALBEMARLE ARPT	5/5/2017	Numerous trees were reported down in Albemarle, focused near Pee Dee Avenue and East Main Street.
ALBEMARLE	5/5/2017	One tree fell onto a home at New Castle Court. The tree crashed through the roof of the house.
OAKBORO	7/5/2017	A couple of trees were blown down on Old Sandbar Road.

**APPENDIX G: NCEI STORM EVENT DATA**

ALBEMARLE	7/18/2017	Multiple trees were reported and power lines were reported down in the Albemarle area.
NEW LONDON	7/28/2017	One tree was blown down near the intersection of NC-740 and Woodhurst Road.
ALBEMARLE	4/19/2019	Several trees blown down in the city of Albermarle.
NORWOOD	4/19/2019	Several trees blown down through-out the city.
RICHFIELD	5/4/2019	One tree was reported down on Willie Road at Fontana Drive and another tree down on Willie Road at Spivey Road.
NEW LONDON	6/20/2019	Numerous trees and power lines were reported down in the New London area.
BLOOMINGTON	8/1/2019	Multiple trees were blown down and a roof was blown off a barn near the intersection of Canton Road and Austin Road.
<b>Union County</b>		
Weddington	4/24/1995	Trees down on home on Route 16.
Waxhaw	8/15/1995	Trees down near Waxhaw in SW Union County.
MARSHVILLE	4/20/1996	Severe thunderstorms developed in the western North Carolina mountains and moved east. Trees and power lines were blown down at several locations from Swain county to Union county. Around Maggie Valley and Lake Junaluska a porch was blown off a house and landed on a car. Power was out to about 5700 people in that area. Another area of damage was near the Blue Ridge Parkway where trees and signs were blown down. Around Cashiers a number of trees were downed causing damage to homes and a pickup truck was blown off an embankment. Also shingles were blown off houses and roofs were blown off of some utility buildings. Near Brevard there was a damage swath about 200 yards wide and 3/4 mile long where a mobile home was blown off its foundation. Nine other mobile homes and two houses were damaged by the wind. In Gaston county shingles were blown off homes in a couple of locations, large trees were downed by the wind and a trampoline was blown into power lines. A damaging storm traversed Union county, blowing over a mobile home, destroying a barn and downing a number of large trees. Trees and power lines were downed near Charlotte.
MONROE	4/30/1996	
MONROE	5/29/1996	
MONROE	7/30/1996	A severe thunderstorm blew down trees and power lines from Monroe to the east of town. There were numerous cloud to ground lightning strikes. A restaurant was reported to have burned from one of the strikes.
MARSHVILLE	8/26/1996	A downburst ripped part of the roof off a well constructed barn causing significant damage. Some swirls in nearby grass suggested a tornado possibly caused the damage but evidence is insufficient and no witnesses observed the storm.
MONROE	1/3/1999	A fast moving low-topped thunderstorm moved through Union county North Carolina along a boundary separating remnants of an arctic airmass and warm moist air from the Atlantic Ocean. The storm became severe, producing a southwest to northeast path of damage across central Union county. Trees were downed and there was damage to a home and picnic table.
WEDDINGTON	3/21/1999	A severe thunderstorm generated damaging winds that blew down fences and injured horses that were loosed from their pasture.
WINGATE	5/13/1999	Scattered thunderstorms developed during the afternoon and evening of the 13th and a few pulsed to severe levels. In Henderson county, golf ball size hail covered Highway 280 and a large tree fell onto a house in Hendersonville, causing significant damage to the house and outdoor furniture. Dime to golf ball size hail was reported in Union county along with a measured wind gust

APPENDIX G: NCEI STORM EVENT DATA

		to 85 mph. Quarter size hail was reported late in the evening in Avery county. There was a public report of a sighting of a very weak tornado that appeared to make a brief touchdown, but caused no damage, north of Marion. Due to insufficient data in support of this report, an official tornado event will not be entered..
WAXHAW	6/10/1999	Scattered thunderstorms developed in the mountains during the early afternoon. A couple of those storms became severe and downed trees and power lines. A cluster of severe thunderstorms developed in the southern piedmont during the evening and produced damaging straight-line winds which downed trees in many locations. A small mobile home was blown over southwest of Lincolnton. More than one inch of rain fell in a short period of time in Charlotte and caused some urban flooding in which a few cars were involved. However, no serious problems were reported.
WEDDINGTON	7/6/1999	One thunderstorm early in the afternoon became severe and an automated gage at Panthertown measured a wind gust to 58 mph. Downed trees in Weddington caused some property damage, but a dollar amount was not known at the time of the writing.
MONROE	7/24/1999	Clusters of slow-moving thunderstorms developed during the afternoon on another hot and humid summer day. Some of the storms became severe, producing large hail the size of nickels and quarters, and straight-line winds which downed numerous trees. In Kannapolis, the roof of a commercial building was blown off. In rural areas around Monroe, small streams briefly came out of their banks and flooded typical flood-prone areas.
MONROE	7/31/1999	Severe thunderstorms shortly after midnight produced damaging winds and a considerable amount of lightning across the southern piedmont of North Carolina. Scattered trees were downed, some on roads. At a Faith school, a grandstand was blown down and a ticket booth was blown over. Signs were blown away in the town, a screen door was torn off a business and trees were split in half. Downed trees also occurred in nearby Richfield and East Rowan. At the Concord Airport, 25 percent of a hangar's roof was blown off. Lightning strikes across the region caused numerous structure fires.
MONROE	8/1/1999	Clusters of severe thunderstorms rumbled through the southern piedmont of North Carolina during the late afternoon and evening hours. Straight-line winds produced by these storms downed many trees and some power lines. One house in Mt. Ulla was damaged by a downed tree. A citizen near Pineville reported twin gustnadoes separated by 30 seconds, which spun up along the gust front of one of the severe thunderstorms. The wind from the gustnadoes pinned the man against the outside wall of his home, chewed up tree limbs and downed a few trees, and threw a 40-foot section of a tree over his house. A neighbor measured the wind associated with the first gustnado at 70 mph with a hand held anemometer. Large hail and straight-line winds broke windows in Marshville.
WAXHAW	8/1/1999	Clusters of severe thunderstorms rumbled through the southern piedmont of North Carolina during the late afternoon and evening hours. Straight-line winds produced by these storms downed many trees and some power lines. One house in Mt. Ulla was damaged by a downed tree. A citizen near Pineville reported twin gustnadoes separated by 30 seconds, which spun up along the gust front of one of the severe thunderstorms. The wind from the gustnadoes pinned the man against the outside wall of his home, chewed up tree limbs and downed a few trees, and threw a 40-foot section of a tree over his house. A neighbor measured the wind associated with the first gustnado at 70 mph

**APPENDIX G: NCEI STORM EVENT DATA**

		with a hand held anemometer. Large hail and straight-line winds broke windows in Marshville.
MARSHVILLE	8/1/1999	Clusters of severe thunderstorms rumbled through the southern piedmont of North Carolina during the late afternoon and evening hours. Straight-line winds produced by these storms downed many trees and some power lines. One house in Mt. Ulla was damaged by a downed tree. A citizen near Pineville reported twin gustnadoes separated by 30 seconds, which spun up along the gust front of one of the severe thunderstorms. The wind from the gustnadoes pinned the man against the outside wall of his home, chewed up tree limbs and downed a few trees, and threw a 40-foot section of a tree over his house. A neighbor measured the wind associated with the first gustnado at 70 mph with a hand held anemometer. Large hail and straight-line winds broke windows in Marshville.
MONROE	8/14/1999	Isolated severe thunderstorms brought damaging wind and large hail to a few locations in the northwest and southern piedmont of North Carolina. Just north of Conover, it hailed for 15 minutes, with the largest hail falling near the end and badly denting a car. Ten trees were blown down in southeast Union county. Trees were also blown down in Rowan county including 2 large trees which fell on a mobile home in the town of Cleveland.
INDIAN TRAIL	4/1/2001	911 center reported trees down and wind estimated to 65 mph. A storm spotter nearby recorded an actual measured gust of 60 mph.
MONROE	4/1/2001	911 center reported trees down.
MONROE	4/1/2001	
MARSHVILLE	4/1/2001	911 center reported trees down and wind estimated at 65 mph.
INDIAN TRAIL	5/19/2001	Sheriff's department measured a 52-knot wind gust during a severe thunderstorm. Minutes later, large hail was reported. There were also power outages.
STALLINGS	5/19/2001	Emergency management reported trees down.
WINGATE	5/19/2001	Emergency operations center reported six trees down between Wingate and Marshville.
INDIAN TRAIL	5/22/2001	Sheriff's department reported three large trees down, with large limbs landing on roofs.
WINGATE	6/22/2001	A very strong microburst completely tore the roof off one duplex and damaged five others. Numerous trees and power lines also brought down.
MONROE	8/9/2001	Two trees were snapped off by marginally-severe thunderstorm winds.
MONROE	4/17/2006	Quite a few trees down.
MARSHVILLE	4/22/2006	Power lines down between Marshville and New Salem. A tree and large limbs also down on Medlin-Roberts Rd, with roof damage to several barns and sheds in the area.
WINGATE	4/22/2006	A couple trees blown down.
FAIRVIEW	5/26/2006	Three large oak trees blown down, one on a house.
NEW SALEM	5/26/2006	A couple trees blown down.
FAIRVIEW	6/11/2006	Trees down on Unionville Brief Rd.
MONROE	6/12/2006	Numerous trees and power lines down in the area around the intersection of Potter and Newton Rds.
MONROE	8/4/2006	Trees down on highway 205 near Olive Branch Rd.
WAXHAW	8/4/2006	Trees blown down just south of Waxhaw near highway 75 and power lines blown down in Waxhaw.
MONROE	8/9/2006	Several trees down between highway 601 and Morgan Mill Rd and another tree down along Lawyers Rd.

**APPENDIX G: NCEI STORM EVENT DATA**

MARSHVILLE	11/16/2006	Six trees blown down along highway 205, with additional trees down on Olive Branch Rd.
ALTON	4/4/2008	A tree was blown down on McManus Rd.
WAXHAW	4/4/2008	A tree was blown down on Parkwood School Rd.
MONROE	5/20/2008	Numerous trees were blown down across much of the county.
WAXHAW	6/11/2008	A tree was blown down and the roof blown off a barn on S Potters Rd.
WAXHAW	6/11/2008	Trees blown down.
STALLINGS	6/27/2008	A large tree and several large limbs were blown down across Stallings.
MONROE	7/8/2008	Numerous trees and power lines were blown down across the county.
MARVIN	7/23/2008	Large tree limbs were blown down.
STOUTS	7/23/2008	Numerous trees were uprooted, two large storage containers blown around, and garage doors blown in on Stinson Hartis Rd.
UNIONVILLE	2/28/2011	Several trees were blown down a little way south of Fairview.
WEDDINGTON	4/5/2011	Numerous trees were blown down across Union County, with several roads closed around Monroe due to downed trees.
WAXHAW ARPT	5/11/2011	Numerous trees were blown down to the south of Waxhaw, toward the state line.
ALTON	5/11/2011	Multiple trees were blown down along highway 207, near the state line.
ALLEN XRDS	6/10/2011	Several trees were blown down in the Allens Crossroads area, with one tree down on a fire truck.
WAXHAW	6/18/2011	Numerous trees and power lines were blown down across the county.
INDIAN TRAIL ARPT	7/13/2011	Several large tree limbs were blown down at Lawyers Rd and Stevens Mill Rd, near the Mecklenburg County line.
HAMILTONS XRDS	7/25/2011	A tree was blown down near highway 205 and Ansonville Rd.
ALLEN XRDS	7/25/2011	A tree was blown down on Camden Rd about 4.5 miles south of Marshville.
MONROE	8/8/2011	Numerous trees were blown down from just east of the Monroe city limits toward Marshville.
STALLINGS	8/11/2011	A few trees were blown down in the Water Oak area.
MONROE	8/11/2011	A tree was blown down onto a house on Johnson St in Monroe.
MINERAL SPG	8/11/2011	Trees were blown down on Pleasant Grove Rd.
INDIAN TRAIL	8/21/2011	Several trees and power lines were blown down.
HAMILTONS XRDS	8/21/2011	A tree was blown down on Ansonville Rd.
NEW SALEM	8/21/2011	A tree was blown down on highway 205 near New Salem.
MARSHVILLE	3/24/2012	Two large trees were blown down at Olive Branch Rd and Old Gold Mine Rd.
HOUSTON	4/3/2012	Multiple trees were blown down along Waxhaw Highway, especially near the intersection of South Rocky River Rd.
WESLEY CHAPEL	6/24/2012	Trees were blown down on power lines on Antioch Church Rd.
FAIRVIEW	7/1/2012	Trees were blown down near Fairview and in Unionville. More than two dozen trees were felled on the Wingate University campus, with the roofs of several buildings and some automobiles damaged by the fallen trees. Another tree fell on a convenience store in Wingate.
WINGATE	7/1/2012	Multiple trees were blown down near the intersection of Macedonia Church Rd and highway 601.
MINERAL SPG	7/3/2012	A tree was blown down on Nesbit Rd and another tree down on Plyler Mill Rd several miles southwest of Monroe.
MONROE	7/5/2012	Multiple trees and power lines were blown down on Franklin St and Bragg St in the city with large limbs down at Medlin Rd and Macedonia Church Rd.

**APPENDIX G: NCEI STORM EVENT DATA**

		Other large limbs were blown down on Wolf Pond Rd near Joe Collins Rd and four trees blown down on Bruce Thomas Rd near Stack Rd. Trees fell on seven homes, with four of the homes incurring major damage.
MONROE	7/9/2012	Several trees were blown down from Monroe to Wingate.
HAMILTONS XRDS	7/9/2012	Several power lines were blown down on Ansonville Rd.
WEDDINGTON	7/10/2012	Multiple trees and large limbs were blown down in the Blakeney area.
MONROE	7/16/2012	A few trees were blown down along Wolf Pond Rd, including one tree that fell on a vehicle south of the Marvin Watkins Rd intersection.
WAXHAW	7/24/2012	Multiple trees were blown down around the Waxhaw area.
WEDDINGTON	7/27/2012	Multiple trees and power lines were blown down from near Waxhaw to near Monroe.
FAIRFIELD	8/2/2012	Multiple trees were blown down along New Salem Rd from the Tarton Mill Rd intersection to the highway 200 intersection.
MINERAL SPG	8/6/2015	County comms reported multiple trees blown down between Waxhaw and Monroe.
NEW SALEM	9/4/2015	County comms reported multiple trees blown down along Highway 218 east of Fairview.
STURDIVANTS	4/3/2017	Shingles were blown off an outbuilding on Gulledge Rd and a carport was blown across a road. A couple of trees were also blown down.
MARSHVILLE	7/5/2017	County comms reported multiple trees and power lines blown down in the Marshville area.
UNIONVILLE	7/15/2017	Public reported numerous trees blown down, several houses with roof damage and multiple chicken houses heavily damaged or destroyed in and around Unionville.
STOUTS	7/28/2017	Law enforcement reported trees blown down on Flagstone Ln.
WAXHAW	10/23/2017	County comms reported multiple trees and power lines blown down in the Waxhaw area.
BAKERS	4/19/2019	Public reported trees blown down, a collapsed shed and damage to a silo north of Union.
BAKERS	6/22/2019	County comms reported multiple trees blown down off Highway 601 just north of Monroe.

**TABLE G.14: WINTER STORM EVENTS**

Date	Description
<b>Cabarrus County</b>	
1/6/1996	Rain gradually changed to freezing rain and then snow and sleet across the southern Piedmont. The precipitation continued well into the next day. The layer of ice under the 1 to 2 inches of snow caused serious traffic problems. All across western and central North Carolina, numerous traffic accidents and sledding accidents were reported. There were numerous indirect injuries and a few fatalities associated with the storm. Most injuries and deaths were traffic related. In Alexander, a man was crushed when an outbuilding collapsed from the weight of the snow.
1/11/1996	The second snowstorm within a week caused more excitement in North Carolina. Up to a foot of snow was reported in some of the mountains with most mountain and foothill locations receiving 3 to 6 inches. In the piedmont, there was more of a mixture of ice with minimal ice storm conditions reported in and around the Charlotte area. There were some power outages and numerous traffic accidents.
2/3/1996	Light snow accumulated to 1 to 3 inches on top of the ice. Travel problems worsened in some places.
2/16/1996	Snow fell and accumulated to several inches with heavier amounts in the northern mountains.
2/19/1999	A surface low moving across central Georgia and South Carolina combined with a strong upper level system to produce light snow across much of western North Carolina during the afternoon. Most accumulations were between 1 and 2 inches. Although there was a band of 3 inch accumulations stretching from the northern mountains, southeast through Morganton and to Shelby. Also, some isolated accumulations of around 8 inches were reported from the very highest peaks in the northern mountains.
1/16/2008	Light snow developed across the Piedmont during mid-evening, and continued through much of the overnight hours. By mid-morning on the 17th, total accumulations ranged from around an inch south of I-85, to 3 inches or so along the I-40 corridor. Sleet and freezing rain mixed in with the snow before the event ended.
1/22/2008	Freezing drizzle and light freezing rain developed across the western Piedmont around sunrise. Roads became very slick and hazardous, and there were numerous traffic accidents during the morning commute.
2/16/2015	A mix of sleet, snow, and freezing rain overspread the I-77 corridor in Charlotte metro and surrounding areas during late afternoon. Sleet became the primary precipitation type during the evening, before precipitation transitioned to freezing rain south of the I-85 corridor by late evening. Deteriorating road conditions were reported throughout the evening. By midnight, heavy accumulations of sleet and/or freezing rain were reported. Most areas saw around a half inch to an inch of sleet, along with around a tenth of an inch of ice accretion. However, areas south of I-85 saw more in the way of freezing rain, with up to a quarter inch of ice accretion reported in addition to light sleet accumulations. Scattered power outages were therefore more concentrated there. Roads became very treacherous and impassable in many areas until melting began on the afternoon of the 17th.
2/23/2015	Light snow associated with a wave of low pressure overspread the foothills and Piedmont of the Carolinas by late evening of the 23rd, and continued through the overnight before tapering off during the morning of the 24th. Accumulations ranged from a dusting to 2 inches, with the highest amounts generally occurring closer to the mountains. Temperatures right around freezing and warm roads resulted in minimal travel issues.
2/25/2015	After the light snow that fell across portions of the Piedmont on the morning of the 24th, an area of low pressure moving along the Gulf Coast spread yet another round of snow across the North Carolina Piedmont during the evening. Heavy snowfall accumulations were reported in many areas north of the I-85 corridor by midnight. Due to occasional transitions to rain undercutting snowfall rates, total accumulations were generally in the 2 to 4 inch range, although localized

**APPENDIX G: NCEI STORM EVENT DATA**

	amounts as high as 7 inches were reported across the northwest Piedmont. The snow tapered off before sunrise.
1/6/2017	As an area of surface low pressure moved northeast along the Gulf and Southeast coasts, moisture overspread the North Carolina Piedmont throughout the 6th. As cold air gradually spilled in from the north, precipitation slowly transitioned from rain to sleet and snow. By daybreak on the 7th, locations across far northern Gaston, Mecklenburg, and Cabarrus Counties had received as much as 5 inches of snow, while locations near the South Carolina border were just beginning to transition to sleet. By the time the precipitation had tapered off to flurries during late morning, mostly snow had fallen near the Iredell, Rowan, and Lincoln County lines, and total accumulations there ranged from 4 to 6 inches. Meanwhile, locations from Gastonia, through Uptown Charlotte to Concord saw quite a bit of sleet, with total accumulations of sleet and snow ranging from 1 to 3 inches. Locations closer to the South Carolina border saw primarily sleet and rain, with some sleet accumulations as high as one half inch.
2/5/2017	Very light freezing precipitation developed briefly across portions of the Piedmont during the pre-dawn hours. This caused some patchy areas of a light glaze that resulted in a few accidents.
3/12/2017	An upper level disturbance interacting with an unseasonably cold air mass resulted in an area of snow that moved quickly across much of the western Piedmont and foothills of North Carolina during the morning of the 12th. Precipitation began as rain in some areas, but quickly changed to snow. Most locations saw total snowfall accumulation from a dusting to less than two inches. However, some locations across the southern Piedmont saw up to 3 inches.
1/23/2019	Patchy light freezing rain developed across western North Carolina during the early morning hours of the 23rd and continued off and on through mid-morning. Ice accretion was generally confined to areas north of I-85, and was quite light in most areas, around a tenth of an inch or less. Some slick spots developed on roads, resulting in a few traffic accidents.
4/2/2019	Moisture associated with an area of low pressure developing off the southeast coast overspread an unseasonably cool air mass over the Piedmont during the morning hours. Precipitation initially fell as a mix of rain and snow. However, pockets of snow developed in association with heavier precipitation rates. This resulted in some areas of accumulation in the 0.5 to 1-inch range, mainly in areas south and east of the city of Charlotte. However, up to 2 inches fell across portions of Union County. Despite warm pavement, snowfall rates were such that snow accumulated on some roadways, resulting in slick spots.
<b>Stanly County</b>	
1/17/2008	Between one to two inches of snow accumulated countywide mostly before daybreak.
1/19/2008	Around one half inch of snow accumulated during the afternoon and early evening hours.
1/10/2011	Six inches of snow fell across the area during the morning and afternoon hours. Snow changed over to freezing rain during the afternoon resulting in nearly an eighth inch of ice on top of the snow. All area roads were covered in snow resulting in the closure of schools and businesses.
2/16/2015	Snowfall amounts of a half of an inch to an inch fell across the county. In addition, around a tenth of an inch of freezing rain accrual was reported.
2/24/2015	Snowfall amounts of a trace to 1 inch fell across the county.
2/25/2015	Snowfall/sleet amounts of 2 to 3 inches fell across the county.
1/7/2017	Snowfall amounts ranged from a dusting across southern portions of the county to near 1 inch across the north.
<b>Union County</b>	
1/6/1996	Rain gradually changed to freezing rain and then snow and sleet across the southern Piedmont. The precipitation continued well into the next day. The layer of ice under the 1 to 2 inches of snow caused serious traffic problems. All across western and central North Carolina, numerous traffic accidents and sledding accidents were reported. There were numerous indirect injuries and a few fatalities associated with the storm. Most injuries and deaths were traffic related. In Alexander, a man was crushed when an outbuilding collapsed from the weight of the snow.
1/11/1996	The second snowstorm within a week caused more excitement in North Carolina. Up to a foot of snow was reported in some of the mountains with most mountain and foothill locations receiving

**APPENDIX G: NCEI STORM EVENT DATA**

	3 to 6 inches. In the piedmont, there was more of a mixture of ice with minimal ice storm conditions reported in and around the Charlotte area. There were some power outages and numerous traffic accidents.
1/16/2008	Light snow developed across the Piedmont during mid-evening, and continued through much of the overnight hours. By mid-morning on the 17th, total accumulations ranged from around an inch south of I-85, to 3 inches or so along the I-40 corridor. Sleet and freezing rain mixed in with the snow before the event ended.
1/22/2008	Freezing drizzle and light freezing rain developed across the western Piedmont around sunrise. Roads became very slick and hazardous, and there were numerous traffic accidents during the morning commute.
2/16/2015	A mix of sleet, snow, and freezing rain overspread the I-77 corridor in Charlotte metro and surrounding areas during late afternoon. Sleet became the primary precipitation type during the evening, before precipitation transitioned to freezing rain south of the I-85 corridor by late evening. Deteriorating road conditions were reported throughout the evening. By midnight, heavy accumulations of sleet and/or freezing rain were reported. Most areas saw around a half inch to an inch of sleet, along with around a tenth of an inch of ice accretion. However, areas south of I-85 saw more in the way of freezing rain, with up to a quarter inch of ice accretion reported in addition to light sleet accumulations. Scattered power outages were therefore more concentrated there. Roads became very treacherous and impassable in many areas until melting began on the afternoon of the 17th.
1/7/2017	As an area of surface low pressure moved northeast along the Gulf and Southeast coasts, moisture overspread the Piedmont throughout the 6th. Most of the precipitation fell as rain south of the I-85 corridor. However, as cold air gradually spilled in from the north, a transition to mainly sleet with some pockets of freezing rain occurred. By mid-morning on the 7th, locations closer to the I-85 corridor had up to a half inch of mainly sleet, while some locations saw a light glaze of ice, mainly on elevated surfaces.
3/12/2017	An upper level disturbance interacting with an unseasonably cold air mass resulted in an area of snow that moved quickly across much of the western Piedmont and foothills of North Carolina during the morning of the 12th. Precipitation began as rain in some areas, but quickly changed to snow. Most locations saw total snowfall accumulation from a dusting to less than two inches. However, some locations across the southern Piedmont saw up to 3 inches.
4/2/2019	Moisture associated with an area of low pressure developing off the southeast coast overspread an unseasonably cool air mass over the Piedmont during the morning hours. Precipitation initially fell as a mix of rain and snow. However, pockets of snow developed in association with heavier precipitation rates. This resulted in some areas of accumulation in the 0.5 to 1-inch range, mainly in areas south and east of the city of Charlotte. However, up to 2 inches fell across portions of Union County. Despite warm pavement, snowfall rates were such that snow accumulated on some roadways, resulting in slick spots.